CURATED PAST EXAM ITEMS
- Solutions -

ILA 201-I – Valuation and Advanced Product and Risk Management, International

Important Information:

- These curated past exam items are intended to allow candidates to focus on past SOA fellowship assessments. These items are organized by topic and learning objective with relevant learning outcomes, source materials, and candidate commentary identified. We have included items that are relevant in the new course structure, and where feasible we have made updates to questions to make them relevant.
- Where an item applies to multiple learning objectives, it has been placed under each applicable learning objective.
- Candidate solutions other than those presented in this material, if appropriate for the context, could receive full marks. For interpretation items, solutions presented in these documents are not necessarily the only valid solutions.
- Learning Outcome Statements and supporting syllabus materials may have changed since each exam was administered. New assessment items are developed from the current Learning Outcome Statements and syllabus materials. The inclusion in these curated past exam questions of material that is no longer current does not bring such material into scope for current assessments.
- Thus, while we have made our best effort and conducted multiple reviews, alignment with the current system or choice of classification may not be perfect. Candidates with questions or ideas for improvement may reach out to education@soa.org. We expect to make updates annually.

SOCIETY OF ACTUARIES®

ILA 201-I

CURATED PAST EXAM SOLUTIONS

ALL LEARNING OBJECTIVES

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Fall 2020 LFMC Exam

1. Fall 2020 LFMC Exam (LO 2c)

Learning Objectives:

2. The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

~~4. The candidate will understand U.S. financial and valuation standards, principles and methodologies applicable to life insurance and annuity products.~~

~~5. The candidate will understand how to explain and apply the methods, approaches and tools of financial management in a life insurance company context.~~

Learning Outcomes:

2 The Candidate will be able to:

c) Describe the purpose and application of economic capital

~~(4a) The Candidate will be able to describe U.S. valuation and capital frameworks, and explain their impact on the valuation of reserves, capital and financial statements.~~

~~(5a) The Candidate will be able to:~~

- ~~Explain and apply methods in determining regulatory capital and economic capital~~
- ~~Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital~~
- ~~Explain Canadian regulatory capital framework and principles~~
- ~~Explain and apply methods in capital management~~

Sources:

2c Economic Capital for life Insurance Companies, SOA Research paper, Oct 2016 (exclude sections 5 and 7)

~~Economic Capital A Case Study to Analyze Longevity Risk, Silverman, JRM, 2010~~

~~LFM-148-20 The Theory of Risk Capital in Financial Firms~~

~~LFM-144-20 The Modernization of Insurance Company Solvency Regulation in the US, Klein, Networks Financial Institute Policy Brief, 2012 (exclude Sections 7 and 9)~~

Commentary on Question:
This question tested the candidates' knowledge of economic capital and financial management.

Solution:
(a) **(LO 2c)** With regard to solvency regulation:

(i) List two reasons U.S. regulators would be interested in international regulatory developments.

(ii) Explain the shortcomings of the U.S. RBC factor-based approach compared to Solvency II's model-based approach.

Commentary on Question:
Candidates generally answered this part of the question well. Any two valid points in part (i) received full credit.

(i)

- U.S. regulators might be interested in international developments to identify potential improvements in U.S. regulation that they believe have merit.
- U.S. regulators may feel pressure to adopt certain methods to meet international standards or to prevent conflicts over "regulatory equivalency".
- U.S. regulators may wish to avoid federal intrusions into state regulation by adopting reforms that are reasonably consistent with international standards and address any perceived deficiencies in the current regulations.

(ii)

- The RBC approach is a one-size-fits-all approach, whereas a model-based approach can be tailored towards individual company characteristics.
- The RBC formula omits some risks, such as catastrophe and operational, that could be better quantified using a model.
- A model-based approach compels insurers to take a more forward-looking and comprehensive view of their risk and they can determine a regulatory capital amount that is more suited to their circumstances.
- The vast majority of U.S. insurance companies have regulatory capital significantly greater than the minimum amount that would require RBC

action levels to be triggered; this calls into question how accurately the RBC formulas are actually measuring companies' financial risks.

(b) **(LO 2c)** Describe the advantages and disadvantages of LHR operating at an economic capital ratio of 150% compared to 400%.

Commentary on Question:
Candidates generally answered this part of the question well.

- 150% Pros: increases the return on capital by reducing the denominator.
- 150% Pros: Operating at this capital level ratio shows some level of capital efficiency if returns are commensurate
- 150% Cons: Mildly adverse performance may cause the insurer to breach the requirement over the next year and suffer the associated frictional costs and loss to franchise value
- 400% Pros: May increase the franchise value by attracting a greater amount of profitable business
- 400% Pros: Helps protect or enhance the interest of a number of stakeholders and to increase shareholder returns by avoiding costs of failure to meet the company's objectives
- 400% Cons: Can be seen as having a cost to the business relating to tax, investment costs and potentially agency effects, thus reducing shareholder value

(c) **(LO 2c)** LHR is considering ways to reduce the economic capital being held for its block of Single Premium Immediate Annuities (SPIAs). Evaluate the effectiveness of each of the following techniques:

(i) Diversification of risk through issuance of life insurance policies

(ii) Securitization of longevity risk through issuance of a 10-year longevity bond

Commentary on Question:
For part (i) candidates received credit for any evaluation on how mortality risks of a life vs. annuity block could be mismatched. Candidates generally did not do well on part (ii).

(i) Life insurance issuance - mostly ineffective.
Diversification can provide some capital relief. But negatively correlated risks are rarely perfectly matched.
Overall changes in mortality may affect life blocks differently from annuity blocks.

(ii) Securitization through longevity bonds - should be effective.
If the economic liability is below the attachment point, the insurer will not need to repay some of the principal. In fact, if the economic liability

reaches the exhaustion point, the insurer would not need to repay any principal.

While such a bond is an out-of-the-money risk to the investor, it can immediately reduce an insurer's economic capital.
While not stated explicitly in the text, it is clear from the text example that the reduction in economic capital is a function of reduction of tail risks in longevity. Credit is given for coherent discussion of this concept.

(d) **(LO 2c)** Critique the following statements:

A. *Unit X is the least profitable business unit due to its large risk capital requirement. If LHR decides to eliminate a business unit, it should eliminate X.*

B. *The required risk capital of the combined X+Y+Z should be allocated across the business units.*

C. *Having unallocated risk capital would indicate LHR is not covering all of its risks.*

Commentary on Question:
Candidates generally critiqued statements A and B well. For statement C, candidates generally neglected to discuss the extreme case of perfect correlation between business units.

A. This is false; you must consider the correlation of risks amongst the units (the combination of units is 700, which is less than adding all 3 units, indicating there is some diversification benefit). A business that is unprofitable on a stand-alone basis may be profitable when there is other business with offsetting risks.

Calculating the marginal risk capital shows unit Z actually has the highest marginal capital. This indicates that eliminating unit Z would actually reduce required risk capital the most.

Unit	Marginal Risk Capital
X	180
Y	100
Z	240
Sum of Marginal Risk Capital	520

B. This is false; the total amount of capital allocated should be 520, the sum of the marginal capital amounts. Allocating all of the risk capital is usually not feasible and it can distort the profitability of each unit.

1. Continued

C. This is false; having unallocated capital indicates that the profitability of the business units is not perfectly correlated. Only in the extreme case of perfect correlation will all capital be allocated. Since not all of LHR's capital is allocated, this indicates a diversification benefit amongst the business units; this diversification actually makes the company less risky than if the units were perfectly correlated.

2. Fall 2020 LFMC Exam (LO 3b)

Learning Objectives:

3(b) The candidate will understand various approaches to manage and evaluate life insurance risks.

~~6. The candidate will understand important insurance company issues, concerns and financial management tools.~~

Learning Outcomes:

3 The Candidate will be able to:

b) Understand the role and framework used by regulators and credit rating agencies for evaluating life insurance companies

~~(6a) The candidate will be able to describe, apply and evaluate considerations and matters related to:~~

- ~~Insurance company mergers and acquisitions~~
- ~~Sources of earnings~~
- ~~Embedded Value determinations~~
- ~~Rating agency considerations~~

Sources:

3(b) Rating Agency Perspectives on Insurance Company Capital, SOA Research Institute, Aug 2023 (excluding Appendices)

~~A.M. Best's - Compendium of Publications~~

Commentary on Question:
This question tests the candidates' knowledge on how AM Best determines its capital adequacy ratio (BCAR) for a life insurance company, and how it can be used to evaluate alternative business decisions.

Solution:
(a) **(LO 3b)** AKL Life Insurance Company is a public company that was recently assigned a negative outlook by A.M. Best.

(i) Describe the process followed by A.M. Best that results in the rating agency assigning a negative outlook to an insurance company.

(ii) List three potential impacts of the negative outlook on AKL's day-to-day operations.

Commentary on Question:

For part (i), an outlook is issued in conjunction with a rating, and the process followed by Best is the same regardless of the ultimate assignment. To receive full credit, candidates needed to sufficiently describe the process from the collection of data all the way through to the dissemination of the rating/outlook.

For part (ii), candidates only needed to list three of the seven potential impacts listed below to receive full credit.

(i) A rating analyst is assigned to facilitate and oversee the entire process.

The first step in the process would be data collection and interviews. The analyst would collect internal data from the insurance company, including financial statements, internal models and management reports. The analyst would then conduct interviews with company management to better understand the data and the company's risk position.

After several rounds of data collection and interviews, the analyst would perform financial analyses that measure the risks in the company, including equity risk, market risk, insurance risk and business risk. While performing these analyses, the analyst would also consider information from external sources, including the economic outlook of the market and industry.

Based on the results of the financial analyses, the analyst would recommend a rating/outlook to a rating committee, and the committee would rigorously review the recommendation and make a final decision. The analyst would then share the committee's decision with the company first. The company would then decide whether to appeal, accept or withdraw from the decision before any information is released to the public.

(ii) Potential impacts of a negative rating are:

- Higher borrowing costs
- Increased regulatory pressure from governments
- Harder to raise capital
- Decreased sales or new business
- Increased lapses or lower persistency
- Negative pressure on stock price and concerns of shareholders
- Shareholders may seek higher returns given negative outlook

(b) **(LO 3b)** Calculate the BCAR for AKL. Show all work, including writing out relevant formulas used in any calculations.

Commentary on Question:

Generally, candidates calculated the BCAR correctly. Common errors included using one of the following formulas:

- *[(Available Capital - Net Required Capital) / Net Required Capital] x 100*
- *[Available Capital / Net Required Capital] x 100*

Net Required Capital = [(15 + 15) ^2 + (5 + 5) ^2 + (5) ^2] ^0.5 + 2
= 34.02

BCAR = [(Available Capital - Net Required Capital) / Available Capital] x 100
= [(100 - 34.02) / 100] x 100
= 65.98

(c) **(LO 3b)** AKL is considering buying a block of term life insurance business and selling a block of variable annuity (VA) business. Each transaction would impact capital as follows:

	Buy term	**Sell VA**	**Both**
Change in Net Required Capital	1	-2	-1
Change in Available Capital	-2	1	-1

(i) Recommend whether AKL should buy the term life insurance block, sell the variable annuity block, do both or do neither based on the BCAR score only.

(ii) Identify two considerations other than the BCAR score that should be taken into account when making the recommendation.

Commentary on Question:
The recommendation in part (ii) depends on recalculating the BCAR using the changes in Available Capital and Net Required Capital, and then comparing it to the base BCAR from part (b) above. The transaction that provides the largest BCAR will then be the recommended transaction. Generally, candidates who used the correct formula for BCAR made the correct recommendation. Candidates who used an incorrect formula received partial credit for calculating components correctly and demonstrating an understanding of the concepts.

For part (ii), candidates only needed to identify two of the four considerations listed below to receive full credit.

(i):

BCAR = [(Available Capital - Net Required Capital) / Available Capital] x 100

BCAR Neither= BCAR if neither transaction is done
= current BCAR
= 65.98, from part(b)

2. Continued

BCAR Buy = BCAR if term block is purchased but annuity block is not sold
= [(98 - 35.02) / 98] x 100
= 64.27

BCAR Sell = BCAR if annuity block is sold but term block is not purchased
= [(101 - 32.02) / 101] x 100
= 68.30

BCAR Both = BCAR if term block is purchased and annuity block is sold
= [(99 - 33.02) / 99] x 100
= 66.64

Based on BCAR score only, AKL should sell the annuity block since the sale would maximize the score

(ii):

- Impact on share price
- Impact on other key metrics such as RBC, profit
- AKL's operational capacities and competencies, expertise, admin systems
- AKL's vision and strategy

4. Fall 2020 LFMC Exam (LO 4d)

Learning Objectives:

4(d) The candidate will understand value creation and inforce management techniques for life and annuity products.

~~1. The candidate will understand and apply pre-IFRS 17 valuation principles to individual life insurance and annuity products issued by Canadian life insurance companies.~~

~~3. The candidate will understand Canadian taxation applicable to life insurance companies and products.~~

Learning Outcomes:

4 The Candidate will be able to:

d) Understand corporate taxation, policyholder taxation and calculate investment income tax

~~(1a) The Candidate will be able to:~~

- ~~Compare and apply methods for life and annuity product reserves~~
- ~~Evaluate, calculate, and interpret liabilities~~
- ~~Recommend and justify appropriate valuation assumptions~~

~~(3a) The Candidate will be able to describe and apply the taxation regulations applicable to Canadian life insurance companies and life insurance products.~~

Sources:

4(d) *Canadian Insurance Taxation*, Swales, et. al., 4th Edition, 2015

- Ch. 4: Income for Tax Purposes – General Rules
- Ch. 5: Investment Income

~~ILA-FM-C-LO1: Canadian Taxation and IFRS 17 - Chapter 10, The Taxation of Life Insurance Policies~~

Commentary on Question:
This question tested the candidates' knowledge of taxation rules before and after 2017. Candidates generally did well on this question. To receive full credit candidates had to demonstrate an understanding of the impacts and application of the change in tax rules.

Solution:

(a) **(LO 4d)** Describe how the introduction of the new tax exemption rules in 2017 impacted the level of tax-exempt accumulation within a life insurance policy.

Commentary on Question:

While candidates generally demonstrated knowledge on the changes in taxation rules pre/post 2017, they did not elaborate on the impacts they had on the accumulated fund.

Changes in exempt testing rules:

- The "endowment date" has increased from age 85 (or 10-year duration) to age 90 (or 15-year duration). This delays the time until the accumulating fund reaches the ultimate tax-exempt room, meaning a decrease in tax exempt accumulation room in later durations.
- The pay period of the endowment of the accumulating fund has moved from 20 years to 8 years. The exempt test policy accumulating fund will increase faster under the 8-pay period model, meaning there will be greater tax-exempt room in the early durations of the policy.

- The interest rate of the accumulating fund of an exempt test policy has changed from 4% to 3.5%. This delay in accumulation due to lower interest rate will decrease the amount of tax-exempt accumulation in later durations.

(b) **(NO LONGER RELEVANT)** ~~You are given the following information for a UL policy issued at age 40:~~

~~Level Face Amount = 100,000~~

~~Policy Year~~	~~Beginning of Year Projected Account Value at Issue~~
~~1~~	~~0~~
~~2~~	~~4,445~~
~~3~~	~~6,000~~
~~4~~	~~7,815~~
~~5~~	~~9,490~~
~~6+~~	~~0~~

~~You are given the following actuarial present value functions, where $\bar{A}_{x:n|}$ is the present value of a life insurance policy which endows at attained age x+n:~~

~~$\bar{A}_{x:n|}$ = x/150 + n/1000, for when the annual interest rate is 3.5%~~

~~$\bar{A}_{x:n|}$ = x/200 + n/400, for when the annual interest rate is 4.0%~~

Determine the tax-exempt status at issue of the above policy:

(i) issued in 2015

(ii) issued in 2020

Show all work, including writing out relevant formulas used in any calculations.

Commentary on Question:
Candidates generally did well on this part of the question.

(i)

Discount Rate	Endowment Age	Duration	Discount rate
100,000* A60:25	60	25	4.00%

End of Pay Period	36,250

End of Policy Year	**Policy AF**	**ETP AF**	**Tax exempt test**
1	4,445	1,813	No
2	6,000	3,625	No
3	7,815	5,438	No
4	9,490	7,250	No
5		9,063	Yes
…	-	-	-

Tax exempt if Policy AF < ETP AF

(ii)

Discount Rate	Endowment Age	Duration	Discount rate
100,000* A48:42	48	42	3.50%

End of Pay Period	36,200

4. Continued

End of Policy Year	Policy AF	ETP AF	Tax exempt test
1	4,445	4,525	Yes
2	6,000	9,050	Yes
3	7,815	13,575	Yes
4	9,490	18,100	Yes
5		22,625	Yes
…	-	-	-

Tax exempt if Policy AF < ETP AF

5. Fall 2020 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

1(a), 1(b) The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~1. The candidate will understand and apply pre-IFRS 17 valuation principles to individual life insurance and annuity products issued by Canadian life insurance companies.~~

Learning Outcomes:

1(a), 1(b) The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(1a) The Candidate will be able to:~~

- ~~Compare and apply methods for life and annuity product reserves~~
- ~~Evaluate, calculate, and interpret liabilities~~
- ~~Recommend and justify appropriate valuation assumptions~~

Sources:

1(a), 1(b) ILA201-600-25: International Actuarial Note 100: Application of IFRS 17 (Ch.1, section A – Introduction to GMM only, Ch. 5, 7-9 & 16)

1(a), 1(b) ILA201-601-25: The IFRS 17 Contractual Service Margin: A Life Insurance Perspective (Sections 2-4.8)

1(a), 1(b) CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, Jun 2022

1(a), 1(b) CIA Educational Note: IFRS 17 Coverage Units for Life and Health Insurance Contracts, Dec 2022

1(a), 1(b) CIA Educational Note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts, Jun 2022

~~LFV-141-18: IFRS 17 Insurance Contracts – IFRS Standards Effects Analysis, May 2017, IASB (sections 1, 2, 4 & 6.1-2 only)~~

~~CIA Educational Note: Comparison of IFRS 17 to Current CIA Standards of Practice, Sep 2018~~

~~CIA Educational Note: Estimates of Future Cash Flows under IFRS 17~~

~~IAN 100 Application of IFRS 17 (exclude section D)~~

Commentary on Question:
This question tested the candidates' understanding of key reporting concepts for IFRS 17, and how they are changing compared to IFRS 4.

Solution:
(a) **(LOs 1a, 1b)** Describe four sources of profits or losses under the IFRS 17 General Measurement Approach.

Commentary on Question:
Candidates generally did well on this part of the question. Most candidates were able to provide and describe four sources of profit. Note that although the solution below includes five sources of profit in loss, only four were required for full credit. Candidates who focused on describing components of an income statement (Insurance Service Revenue, Insurance Service Expense, Insurance Finance income) received full credit if they explained what the income statement terms represented.

Insurers typically earn profits through the insurance service provided and investment results from managing financial assets. The total profit or loss of a group of insurance contracts is the difference between total cash inflows and outflows arising from these contracts. Sources of profit include:

1) Actual liability cash-flows that are different than best estimate assumptions. As actual experience emerges and mortality, lapse, morbidity etc. result in different cash-flows than expected in the actuarial assumptions, this will result in profit or loss.
2) Release of the CSM into profit as the company provides the insurance service over the coverage period for non-onerous contracts. The loss from onerous contracts will be recognized when the contracts are issued.
3) Release of the risk adjustment into profit as the company provides the insurance service over the coverage period.
4) Changes in the liability discount rate as market rates change. This will change the Time Value of Money component of the Insurance Liability calculation, with changes flowing through profit or loss.
5) Investment Income (or loss) from assets backing the insurance contract liability.

(b) **(LOs 1a, 1b)** Critique the following statements with respect to IFRS 17.

A. *IFRS 17 valuation includes both cash flows that relate directly or indirectly to the fulfilment of an insurance contract. Expenses such as claims handling costs, policy administration costs, and overhead are included. However, expenses from abnormal amounts of wasted labour, tax payments, and receipts the insurer does not pay or receive in a fiduciary capacity should be excluded.*

B. *The inclusion of acquisition expenses in the present value of future cash flows reduces the Contractual Service Margin (CSM), and results in the deferral of those expenses to be recognized in profit later. This is similar to the DAC asset that is held on the balance sheet and amortized over time under IFRS 4.*

C. *The IFRS 17 Standard does not specify any particular method to determine coverage units, so the actuary could apply judgment. Coverage units reflect the quantity of the benefits provided under a contract and its expected coverage duration. The quantity of benefits is based on the benefits expected to be incurred by the insurer. Coverage units should be calculated net of reinsurance. For practical reasons, to simplify calculations, coverage units can be based on the present value of benefits provided without discounting.*

D. *Insurance contract liabilities of short-term insurance contracts will decrease when moving from IFRS 4 to IFRS 17.*

Commentary on Question:
Candidates who only identified if the statement was true or false did not receive any credit since all of the statements were partially true and partially false.

To receive full credit, candidates had to explain why the statements were correct or not.

Candidates generally critiqued the first 3 statements well. Candidates generally did not note that for statement C the quantity of benefits expected to be incurred should be from the policyholder perspective. For statement D, candidates generally discussed PAA, but did not discuss CSM and risk adjustment.

A.
"*IFRS 17 valuation includes both cash flows that relate directly or indirectly to the fulfilment of an insurance contract.*": This statement is incorrect. Only cash flows that are directly related to the fulfilment of an insurance contract should be included in IFRS 17 valuation, indirect cash flows should be excluded.

"*Expenses such as claims handling costs, policy administration costs, and overhead are included."* Claims, handling costs, policy administration costs, are directly attributable to

the fulfilment of an insurance contract and so should be included in the cash flows for IFRS 17 valuation. Any overhead expense that can be directly attributable should also be included.

"However, expenses from abnormal amounts of wasted labour, tax payments, and receipts the insurer does not pay or receive in a fiduciary capacity should be excluded."
Expenses from abnormal amounts of wasted labour, tax payments, and receipts the insurer does not pay or receive in a fiduciary capacity will generally not be directly attributable and so should be excluded from the cash flows. Tax payments related to IIT and policy taxes will be directly attributable and so should be included.

B. *"The inclusion of acquisition expenses in the present value of future cash flows reduces the Contractual Service Margin (CSM), and results in the deferral of those expenses to be recognized in profit later. This is similar to the DAC asset that is held on the balance sheet and amortized over time under IFRS 4."*
The inclusion of acquisition expenses in the present value of future cash flows will reduce CSM (assuming that it is a non-onerous contract), since acquisition expenses reduce the expected profit of a contract at issue. Since the CSM is amortized as the insurance service is provided, this effectively results in the expenses being amortized for recognition in profit over the life of the contract. Although this is somewhat similar to the DAC asset there is a key difference. Acquisition expenses reduce the CSM under IFRS 17, reducing the company's total liabilities. The DAC asset is held as a separate asset under IFRS 4.

C. *"The IFRS 17 Standard does not specify any particular method to determine coverage units, so the actuary could apply judgment."*
This statement is correct, determination of coverage units requires application of careful judgement, and consideration of the facts and circumstances to best achieve the principles of reflecting services provided in the period.
"*Coverage units reflect the quantity of the benefits provided under a contract and its expected coverage duration."*
This statement is correct, coverage units should reflect the quantity of benefits provided under a contract and its expected duration.
"*The quantity of benefits is based on the benefits expected to be incurred by the insurer."*
This statement is incorrect, the quantity of benefits should be determined from the perspective of the policy holder.
"Coverage units should be calculated net of reinsurance."
This statement is incorrect. Coverage units should be calculated gross of reinsurance since the underlying business and reinsurance are valued and reported separately.
"For practical reasons, to simplify calculations, coverage units can be based on the present value of benefits provided without discounting."
This is correct. IFRS 17 does not specify if the time value of money should be considered when determining the release pattern for CSM, therefore it is left up to the discretion of the reporting entity.

D. *Insurance contract liabilities of short-term insurance contracts will decrease when moving from IFRS 4 to IFRS 17.* There are too many unknown variables to know if IFRS 17 will have a higher or smaller liability than IFRS 4. Some items to consider for short-term liabilities:
i) When using the Premium Allocation Approach for short term products under IFRS 17 a company is not required to discount the liability for incurred claims, if it expects them to be settled in a year or less.

ii) The risk adjustment under IFRS 17 may be higher or lower than the PfADs held under IFRS 4.
iii) Consideration should be given to the impact of the CSM, which results in different recognition of profit and loss under IFRS 4 vs IFRS 17.

(c) **(LOs 1a, 1b)** Recommend an appropriate IFRS 17 contract boundary for the following annuity product. Justify your answer.

- Single premium fixed annuity with a deferral period of 10 years.
- Annuity benefits are based on the book value at the end of the deferral period with a minimum of 30 basis points (bps) annuitization rate.
- Risk Free Rate = 40 bps

Commentary on Question:
Candidates generally did not do well on this part of the question and did not demonstrate an understanding of what a contract boundary is under IFRS 17. Candidates that did recommend a contract boundary did not provide sufficient justification. Full credit was given to candidates who proposed a contract boundary of the lifetime of the policyholder if they considered the 30 bps guarantee to be a substantive obligation.

The contract boundary should be determined based on the following questions:

1) Does the entity have the right to compel the policyholder to pay the premiums?
2) Does the entity have a substantive obligation to provide the policyholder with services? A substantive obligation ends when the entity has the practical ability to reassess the risks of the particular policyholder and set a price or benefit that fully reflects those risks.

For this question, the obligations of the entity will be the determining factor in the contract boundary, with the question being if the 30 bps minimum guarantee prevents the entity from fully reflecting risks when they price the annuity 10 years from now. Given the company's ability to include a liquidity premium on top of the risk-free rate (which is currently higher than the guaranteed 30 bps), the 30 bps guarantee does not appear to be a substantive obligation.
Since the 30 bps guarantee is not a substantive obligation, I recommend a 10 year contract boundary for the accumulation phase of the annuity. The payout phase of the annuity should be considered a new contract.

6. Fall 2020 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

1(a), 1(b) The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.~~

Learning Outcomes:

1(a), 1(b) The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.~~

Sources:

1(a), 1(b) ILA201-600-25: International Actuarial Note 100: Application of IFRS 17 (Ch. 1, section A – Introduction to GMM only, Ch. 5, 7-9 & 16)

1(a), 1(b) CIA Educational Note: IFRS 17 Coverage Units for Life and Health Insurance Contracts, Dec 2022

~~IFRS 17 Insurance Contracts – IFRS Standards Effects Analysis, May 2017, IASB (sections 1, 2, 4 & 6.1-2 only)~~

~~IFRS 17 Spreadsheet Model~~
~~PwC In depth A look at current financial reporting issues IFRS 17 June 2017~~

Commentary on Question:
This question tested the candidates' understanding of the contractual service margin in IFRS 17.

Solution:

(a) **(LOs 1a, 1b)** You are given the following information about groups of insurance contracts that were issued in prior years:

		Impact of Current Year Assumption Changes on the Fulfilment Cash Flows		
IFRS 17 Group	**CSM at beginning of current year**	**Mortality**	**Lapse**	**Discount Rates**
A	50,000	25,000	(4,000)	8,000
B	10,000	15,000	(2,000)	6,000

	Interest Rate for Current Year			Coverage Units	
IFRS 17 Group	**At Current Period Start**	**At Current Period End**	**At Initial Recognition**	**Current Service**	**Future Service**
A	4.2%	4.0%	5.0%	5,000,000	60,000,000
B	4.2%	4.0%	4.5%	3,000,000	50,000,000

The IFRS 17 general measurement approach is used for this block of business.

Calculate the CSM for each of Groups A and B at the end of the current year. Show all work, including writing out relevant formulas used in any calculations.

Commentary on Question:
This part of the question tested the candidates' knowledge of calculating the CSM at subsequent measurement. Successful candidates demonstrated a clear understanding of the parts that make up CSM.
Candidates generally did well on this part of the question. Most candidates were able to identify all the components required in calculation of the CSM and recognize that CSM cannot be negative.
Common errors included (1) calculating the amortization rate incorrectly by taking only the current service coverage unit/future service coverage unit, and (2) calculating the CSM amortization amount prior to the interest accretion and changes in non-financial assumptions.

EOY CSM = BOY CSM + New contracts added to the group + Interest Accreted on the CSM +/- Changes to the FCF relating to future coverage due to Non-Financial Assumptions - Amortization of the CSM

The CSM must be calculated separately for each group.
There are no new contracts provided in the question, so this step is ignored in the CSM Reconciliation below.

	IFRS17 Group A	**IFRS17 Group B**	**Comments regarding the components**

BOY CSM	50,000	10,000	
Interest Accreted = locked-in interest rate * BOY CSM	2500	450	Assuming the General Model approach is used, interest is accreted based on the locked-in rate at initial recognition
Changes Related to Non-Financial Assumptions = - (impact of mortality + impact of lapse)	-21,000	-13,000	Discount rate change is a financial assumption, and does not affect the CSM. For the changes related to future FCF due to non-financial assumptions, since the net change in the liability is positive, it reduces the CSM
CSM Before Amortization (Sum of above 3 rows, floored at 0)	31,500	0	CSM cannot be negative, so is floored at 0.
CSM Amortization Rate = By Group: Current Service/(Current Service + Future Service)	7.692%	5.660%	This rate is based on coverage units, and is the ratio of current services/(the CSM before amortization was already 0, then there is no CSM to amortize for the period current + future services)
CSM Amortization = CSM Before Amortization * CSM Amortization Rate by Group	2423.08	0	If CSM before amortization is already 0, then there is nothing to amortize for the period.
EOY CSM = CSM Before Amortization – CSM Amortization	29,077	0	Floored at 0, since CSM cannot be negative.

(b) **(LOs 1a, 1b)** You are given the following information for a Single Premium 3-Year Term Life insurance product:

Face Amount:	100,000
Single Premium:	1,000
Annual Expected Mortality Rate	0.1%
Annual Expected Lapse Rate	5.0%
Risk Free Rate	0.4%
Liquidity Adjustment	0.1%
Asset Earned Rate	1.5%
Risk Adjustment (as % of expected claims)	20.0%
Annual Attributable Maintenance Expense	75
Attributable Acquisition Expense (excluding Commissions)	200

Assume:

- The single premium is received at the start of year 1
- Acquisition expenses and commissions are incurred at the start of year 1
- Claims and maintenance expenses are incurred at the end of each year
- The IFRS 17 general measurement approach is used for this block of business.

Determine the maximum amount of commission that can be paid at time of issue without making this contract onerous at inception under the IFRS 17 standard. Show all work, including writing out relevant formulas used in any calculations.

Commentary on Question:
This part of the question tested the candidates' knowledge of the relationship between an onerous contract and its CSM. Successful candidates understood that CSM had to be non-negative, and that onerous contracts had no CSM. Candidates also had to calculate the best estimate liability and risk adjustment and when combined, know how they make up the CSM.

Common errors included the following:

- *Not accounting for survivorship in the $75 directly attributable maintenance expenses each year.*
- *Calculating the End of Year Coverage Units (survivorship) incorrectly.*
- *Applying the risk adjustment factor to the expenses instead of just the claims.*
- *Not including the directly attributable acquisition expense.*
- *Using the top down approach and calculating it as the asset earned rate less the liquidity adjustment.*
- *Only taking the first year's cash flows in calculating the CSM.*

Fulfillment cash flows = Best Estimate Liability + RA
= PV(Cash Outflows) - PV(Cash Inflows) + Risk Adjustment
where the PV(Cash Outflows) will also include the time 0 commissions.

A contract that is onerous will have 0 CSM. Thus the **maximum amount of commission that can be paid is the amount that will make the CSM = 0**.
CSM = max(-(FCF + RA), 0), thus we need to make FCF + RA = 0.

Coverage Units Reconciliation	Year 0	Year 1	Year 2	Year 3
BOY Coverage Units =BOY CU(t) = EOY CU(t-1)		100,000	94,900	90,060
Deaths = 0.1% * BOY CU(t)		100.00	94.90	90.06
Lapses = 5% * BOY CU(t)		5,000	4,745	4,503
EOY Coverage Units = BOY CU – Deaths - Lapses		94,900	90,060	85,467
Probability of Survival Pt = Pt-1*(1-Q(death)t-Q(lapse)t)	1	94.90%	90.06%	85.47%
E(Claims) = Deaths		100.00	94.90	90.06

Maintenance Expenses** =75*BOY CU(t)/100,000		75	71.175	67.545075
Attributable Acqn Expenses (provided)	200			
Risk Adjustment (20% * E(Claims)		20.00	18.98	18.01

**Since the maintenance expenses are directly attributable, they should be weighted by the coverage units/probability of being alive at the end of each year.

Discount rate to use = risk free rate + liquidity adjustment = 0.4% + 0.1% = 0.5%.
There is not enough information to use the top-down approach.
Calculating the present values of the above cash flows back to time 0, discounted at the 0.5% per year:

PV of Expected Claims	282.18	
(+) PV of Expenses	411.64	
(-) Premium	1000	
(=) PV (Cash Outflows - Cash Inflows)	(306.18)	
(+) PV (Risk Adjustment)	56.44	
CSM = max(0, - BEL + RA)	249.74	<- The maximum amount that the commission can be is this amount, as anything larger would make the CSM negative

Check (taking the components above to confirm that using the 249.74 commissions gets the CSM to $0):

PV of Expected Claims	282.18
(+) PV of Expenses	411.64
(+) Commissions (from above)	249.74
(-) Premium	1,000.00
(=) PV (Cash Outflows - Cash Inflows)	(56.44)
(+) PV (Risk Adjustment)	56.44
CSM = max(0, - BEL + RA)	0.00

7. Fall 2020 LFMC Exam (LOs 1a, 1b, 3a, 3b)

Learning Objectives:

1(a), 1(b) The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

3(a), 3(b) The candidate will understand various approaches to manage and evaluate life insurance risks.

~~2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.~~

~~6. The candidate will understand important insurance company issues, concerns and financial management tools.~~

Learning Outcomes:

1(a), 1(b) The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

3(a), 3(b) The Candidate will be able to:

a) Analyze the impact of risk diversification, including considerations for modeling and offsets between mortality and longevity risk

b) Understand the role and framework used by regulators and credit rating agencies for evaluating life insurance companies

~~(2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.~~

~~(6a) The candidate will be able to describe, apply and evaluate considerations and matters related to:~~

- ~~Insurance company mergers and acquisitions~~
- ~~Sources of earnings~~
- ~~Embedded Value determinations~~
- ~~Rating agency considerations~~

Sources:

1(a), 1(b) ILA201-600-25: International Actuarial Note 100: Application of IFRS 17 (Ch. 1, section A – Introduction to GMM only, Ch. 5, 7-9 & 16)

1(a), 1(b) ILA201-602-25: OSFI B-3 Sound Reinsurance Practices and Procedures

1(a), 1(b) CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, Jun 2022

3(a), 3(b) CIA Educational Note: Financial Condition Testing, Jan 2023 (Appendix A only)

~~CIA Educational Note: Valuation of Gross Policy Liabilities and Reinsurance Recoverables (December 2010)~~

~~OSFI B-3 Sound Reinsurance Practices and Procedures~~

Commentary on Question:
This question tested the candidate's knowledge on reinsurance. Candidates did well in recognizing the principles to assist FRIs in developing prudent approaches to managing reinsurance risks. However, most candidates failed to elaborate these principles in detail.

Regarding IFRS 4, candidates clearly understood the regulatory requirement for ceded liabilities. However, few candidates correctly explained the classification of reinsurance contracts.

Solution:
(a) **(LOs 1a, 1b)** Describe the four principles of a sound Reinsurance Risk Management Policy.

Commentary on Question:
In general, candidates did well in identifying the four principles but did not provide sufficient description to demonstrate complete knowledge.

Principle 1: A Federally Regulated Insurer should have a sound and comprehensive reinsurance risk management policy (RRMP) that is overseen by senior management.

- The policy should include purpose and objectives for seeking reinsurance, risk diversification objectives, risk concentration limits and ceding limits and the practices and procedures for managing and controlling its reinsurance risks
- A RRMP should include the roles and responsibilities related to the RRMP, process for ensuring that the RRMP is updated regularly, policy on the use of registered and unregistered reinsurance

- Senior management should oversee the RRMP design, implementation and annual review.
- Senior management is responsible to ensure the RRMP is supported by business operations, including that appropriate policies, procedures and internal controls.

Principle 2: A Federally Regulated Insurer should perform a sufficient level of due diligence on its reinsurance counterparties on an on-going basis to ensure that the FRI is aware of its counterparty risk and is able to assess and manage such risk.

- Due diligence should reflect the level of exposure to the counterparty
- Consider counterparty's ability to meet liabilities under exceptional but plausible adverse events
- FRI should conduct its own due diligence in addition to using third party assessments
- When performing its due diligence, the FRI consider the reinsurance counterparty's claims payment record, expected future claims obligations, balance sheet strength, funding sources (capital and liquidity), management, retrocession arrangements
- Update due diligence regularly throughout the life of the reinsurance contract.
- Conduct more thorough due diligence for unregistered reinsurers. Consider regulatory and supervisory regime plus legal and insolvency frameworks applicable to the unregistered reinsurer.

Principle 3: The terms and conditions of the reinsurance contract should provide clarity and certainty on reinsurance coverage.

- Ensure reinsurance contract is executed prior to the effective date of reinsurance coverage. Contract wording should clearly reflect all material terms and conditions agreed to by all parties.
- Where a comprehensive reinsurance contract is not executed prior to the effective date, interim reinsurance coverage outlined in less formal document (e.g., slip, cover note, letter of proposal, binding letter of intent)
- Sometimes, FRI may enter into a supplemental or subordinated reinsurance contract, a side letter, or other types of arrangements that are ancillary to, and form part of, the main reinsurance contract.

Principle 4: A ceding FRI should not be adversely affected by the terms and conditions of a reinsurance contract.

- A binding reinsurance agreement should ensure funds are available to cover policyholder claims in the event of either the cedant's or reinsurer's insolvency
- Ceding FRIs should ensure that all reinsurance contracts contain an insolvency clause clarifying that the reinsurer must continue to make full payments to an insolvent cedant without any reduction resulting solely from the cedant's insolvency.

- Reinsurance contracts should not contain other types of terms or conditions that may *limit* a troubled or insolvent cedant's ability to enforce the contractual obligations of a reinsurer.
- For funds withheld arrangements, the contract must clearly provide that, in the event of the cedant's or reinsuer's insolvency, the funds withheld, less any surplus due back to the reinsurer, must form part of the property of the cedant's general estate.

(b) Critique the following statements with respect to the valuation of gross policy liabilities and reinsurance recoverables under IFRS 4:

A. An insurer can offset reinsurance recoverables against the related gross liabilities; ceded liabilities are not required to be disclosed for financial reporting or regulatory purposes.

B. The actuary's report should describe the valuation and presentation of policy liabilities and reinsurance recoverables for the insurer's balance sheet and income statement, and the actuary's opinion on the appropriateness of those liabilities and recoverable and on the fairness of their presentation.

C. A simple "gross-up" of the net liability can be used to determine the gross liability for all elements of an insurer's net liability. The reinsurance recoverables can then be calculated as the difference between the gross and net liabilities.

D. Any provision for impairment of the reinsurance recoverables should be included in the gross liability

E. Direct written contracts are to be classified as insurance contracts, financial instruments or service contracts. The corresponding ceded reinsurance contract must follow the classification of the direct contract.

F. It is expected that margins would be consistent between the gross liability and the net liability.

Commentary on Question:
Generally, candidates clearly demonstrated an understanding of the treatment of ceded liabilities under IFRS 4. However, few candidates recognized the reinsurance contract is not necessary to follow the classification of the direct contract in statement E.

A. **(LOs 1a, 1b, 3a, 3b)** It is incorrect. Insurer shall not offset reinsurance recoverable against the related gross liabilities. Ceded liabilities are required to be disclosed.

B. **(LOs 1a, 1b)** It is correct.

C. **(LOs 1a, 1b, 3a, 3b)** It is incorrect. It is unlikely that a gross-up methodology would be appropriate for all elements of the net liability. For example, it would not be appropriate for temporary tax timing differences as the effect on the gross liability would not be proportionate to the effect on the net liability.

D. **(LOs 3a, 3b)** It is incorrect. The provision related to recoverability should be included in the net liability.

E. **(LOs 1a, 1b)** It is incorrect. The classification of direct written contracts and the corresponding ceded reinsurance contract may differ. Examples include some financial reinsurance arrangements.

F. **(LOs 1a, 1b, 3a, 3b)** It is correct.

8. Fall 2020 LFMC Exam (LOs 1a, 1b, 3a, 3b)

Learning Objectives:

1(a). 1(b) The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

3(a), 3(b) The candidate will understand various approaches to manage and evaluate life insurance risks.

~~1. The candidate will understand and apply pre-IFRS 17 valuation principles to individual life insurance and annuity products issued by Canadian life insurance companies.~~

Learning Outcomes:

1 The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

3 The Candidate will be able to:

a) Analyze the impact of risk diversification, including considerations for modeling and offsets between mortality and longevity risk

b) Understand the role and framework used by regulators and credit rating agencies for evaluating life insurance companies

~~(1a) The Candidate will be able to:~~

- ~~Compare and apply methods for life and annuity product reserves~~
- ~~Evaluate, calculate, and interpret liabilities~~
- ~~Recommend and justify appropriate valuation assumptions~~

Sources:

1(a), 1(b) CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, Jun 2022

3(a), 3(b) CIA Educational Note: Financial Condition Testing, Jan 2023 (Appendix A only)

~~CIA Educational Note: Valuation of Universal Life Insurance Contract Liabilities~~

~~CIA Educational Note: Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies: July 2002 (excl. appendices)~~

Commentary on Question:
This question tested the candidates' knowledge on developing valuation assumptions.

Solution:
(a) **(LOs 3a, 3b)** Describe four special considerations in determining economic best estimate valuation assumptions under CALM for UL policies that are not required for traditional whole life policies.

Commentary on Question:
This part of the question tested the candidates' knowledge of the best-estimate economic assumptions used in the valuation of UL products. Candidates generally did not do well on this part of the question, with most candidates not focused on economic assumptions. Only four of the five considerations listed below were required to be described for full credit.

In addition to expected assumptions for investments, asset defaults, reinvestment strategies, and inflation, special considerations needed for UL under CALM that are not required for traditional whole life policies include:

1) Scenario Testing of Interest Rate Risk

Both deterministic and stochastic modeling can be used. Stochastic modeling is helpful in assessing exposure to certain risks such as interest guarantees and bonuses linked to interest rates. If stochastic modeling proves impractical, the actuary would, at a minimum, test additional interest scenarios.

2) Scenario Testing of Non-Fixed Income Assets

In the presence of substantial equity investments supporting insurance contract liabilities, the actuary may choose PfADs on non-fixed investment returns by scenario testing. However, the provision resulting from applying the methodology in paragraph 2340.13 constitutes a minimum provision if scenario testing is not employed.

3) Considerations for Investments Supporting Policy Owners' Fund

- Asset/liability matching may be difficult when the insurance contract liability is less than the amount of funds in the investment option.
- The actuary would project the investment returns for the assets supporting the policy owner funds. The actuary might blend some or all of the equity-linked funds in setting the expected investment return assumption by making assumptions about policy owners' fund mix in future years.

- The actuary might model each equity fund separately and make explicit assumptions about fund transfers made by policy owners to achieve a target mix in future years. In this case, the actuary would make an assumption about the extent to which these funds are correlated.

4) Considerations for Investments Supporting Insurance Contract

- When the insurance contract liability is less than the amount of funds in the investment option (e.g., UL contracts with YRT COI charges and minimal interest rate guarantees and the policy owner funds are matched with an equal amount of assets), the insurance funds are then supported by negative assets that are equivalent to the present value of future gains (e.g., mortality charges less mortality costs, expense charges less actual expenses, actual crediting spreads less actual expenses covered by spread, etc.).
- A sizeable insurance component may build up for UL contracts with Level COI charges. The resulting insurance cash flows usually have a very long duration and could be supported by long-term fixed income assets or by non-fixed income assets.

5) Inflation

For UL, inflation rate may have an effect on policy owner benefits such as death benefits and critical illness benefits linked to the Consumer Price Index (CPI).

(b) **(LOs 1a, 1b, 3a, 3b)** Explain how the valuation assumptions including margins differ between the two blocks of business for the following assumptions:

(i) Mortality

(ii) Expenses

(iii) Lapses

(iv) Premium persistency

Commentary on Question:
This part of the question tested the candidates' knowledge of valuation assumptions for different products. Candidates were generally able to explain how best-estimate assumptions would differ, but few candidates were able to properly describe the considerations for determining margins. Many candidates stated that margins should be higher when the best-estimate assumption is more adverse, which may not always be true. For example, if the product with simplified underwriting has fully credible experience and the product with full underwriting is new and there is no prior experience.

Generally, candidates did well for parts (i) and (iii). In part (ii) many candidates commented on the fact UL A would have lower expenses because it had simplified

underwriting, even though the question was pertaining to valuation assumptions. Part (iv) was generally not well done, with many candidates misunderstanding the concept of premium persistency. Most candidates stated that the minimum funded product would have lower premium persistency, when the opposite is likely true.

(i) Mortality

UL A should use a higher best estimate mortality assumption than UL B because it has more anti-selection due to the following:

- Simplified underwriting
- Marketed as a minimum funded product, i.e. protection oriented

Therefore, UL A should use a higher best estimate mortality assumption than UL B.

UL B may require a mortality improvement assumption if it is death supported, which is possible with UL products that have a level COI, level NAAR, and heavily YRT reinsured.

With respect to margins, UL B may require a negative margin depending on if it is death supported. The opposite would be true for mortality improvement for the same reason. The size of the margin would potentially be commensurate with the quality and quantity of experience data available for each type of product which may depend on the company's historical experience.

(ii) Expenses

Expense assumption should cover standard maintenance plus fund related costs.

- Higher expense for UL B due to more investment choices. Likely more exempt testing as well since it is crucial for tax-preferred cash value buildup.
- Higher expense for UL B due to more investment switches, but will depend on economic market conditions. In higher interest rate scenarios, more switches can be expected on UL B.
- Less fund build up in UL A is expected since it was sold as a T100 replacement.

With respect to margins, a wider margin might be required if the business is volatile (e.g. new and growing), or if the company has historically had difficulty managing expenses (e.g. poor cost containment, overruns).

(iii) Lapses

UL A should have higher lapses than UL B for the following reasons:

- UL A has lower surrender charges which run off faster than UL B.
- UL B has a persistency bonus which encourages increased persistency.

- UL B has level COI charges which generally have lapse characteristics similar to T100, i.e. lapse supported
- UL A sold for death benefit protection and has increasing YRT charges. Will lead to anti-selective lapses as the COIs increase. The policyholder may assess if future elevated COIs are worth paying in exchange for the death benefit, depending on their remaining life expectancy. It will only make sense for those with less time left to live

With respect to margins, the adjustment will be in different directions if UL A is lapse sensitive and UL B is lapse supported. Additionally, if regulation (tax, capital, etc.) impact the value of certain classes of products such as Level COI UL or the economic environment increases the value of certain guarantees or bonuses that are difficult to predict, these might warrant wider margins for UL B. Other factors may include the extent to which the company has credible experience on either product and the degree of sensitivity to deviations in lapse experience.

(iv) Premium Persistency

UL A may have higher premium persistency than UL B:

- Minimum funded policies means premiums need to be paid regularly to keep policies funded.
- UL B will likely feature higher amounts paid in early years until fully funded. The bonus structure encourages high funding in the first ten years as allowable within the exempt test/MTAR line of the policy.

In terms of margins, it's possible that the margin for premium persistency is implicitly tied to the lapse/withdrawal assumption, i.e. net deposits. To reflect that one margin applies to two distinct underlying assumptions, the margin would therefore be wider than the standalone margins, and would vary between UL A and B based on considerations for differences in lapse/withdrawal and premium persistency.

9. Fall 2020 LFMC Exam (LOs 2a, 3a, 3b)

Learning Objectives:

2(a) The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

3(a), 3(b) The candidate will understand various approaches to manage and evaluate life insurance risks.

~~1. The candidate will understand and apply pre-IFRS 17 valuation principles to individual life insurance and annuity products issued by Canadian life insurance companies.~~

Learning Outcomes:

2(a) The Candidate will be able to:

(a) Explain and calculate regulatory capital using various international frameworks

3(a), 3(b) The Candidate will be able to:

a) Analyze the impact of risk diversification, including considerations for modeling and offsets between mortality and longevity risk

b) Understand the role and framework used by regulators and credit rating agencies for evaluating life insurance companies

~~(1a) The Candidate will be able to:~~

- ~~Compare and apply methods for life and annuity product reserves~~
- ~~Evaluate, calculate, and interpret liabilities~~
- ~~Recommend and justify appropriate valuation assumptions~~

Sources:

2(a) ILA201-604-25: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1-6 (excluding Sections 4.2-4.4)

3(a), 3(b) CIA Educational Note: Financial Condition Testing, Jan 2023 (Appendix A only)

~~Report of the Task Force on Segregated Fund Liability and Capital Methodologies (Aug 2010) [Can-1-32]~~

~~CIA Educational Note: Reflection of Hedging in Segregated Fund Valuation – May 2012 [Can-1-13]~~

Commentary on Question:
This question tested the candidates' knowledge of the valuation of segregated fund guarantees.

Solution:
(a) **(LO 2a)** With respect to methods of valuing segregated fund policy liabilities:

(i) Explain why avoiding excessive and unnecessary pro-cyclicality is a desirable feature.

(ii) List five other desirable features.

Commentary on Question:
For part (i) candidates were expected to define pro-cyclicality and describe why it is undesirable in valuation. In general, candidates did not relate long duration liabilities to short term market variability nor explain why a market crash may result in increased guarantees and increase in hedging costs.

For part (ii) full credit was received if candidates explained features without listing the actual names.

(i) Pro-cyclicality is the idea that value of the guarantee increases when markets crash due to the increased in-the-moneyness and the fact that market volatility increases after a crash. This impacts the expected guarantee payoff and the cost of hedging. Segregated fund guarantees are often long duration and the unhedged liabilities are driven by long-term views on investment returns. Given the contracts are long-duration liabilities, it may not make sense to fully reflect short-term volatility that arises from market crashes, which is not expected to persist.

(ii) Desirable features of valuing segregated fund policy liabilities:
1. Practical
2. Economically sound
3. Comprehensive
4. Comparable
5. Results in an appropriate emergence of profits
6. Avoid excessive and unnecessary pro-cyclicality

(b) **(LO 2a)** With respect to hedging in the context of CALM valuations:

(i) Describe the steps required for a first-principles application of CALM with a dynamic hedging program.

(ii) Describe the risks and costs of hedging to reflect in valuation.

Commentary on Question:
Candidates generally did well on part (i). For part (ii), most candidates did not describe enough risks and costs required for full credit.

(i) **Steps for a first-principles approach to CALM dynamic hedging:**

1. Generate real-world stochastic scenarios of market assumptions; investment returns and interest rates.
2. For each scenario,
    a. Project liability cash flows over the term of the liabilities using actuarial assumptions that include MfADs,
    b. At each time step, calculate the Greeks (those being hedged),
    c. Using the information from step b, project the rebalancing of the hedge portfolio and the resulting hedge portfolio cash flows,
    d. Perform a roll-forward CALM cash flow test to determine the amount of required assets which reduce to zero at the last liability cash flow, taking into account the cash flows from the hedge portfolio calculated in step c.
3. Calculate the CTE (60% to 80%) of the value of required assets.

(ii) The following are risks and costs associated of hedging that should be reflected in valuation:

1. Basis risk: Basis risk arises from the imperfect alignment between hedging instruments and fund returns underlying segregated fund guarantees. Hedging programs typically use derivative instruments which derive their value from market indices, while the segregated fund products offer managed fund investment options whose goal is often to outperform some benchmark. Hedging instruments do not replicate the element of active management and may also fail to exactly replicate the indices they are tracking.
2. Liquidity risk: Non-commission-type costs associated with transactions required to rebalance the portfolio.
3. Transaction costs and commissions: Hedging programs can have significant amounts of trading which generate transaction costs.
4. Counterparty risk: Additional credit risk associated with derivatives specifically related to the hedging program.
5. Volatility risk: Dynamic hedging strategies such as delta hedging eliminate market/delta risk but introduce volatility/vega risk. In volatile markets, the cost of rebalancing the portfolio can increase substantially.

6. Risks intentionally not hedged: For practicality/materiality purposes, insurers may choose not to hedge certain risks, such as gamma risk
7. Risks not explicitly modelled: Would need to be included in the valuation in some fashion.
8. Discrete vs continuous rebalancing: In practice, dynamic hedging strategies are designed such that they rebalance at discrete intervals, which is different than theoretical strategies based upon continuous rebalancing. Less frequent rebalancing in modelling versus in practice would imply conservatism in the valuation.
9. Operational risk: Hedging programs can introduce new operational risk due to their complexity.

(c) **(LOs 2a, 3a, 3b)** NewCo Life recently introduced their first segregated fund product with guarantees. NewCo will dynamically hedge most, but not all, aspects of the liability.

For valuation, NewCo is considering using either the Adapted Risk Neutral Method or the Hedge Cost Method as an approximation to the First Principles Stochastic-on-Stochastic Method.

(i) List the pros and cons of both approximation methods.

(ii) Recommend an approximation method. Justify your answer.

Commentary on Question:
For part (i), most candidates were able to list the pros and cons of both the Adapted Risk Neutral (ARN) method and the Hedge Cost (HC) Method. In part (ii) candidates were expected to choose and provide sufficient rationale between ARN and HC. Candidates were given credit for recommending the HC method if appropriate justification was provided. Some candidates chose another method, and received appropriate credit based on rationale.

(i) **Pros and Cons of each approximation:**

a. Adapted Risk Neutral Method
   i. Pros:
      1. Does not require a stochastic-on-stochastic projection
      2. Does not require development of proxy functions
   ii. Cons:
      1. Lack of convergence to CALM when only partial hedging is employed
      2. Amount of hedges held is not explicitly calculated

b. Hedge Cost Method:
   i. Pros:
      1. No stochastic inner loop required
      2. Useful when analyzing CTE(0)
   ii. Cons:

1. Produces a distribution of outcomes that is significantly different from the true outcomes
2. Amount of hedges held is not explicitly calculated

(ii) **Recommend an approximation method:**

I recommend NewCo use the Adaptive Risk Neutral (ARN) method.

ARN can be appropriate when material hedging is performed against a risk neutral liability. HCM uses real world scenarios where adverse scenarios will be those with poor investment returns, similar to a no-hedge scenario. Since NewCo is hedging most of the risks for this product, ARN is an appropriate approximation.

ARN may require adaptations for aspects of the risk neutral liability not being hedged. HCM requires assumptions to be developed for hedge costs and hedging program benefits. The number of assumptions / adaptations needed is less under ARN. This is beneficial since NewCo does not have experience with the product nor corresponding hedging program.

Neither ARN nor HCM require SOS calculations. From computational efficiency, the two methods are relatively equivalent.

ARN provides good alignment with asset / liability movement and reduces income volatility. HCM produces a distribution of outcomes that is significantly different from true outcomes. With HCM, emergence of profit and tracking of hedge error is not expected to follow actual patterns. ARN better meets the objective of reducing income volatility than HCM.

The actuary should use caution when using HCM over a long period of time. Similar caution not stated for the ARN method.

10. Fall 2020 LFMC Exam (LO 2a)

Learning Objectives:

2(a) The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

~~4. The candidate will understand U.S. financial and valuation standards, principles and methodologies applicable to life insurance and annuity products.~~

Learning Outcomes:

2 The Candidate will be able to:

a) Explain and calculate regulatory capital using various international frameworks

~~(4a) The Candidate will be able to describe U.S. valuation and capital frameworks, and explain their impact on the valuation of reserves, capital and financial statements.~~

Sources:

2(a) ILA201-604-25: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1-6 (excluding Sections 4.2-4.4)

~~CIA Draft Educational Note: Life Insurance Capital Adequacy Test (LICAT) and Capital Adequacy Requirements for Life and Health Insurance (CARLI), June 2017~~

~~LFV-646-18: OSFI Draft Guideline – Life Insurance Capital Adequacy Test (LICAT), Chapters 1 – 3, 5 – 9, 11, Sept 2017~~

Commentary on Question:
This question tested the candidates' knowledge of capital requirements.

Solution:
(a) **(LO 2a)** Calculate the following, with respect to LICAT:

(i) The total mortality risk capital requirement.

(ii) The lapse risk capital requirement.

(iii) The operational risk capital requirement.

(iv) The diversified risk capital requirement.

(v) The total insurance risk capital requirement.

Show all work, including writing out relevant formulas used in any calculations.

Commentary on Question:
This part of the question tested the candidates' understanding on the key risk components of LICAT. The question requires the candidates to show all work including writing out relevant formulas. Partial credit was received if the definition/formula for the risk components were correctly written out.

(i) **Mortality Risk Requirement** = $\sqrt{MVR^2 + MCR^2} + MLR + MTR$

Mortality Volatility Risk (MVR) = 2.7*A*E/F,
where A is the Deviation of the upcoming year's projected net death claims,
E is the Total net amount for risk for all policies,
F is the Total net face amount for all policies.
MVR = 2.7*3,875*2,000,000/3,500,000 = 5,979

Mortality Level Risk (MLR) is the difference between the present value of shocked cash flows and the present value of best estimate cash flows, determined separately for life and death supported business.

Shock factor = Min(25%, 11% + 20% * volatility RC/next year's expected claims) = MIN(25%,11%+20%*5,979/40,000) = 14%

MLR = shock factor * Change in PV of CFs for each 10% increase in mortality assumptions/10% = 14%*2,300/10% = 3,218

Mortality Trend Risk (MTR): The candidates need to identify this is a life supported product. For life supported product, the trend risk shock for life supported business is a permanent 75% decrease to the Best Estimate Assumption for mortality improvement for 25 years, followed by no mortality improvement (i.e., a 100% decrease) thereafter.

PV of CFs for 10% reduction in Future Mortality Improvement in the first 25 years: 400
MTR = 400/10%*75% = 3,000

Mortality Catastrophe Risk (MCR): Shock is an absolute increase of 1 death per 1000 (in Canada) in year following the report date.
MCR = PV shocked CFs (1/1000) - PV BEL CF = 22,500 – 20,000 = 2,500

Total Mortality Risk Requirement = $\sqrt{MVR^2 + MCR^2} + MLR + MTR$
= 12,698

(ii) **Lapse Risk Requirement** = $\sqrt{VR^2 + CR^2} + LR + TR$

Lapse Level and Trend (LR+TR) is calculated for level and trend risk combined. The combined shock is a permanent ±30% change in Best Estimate Assumptions for lapse rate at each age and duration.

LR + TR = 20,500 – 20,000 = 500

Lapse volatility (VR) shock maybe quantified as: PV of cash flows (lapse shocked at +/-60% in first year) – PV of cash flows (lapse Shocked at +/-30% in first year),

VR = 21,300 – 20,500 = 800

Lapse catastrophe (CR) is an absolute increase of 20 percentage points in the Best Estimate Assumption for lapse for the first year.

CR = 21,000 – 20,000 = 1,000

Total Lapse Risk Requirement = $\sqrt{\boldsymbol{VR^2 + CR^2}} + \boldsymbol{LR + TR}$
= 1,781

(iii) **Operational Risk Requirement** = Business volume required capital + Large increase in business volume required capital + General required capital

- Business volume required capital = 2.5% * Direct written premium = 2.5%*5,000 = 125
- Large increase in business volume required capital = 0
- General required capital = 2.5% * ceded premium + 5.75% * (credit risk + insurance risk + market risk) = 5.75% * (1,200 +3,000+14,478) = 1,074

where Total insurance risk = 12,698 + 1,781 = 14,478 from part (i) and (ii) above.

Operational Risk Requirement = Business volume required capital + Large increase in business volume required capital + General required capital = 125 + 0 +1,074 = 1,199

(iv) **Diversified (within risk) Insurance risk requirement =**

$$\sqrt{\sum_{i,j=1}^{7} \rho_{ij} \times (IR_i - 0.5 \times LT_i) \times (IR_j - 0.5 \times LT_j)} + PC$$

Mortality -0.5*(MLR+MTR) = 9,589
Lapse -0.5*(MLR+MTR) = 1,531

ρ_{ij}	Mort	Lapse
Mort	1	0.5
Lapse	0.5	1

Diversified Insurance risk requirement (I) = MAX (Diversified (within risk) Insurance risk requirement, highest insurance risk requirement – 0.5*LT) = 10,438

(v) **Total Insurance risk requirement = ($\sqrt{A^2 + A \times I + I^2}$)**

A = market risk requirement + credit risk requirement = 4,200

D = 13,055.72

(b) **(LO 2a)**

(i) Calculate the Core LICAT ratio.

(ii) Calculate the Total LICAT ratio.

(iii) Comment on the capital standing of this company.

Show all work, including writing out relevant formulas used in any calculations.

Commentary on Question:

For part (iii) candidates were expected to comment on the regulator's supervisory target and minimum targets for full credit.

Base Solvency Buffer = 1.05 * Total Capital Requirement = 1.05*(Diversified total risk requirement + Operational risk requirement) = 14,967.46

Available Capital = Tier 1 + Tier 2 = 30,000

(i) Core LICAT Ratio = (Tier 1 capital + 70% x (Surpluse Allowance+Eligible Deposit))/Base Solvency Buffer = 156%

(ii) Total LICAT Ratio = (Available Capital + Surpluse Allowance + Eligible Deposit)/Base Solvency Buffer = 213%

(iii) Insurers are required, at minimum, to maintain a Total LICAT Ratio of 90% and a Core LICAT Ratio of 55%. The regulator also requires a supervisory target of Total LICAT Ratio of 100% and Core LICAT Ratio at 70%. This company is of good capital standing.

Spring 2021 LFMC Exam

2. Spring 2021 LFMC Exam (LOs 2a, 2c, 3a, 3b)

Learning Objectives:

2 The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

3 The candidate will understand various approaches to manage and evaluate life insurance risks.

~~5. The candidate will understand how to explain and apply the methods, approaches and tools of financial management in a life insurance company context.~~

Learning Outcomes:

2 The Candidate will be able to:

a) Explain and calculate regulatory capital using various international frameworks

c) Describe the purpose and application of economic capital

3 The Candidate will be able to:

a) Analyze the impact of risk diversification, including considerations for modeling and offsets between mortality and longevity risk

b) Understand the role and framework used by regulators and credit rating agencies for evaluating life insurance companies

~~(5a) The Candidate will be able to:~~

- ~~Explain and apply methods in determining regulatory capital and economic capital~~
- ~~Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital~~
- ~~Explain Canadian regulatory capital framework and principles~~
- ~~Explain and apply methods in capital management~~

Sources:

2(a)	ILA201-604-25: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1-6 (excluding Sections 4.2-4.4)
2(c)	Economic Capital for Life Insurance Companies, SOA Research Paper, Oct 2016 (only sections 2 & 6)
3(a), 3(b)	CIA Educational Note: Financial Condition Testing, Jan 2023 (Appendix A only)
3(b)	Rating Agency Perspectives on Insurance Company Capital, SOA Research Institute, Aug 2023 (excluding Appendices)

~~Economic Capital for life Insurance Companies, SOA Research paper, Oct 2016 (exclude sections 5 and 7)~~

~~Economic Capital A Case Study to Analyze Longevity Risk, Silverman, JRM, 2010~~

Commentary on Question:
This question tested the candidates' understanding of the Economic Capital Liability Runoff approach.

Solution:
(a) **(LOs 2c, 3a, 3b)** A life insurance company is currently developing an Economic Capital model for its life in-force block, which includes UL, term and whole life products, using the Liability Runoff Approach. The intended applications of the model are for establishing the risk management and risk appetite.

Critique each of the following proposed approaches. Recommend improvements where applicable.

A. *The liability runoff approach is being performed using a stochastic simulation with 3,000 real world economic scenarios. The scenarios being used were originally developed in the context of Variable Annuity Pricing.*

B. *The current valuation assumptions consist of best estimate assumptions plus margins for adverse deviations. Risk driver categories are aligned with these margins, covering a variety of economic and non-economic assumption sub-categories.*

C. *Current inforce data is used to generate projected liability cash flows. Lapse assumptions vary by scenario for UL products. Mortality and expense assumptions for all products and lapse assumptions for non-UL products are on a best estimate basis and do not vary by scenario, with the exception of*

expense inflation, which is scenario-dependent.

D. *Projected asset cash flows are generated for each scenario, such that the level of assets required at the beginning of a given scenario satisfies key obligations including paying policyholder cash flows, debt payments, and dividends.*

E. *The required assets at the valuation date are ranked to form a distribution. The plan is to use a CTE99 metric applied to the distribution, based upon the segregated fund pricing methodology which uses CTE.*

F. *The economic capital is defined by applying the CTE99 metric to the total assets required and deducting the current statutory liabilities.*

G. *It has been suggested that the development team use a correlation matrix approach to calculate the between-risk diversification benefits.*

Commentary on Question:
Candidates generally did not do well on this part of the question, especially with respect to statements A, B, and D. Some candidates critiqued the approach without providing justification or just rephrased the question by rearranging some words. To receive full credit, candidates had to provide valid reasons to support the critique.

Common errors include the following:
Statement A (Economic Scenarios) – Candidates suggested using more scenarios or not appropriate because it is developed in the context of Variable Annuity Pricing.

Statement B (Risk Driver) –The question stated the current valuation assumption includes a Margin for Adverse Deviation. The question did not state economic capital assumptions are padded. Candidates mis-interpreted the question and answered to use best estimate assumptions for economic capital. This was not the focus of the question.

Statement D (Asset cash flow) –Candidates failed to identify the assumptions or types of cash flow missing in the approach.

A Economic Scenario – It is good to use 3,000 scenarios as the paper suggests to use 1000 or more scenarios. The scenario distribution is a realistic assessment of the future risks and returns. Since the scenarios were originally developed for pricing, they represent a "best view" and are appropriate to use.

B Risk Driver – Company needs to select the risk drivers that represent the key risks. The process involves understanding of risk drivers and their relationship. It may be appropriate for practical reasons to use Valuation PfADs but they should be assessed whether it makes sense to look at things on a more aggregate or more granular level. Example, if mortality PfADs combine base or improvement, should the risk driver look at them separately?

C Liability Cash flow – If the company is writing significant new business, it is necessary to include new business in the projection. It is good that the approach vary lapse assumptions by scenario for key products. This will help to better understand the tail risk. However, the current approach did not quantify capital for mortality and expense risks. One approach is to develop stress test on these assumptions to determine the associated amount.
In addition, the liability cash flows should consider including realistic management actions.
Company can also develop a fully integrated stochastic model incorporating non-economic assumptions (example mortality, policyholder behavior) to better understand interaction between risks.

D Asset Cash flow – The cash flow should include investment returns earned on those assets (including investment strategy and re-investment considerations)

E CTE Metric – CTE is effective for capturing tail risks, especially if there are extreme edge case scenarios. The shortcoming of using CTE metric over VAR is that it is more difficult to communicate the results to senior management, and it may be more difficult to work with from a practical perspective.
Risk appetite statements and fundamental corporate philosophies should ultimately drive the decision of selecting a confidence level. It would be good to understand the chosen level of confidence relative to Valuation and Capital calculations.
CTE99 is likely too conservative as compared to Var99.5.

F Valuation of liabilities – The most important measure is the total assets required. This would be higher than the liabilities. Hence, the split of required assets between liabilities and economic capital is not important from this perspective.
Economic Capital = Total assets required – current value of liabilities (mean of the distribution or best estimate liabilities)

G Correlation matrix – Under the correlation matrix approach, standalone capital is calculated for individual risk factors and then aggregated by multiplying the capital results through a correlation matrix. The advantage of this approach is its ease of calculation. Another approach is to use scenario aggregation which involves the use of integrated scenarios containing multiple risk factors (example economic assumptions and lapse assumptions). This would implicitly account for correlation.

(b) **(LOs 2a, 2c, 3a, 3b)** Describe ways that Economic Capital can be applied in the following areas:

(i) Capital Adequacy

(ii) Performance Measurement

Commentary on Question:

Candidates generally did well on this part of the question.

(i) Capital adequacy is the core use of Economic Capital to provide a measure of capital that captures the risk of the insurer's own portfolio. Effective use of Economic Capital requires the Economic Capital to be integrated into the capital management process. Acceptance of the Economic Capital by regulators and rating agencies is necessary for achieving its business benefits.

(ii) In order to use Economic Capital to measure performance, it needs to be incorporated in some related measure of return. One approach involves using Economic Capital as a denominator to calculate the return on risk-adjusted capital (RORAC). An alternative approach involves the inclusion of Economic Capital as the measure of required capital within a value-based measure, such as embedded value (EV).

3. Spring 2021 LFMC Exam (LOs 2a, 2c, 3a, 3b)

Learning Objectives:

2(c) The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

3(a) The candidate will understand various approaches to manage and evaluate life insurance risks.

~~1. The candidate will understand and apply pre-IFRS 17 valuation principles to individual life insurance and annuity products issued by Canadian life insurance companies.~~

Learning Outcomes:

2(c) The Candidate will be able to:

c) Describe the purpose and application of economic capital

3(a), 3(b) The Candidate will be able to:

a) Analyze the impact of risk diversification, including considerations for modeling and offsets between mortality and longevity risk

b) Understand the role and framework used by regulators and credit rating agencies for evaluating life insurance companies

~~(1a) The Candidate will be able to:~~

- ~~Compare and apply methods for life and annuity product reserves~~
- ~~Evaluate, calculate, and interpret liabilities~~
- ~~Recommend and justify appropriate valuation assumptions~~

Sources:

2(c) Economic Capital for Life Insurance Companies, SOA Research Paper, Oct 2016 (only sections 2 & 6)

3(a) ILA201-100-25: Diversification: Consideration on Modelling Aspects & Related Fungibility and Individual Life and Annuities – Life ALM and Modelling Exam Fall 2024 and Spring 2025 6 Transferability, CRO, Oct 2013 (pp. 1-18)

~~CIA Educational Note: Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies: July 2002 (exclude appendices)~~

~~CIA Final Communication of a Promulgation of Prescribed Mortality Improvement Rates (July 2017)~~

Commentary on Question:
This question tested the candidates' knowledge of mortality and mortality improvement assumptions and their review.

Solution:
(a) **(LOs 2c)** Describe the steps you would take to validate the data from ABC's mortality experience study.

Commentary on Question:
Candidates generally answered this part of the question well. Candidates who received full credit described the four steps of mortality experience study data validation. Few candidates described the first step. Candidates generally described the last three steps well.

1. Review the extract specifications with knowledgeable systems people.
2. Summarize data, and validate it against other sources (e.g. Are death benefits paid consistent with financial statements? Is the mix of business by size, underwriting class, etc. consistent with sales statistics?)
3. Review study results for reasonableness against past studies, as well as intuitive tests (e.g. non-smokers are expected to have better mortality experience than smokers).
4. Where inconsistencies in the data can be clearly identified, the data would be adjusted. The problem blocks of experience would be excluded from the study to remove any study bias if solutions to the inconsistencies are not evident, and results would be materially affected.

(b) **(LOs 2c)** The current mortality assumption varies by gender but does not vary by age. Evaluate whether the current data supports adding age bands as a new factor using the information provided below:

Age band	Exposure Count	Number of Deaths (2010-2019)
<55	9,000	600
55-74	39,000	2,200

75+	20,000	1,900

Commentary on Question:
Candidates generally identified both the credibility of the information and the connection between the age bands factor and the mortality result for the evaluation. Candidates who received full credit concluded the evaluation with both supporting considerations identified and explained. Candidates who calculated the mortality rate of each age band but did not describe the intuitiveness of the trend received partial credit.

1. Credibility of the information

The number of deaths in each age band is not fully credible. Age bands can be further grouped together to make them credible. The Normalized Method is the preferred credibility method and 3,007 deaths needed for full credibility.

2. The differentiation should make intuitive sense.

The actuary should be able to explain the connection between the age bands factor and the mortality result. Age bands does not seem to make sense to be a differentiating factor based on the information provided, as the mortality rate by count in <55 age band is higher than in the 55-74 age band, which is not intuitive to explain.

Given that the current data is lack of credibility and does not make intuitive sense, we conclude that it does not support adding age bands as a new factor.

(c) **(LOs 2c)** The Propose changes to the current data and/or process so that joint life mortality can be studied separately from single life mortality.

Commentary on Question:
Candidates generally answered this part of the question well. Most candidates considered a few issues of mortality studies involving joint lives and proposed changes. Few candidates considered the choice of expected mortality or the application of mortality improvements.

1. First Death Reporting

Make sure the data is accurate and tracks the death of each individual life. This is usually tracked reasonably well for joint first to die (JFS) policies, because usually there's reduced payouts upon death of primary member. This approach may be impractical for joint last to die (JLS) policies if material number of first deaths are not reported.

2. Choice of Expected Mortality

Due to the lack of multiple life industry studies, it is common practice to use single life mortality tables instead. The actuary should make sure the table selections are appropriate.

3. Incidence of Substandard Lives

A significant number of joint last to die policies are issued with one substandard life. Therefore, joint last to die policies have a higher incidence of substandard lives than a

single life portfolio. Consider adjusting equivalent single ages (may make tracking substandard experience difficult) or applying a rating to the single life mortality.

4. Credibility

Refining data into credible subgroups is more difficult for joint last to die policies than for single life business. The early duration credibility for joint last to dies business is significantly lower than a similarly sized block of single life policies due to the low probability of claim. So, larger in-force blocks are needed relative to single life policies. In addition, the number of policy combinations is much larger than single life business.

5. Use of Approximations

Exercise caution when using an expected table developed using the equivalent single age or the joint equivalent age method. Using equivalent single age approach for joint last to die policies will show very favourable experience in early durations but unfavorable experience for latter durations. Determine if any approximations would be needed, especially given credibility concerns.

6. Application of Mortality Improvements

Determine how/if single life mortality improvement will be applied and use caution in application of single life mortality improvement factors to joint last to die claim experience.

(d) **(LO 3a)**

(i) The List factors that should be considered when setting an appropriate level of aggregation across insurance products.

Commentary on Question:
Candidates generally answered this part of the question well.

When considering an appropriate level of aggregation for different insurance products, the actuary would consider different factors such as

- the plan of insurance and benefits provided
- the socioeconomic profile of the insureds
- the insurer's underwriting practice for the plan of insurance
- the age distribution
- the country of issue and residence
- the insurer's distribution system and other marketing practice

The structure and impact of any reinsurance arrangement would not be a reason alone to differentiate between products with a similar profile.

(ii) ABC Life has grouped its business into death sensitive and death supported blocks. The change in liabilities of applying the margin without diversification to the base mortality improvement rates for each block of business are shown below:

Age band	Scenario 1: Mortality improvement rate reduced by margin for adverse deviation	Scenario 2: Mortality improvement rate augmented by margin for adverse deviation
<55 death sensitive	+1000	-400
<55 death supported	-1200	+700
55-74 death sensitive	+1600	-800
55-74 death supported	-900	+1100
75+ death sensitive	+1700	-1400
75+ death supported	-1300	+900

Calculate the minimum margin for adverse deviation for base mortality improvement rates allowed after reflecting diversification between death supported and death sensitive blocks of business. Justify your answer and show all work.

Commentary on Question:
To receive full credit, candidates had to calculate the diversification factor to show that it is within the range of diversification benefits permitted. Candidates generally received partial credit for correctly calculating the margin with diversification benefits for each age band.

The resulting impact of adding or deducting the margin for adverse deviations adjusted for diversification to the base mortality improvement rates for purposes of determining the minimum valuation assumption, would be to increase liabilities by an amount at least as high as the maximum of (increase in liabilities on the death sensitive blocks of business, increase in liabilities on the death supported blocks of business) using the margin for adverse deviations without diversification for each age group.

Age Band <55: Maximum of (+1000, +700) = +1000
Age Band 55-74: Maximum of (+1600, +1100) = +1600
Age Band 75+: Maximum of (+1700, +900) = +1700

Margin with diversification = 1000 + 1600 + 1700 = 4300

Margin with no diversification = 1000 + 700 + 1600 + 1100 + 1700 + 900 = 7000

Diversification Factor = 1 – Margin with diversification / Margin with no diversification = 1 – 4300/7000 = 39%, which is within the range of diversification benefits permitted.

Diversification factors would be between 0% and 50% of the margin for adverse deviations and would not be higher than 50%.

Therefore, the minimum margin for adverse deviation for base mortality improvement rates allowed after reflecting diversification between death supported and death sensitive blocks of business is 4300

6. Spring 2021 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.~~

~~3. The candidate will understand Canadian taxation applicable to life insurance companies and products.~~

Learning Outcomes:

The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.~~

~~(3a) The Candidate will be able to describe and apply the taxation regulations applicable to Canadian life insurance companies and life insurance products.~~

Sources:

1(a), 1(b)	ILA201-600-25: International Actuarial Note 100: Application of IFRS 17 (Ch. 1, section A – Introduction to GMM only, Ch. 5, 7-9 & 16)
1(a), 1(b)	CIA Educational Note: IFRS 17 Coverage Units for Life and Health Insurance Contracts, Dec 2022
1(a), 1(b)	ILA201-601-25: The IFRS 17 Contractual Service Margin: A Life Insurance Perspective (Sections 2-4.8)

~~CIA Educational Note: IFRS 17 Coverage Units for Life and Health Insurance Contracts, Dec 2019~~

~~International Actuarial Note 100: Application of IFRS 17~~

~~CIA Educational Note: Comparison of IFRS 17 to Current CIA Standard of Practice, Sept 2018~~

Commentary on Question:
This question tested the candidates' knowledge of IFRS 17. Candidates generally understood the concepts of the CSM, and were able to calculate the profits under two methods and provided appropriate recommendation.

Solution:
(a) **(LOs 1a, 1b)** Calculate the profit or loss recognized through the CSM every year using each of the following approaches:

(i) Simple sum of contractual coverages

(ii) Notional CSM

Show all work.

Commentary on Question:
Candidates generally showed a better understanding of part (i) than part (ii). Common mistakes include omitting the element of interest in the calculation of CSM and omitting tPx in the calculation of current service. For part (ii), some candidates had trouble with the Notional CSM method and did not calculate the CSM by the Whole Life and CI rider separately, and instead combined them at the beginning instead. Few candidates received the full credit since they did not calculate the profit & loss recognition.

Simple sum of Contractual Coverages								
Year	1	2	3	4	5	6	7	8
Coverage	110,000	110,000	110,000	110,000	110,000	100,000	100,000	100,000
tPx	1.0000	0.9500	0.9030	0.8570	0.8150	0.7740	0.7350	0.6980
Current Service	110,000	104,500	99,330	94,270	89,650	77,400	73,500	69,800
Current + future se	718,450	608,450	503,950	404,620	310,350	220,700	143,300	69,800
CSM amort factor	15.3%	17.2%	19.7%	23.3%	28.9%	35.1%	51.3%	100.0%
CSM1 (CI Rider)	100							
CSM2 (WL)	500							
Opening CSM	600	523.38	446.50	369.24	291.71	213.67	142.90	71.69
i CSM	18	15.70	13.39	11.08	8.75	6.41	4.29	2.15
CSM Amortized	94.62	92.59	90.65	88.61	86.79	77.18	75.49	73.84
P&L Recognised	76.62	76.88	77.25	77.53	78.04	70.77	71.21	71.69
Ending CSM	523.38	446.50	369.24	291.71	213.67	142.90	71.69	0.00

Notional CSM Approach								
CI Rider								
Coverage	10,000	10,000	10,000	10,000	10,000	-	-	-
tPx	1.0000	0.9500	0.9030	0.8570	0.8150			
Current Service	10,000	9,500	9,030	8,570	8,150			
Current + future se	45,250	35,250	25,750	16,720	8,150	-	-	-
CSM amort factor	22.1%	27.0%	35.1%	51.3%	100.0%			
CSM1	100							
Opening CSM	100	80.24	60.37	40.38	20.27			
i CSM	3	2.41	1.81	1.21	0.61			
CSM Amortized	22.76	22.27	21.81	21.32	20.88			
Ending CSM	80.24	60.37	40.38	20.27	0.00			
Whole Life base policy								
Coverage	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
tPx	1.0000	0.9500	0.9030	0.8570	0.8150	0.7740	0.7350	0.6980
Current Service	100,000	95,000	90,300	85,700	81,500	77,400	73,500	69,800
Current + future se	673,200	573,200	478,200	387,900	302,200	220,700	143,300	69,800
CSM amort factor	14.9%	16.6%	18.9%	22.1%	27.0%	35.1%	51.3%	100.0%
CSM2	500							
Opening CSM	500	438.50	376.80	314.82	252.62	190.03	127.09	63.76
i CSM	15	13.15	11.30	9.44	7.58	5.70	3.81	1.91
CSM Amortized	76.50	74.86	73.29	71.64	70.17	68.64	67.14	65.67
Ending CSM	438.50	376.80	314.82	252.62	190.03	127.09	63.76	0.00
Total IFE	18.00	15.56	13.12	10.66	8.19	5.70	3.81	1.91
Total CSMA	99.26	97.13	95.09	92.96	91.05	68.64	67.14	65.67
P&L Recognised	81.26	81.57	81.98	82.30	82.87	62.94	63.33	63.76
Total Ending CSM	518.74	437.17	355.19	272.89	190.03	127.09	63.76	0.00
Difference in P&L	4.64	4.68	4.73	4.77	4.82	-7.83	-7.88	-7.93

(b) **(LOs 1a, 1b)** Recommend an approach of coverage unit development for this in-force block based on the above result. Justify your answer.

Commentary on Question:
Candidates generally did well on this part of the question and were able to provide reasonable justification.

Notional CSM is recommended because profit recognition associated with the rider is more closely related to the coverage period of the CI rider; otherwise, CI profits are deferred to years after CI rider has expired.

7. Spring 2021 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.~~

Learning Outcomes:

The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.~~

Sources:

1(a), 1(b) CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts, Jun 2022

1(a), 1(b) CIA Educational Note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts, Jun 2022

~~CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts, Jun 2020~~

~~CIA Educational Note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts, Jul 2019~~

Commentary on Question:
This question tested the candidates' knowledge of IFRS 17.

Solution:
(a) **(LOs 1a, 1b)** You are given the following reference portfolio:

As at December 31, 2023	5-Year Corporate Bond	5-Year NHA Mortgage-Backed Securities
Fair Market Value	600	200
Asset Spread	1.20%	0.50%
Expected Credit Loss Experience	0.15%	0.00%
2023 Credit Loss Experience	0.23%	0.00%

The risk-free rate as at December 31, 2023 is 2.0%.

(i) List the advantages and disadvantages in using a reference portfolio to determine the IFRS 17 discount rates.

(ii) Calculate the IFRS 17 discount rate on December 31, 2023 using a top-down approach. Explain your approach.

(iii) Calculate the IFRS 17 discount rate on December 31, 2023 using a bottom-up approach. Explain your approach.

Commentary on Question:
For the top-down approach, common mistakes included (i) calculating the discount rate using only the Corporate Bond yield instead of blending the Corporate bond and NHA NBS based on their fair market value in the reference portfolio; and (ii) calculating the adjusted spread above risk-free rate based on the reference portfolio and not adding the risk-free rate back to the discount rate.

(i) **Advantages** in using a reference portfolio to determine the IFRS 17 discount rates:

- Using a reference portfolio makes the construction of discount rate curves operationally simpler.
- Separation between insurance contract reference portfolio and actual asset portfolios, easier to make adjustments to align liquidity.
- Actual trading activity will not affect the discount rates.

Disadvantages in using a reference portfolio to determine the IFRS 17 discount rates:

- Can increase earnings and/or balance sheet volatility if there are differences between underlying assets held and the custom reference portfolio.

(ii) **Top-Down method:** Gross yield is calculated based on the reference portfolio provided. The gross yield is then adjusted by removing factors not relevant to the insurance contracts such as credit spread, and market risk adjustment if non-fixed income assets are included in the reference portfolio. The reference portfolio must reflect the characteristics of the insurance contracts.

Credit spread needs to be calculated using Credit Loss Model approach.

Since no non-fixed income assets are included in the reference portfolio, market risk adjustment is not required for this reference portfolio.

Credit spread calculation:

- Expected Credit Loss is provided

ECL (Corporate Bond) = 0.15%
ECL (NHA NBS) = 0.00%

- Unexpected Credit Loss

Assume a 100% margin (or any other margin the candidate chooses that is reasonable).
UCL (Corporate Bond) = 0.15%*100% = 0.15%
UCL (NHA NBS) = 0.00%

IFRS 17 discount rate based on the reference portfolio is then calculated by blending the adjusted yields of the Corporate Bond and the NHA NBS by the fair MV.

$$= \frac{600}{600+200} \times (2.0\% + 1.2\% - 0.15\% - 0.15\%) + \frac{200}{600+200} \times (2.0\% + 0.5\%)$$

= 2.80%

(iii) **Bottom-Up method:** Start with the risk-free rates and add back a liquidity premium. The liquidity premium can be determined using a market-based approach.

Since the NHA MBS provided has no credit risk and has the same duration as the liability, it can be used to determine the liquidity premium.

Liquidity premium = spread over risk free rate = 0.5%

Therefore, the discount rate = risk-free rate + liquidity premium = 2% + 0.5% = 2.5%

(b) **(LOs 1a, 1b)** You are given the following Standard Normal Cumulative Probability Table.

z	0.000	0.253	0.526	0.842	1.282
P(Z≤z)	0.5	0.6	0.7	0.8	0.9

(i) Calculate the best estimate benefit claim cost at issue. Show all work.

(ii) It has been determined that the new universal life insurance product will be reinsured by DDT Re on a yearly renewable term basis. DDT Re has priced the reinsurance premium using its lower mortality experience and lower income tax rates relative to BMS Life. DDT Re uses the same discount rate as BMS Life.

Critique each of the following statements:

A. *BMS Life's fulfillment cash flows reflect DDT Re's lower mortality assumption and lower income tax.*

B. *BMS Life measures the direct contract and the reinsurance contract using the variable fee approach. DDT Re measures the reinsurance contract using the premium allocation approach.*

C. *BMS Life's risk adjustment reflects DDT Re's counterparty risk.*

D. *DDT Re will have a longer contract boundary than BMS Life due to DDT Re's lower mortality assumption.*

Commentary on Question:
This part of the question tested the candidates' understanding of the fulfillment cash flows. Most candidates were able to calculate the Risk Adjustment using the correct confidence level.

Common errors in the critiques include the following:

- *Not commenting on whether income tax should be reflected in FCF or not.*
- *Agreeing that DDT Re can model the reinsurance contract using PAA due to YRT contract.*
- *Identifying counterparty risk as a financial risk.*

(i) With a 80% confidence level, from the standard Normal Table, find $P(Z \leq 0.8) = 0.842$

Therefore, Risk Adjustment (RA) = σ (benefit payment) × $P(Z \leq 0.8) = \sqrt{3000} \times 0.842 = 46.12$

PV (FCF) = RA + PV (Benefits) – PV (Premiums)

Given that the premium margin = 12%,
PV (Premiums) = 1.12% × (RA + PV (Benefits))

Therefore,
PV (FCF) = RA + PV (Benefits) – PV (Premiums)
= (RA + PV (Benefits)) - 1.12% × (RA + PV (Benefits))
= -0.12% × (RA + PV (Benefits))

PV (FCF) = -125, RA = 46.12

Therefore,

-125 =-0.12% × (46.12 + PV (Benefits))

PV (Benefits) = 995.55

(ii) A: This is incorrect. The fulfillment cash flows for the direct and reinsured portions of the block should be modelled separately under IFRS 17. BMS should reflect its own mortality assumptions in the direct FCF. The reinsurance premium will be lower reflecting the reinsurer's lower mortality experience. Income tax should not be reflected in FCF.

B: This is incorrect. Reinsurance contract should not be modelled using variable fee approach. BMS's direct contract may be modeled using VFA provided the criteria for using VFA are met. DDT Re should use general model since this is a long-term contract. Note that the fact that the reinsurance contract is on a yearly renewable term does not mean this is a short-term contract.

C: This is correct.

D: This is incorrect. Contract boundary is the period when there are sustentative rights and obligations exist between the reinsurer and BMS. Contract boundary is not determined by the experience of the reinsurer. The boundary of a reinsurance contract held is the same as the boundary of the corresponding reinsurance contract issued.

8. Spring 2021 LFMC Exam (LOs 1a, 1b, 3a, 3b)

Learning Objectives:

1(a), 1(b) The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

3(a), 3(b) The candidate will understand various approaches to manage and evaluate life insurance risks.

~~2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.~~

Learning Outcomes:

1(ab), 1(b) The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

3(a), 3(b) The Candidate will be able to:

a) Analyze the impact of risk diversification, including considerations for modeling and offsets between mortality and longevity risk

b) Understand the role and framework used by regulators and credit rating agencies for evaluating life insurance companies

~~(2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.~~

Sources:

1(a), 1(b) CIA Educational Note: IFRS 17 Market Consistent Valuation of Financial Guarantees for Life and Health Insurance Contracts, Jun 2022

3(a), 3(b) CIA Educational Note: Financial Condition Testing, Jan 2023 (Appendix A only)

~~LFM-649-20: International Actuarial Note 100: Application of IFRS 17 (excluding section C: Ch.11 & section D)~~

~~CIA Educational Note: Comparison of IFRS 17 to Current CIA Standards of Practice, Sep 2018~~

~~LFM-141-18: IFRS 17 Insurance Contracts – IFRS Standards Effects Analysis, May 2017, IASB (sections 1, 2, 4 & 6.1-2 only)~~

~~LFM-656-21: PwC - In transition: The latest on IFRS 17 implementation, Feb 2020~~

~~LFM-655-21: IFRS Standards Exposure Draft Amendments to IFRS 17, Jun 2019~~

Commentary on Question:
This question tested candidates' understanding of reporting concepts for IFRS 17 and the differences compared with current IFRS 4.

Solution:
(a) **(LOs 3a, 3b)** Explain the difference in the profit emergence for life insurance contracts under IFRS 4 and IFRS 17.

Commentary on Question:
Candidates generally did well on this part of the question. Most candidates were able to explain the difference in the profit emergence under IFRS 4 and IFRS 17 to receive full credits.

Under IFRS 17, insurance entity is required to hold unearned profit in CSM and realized it over service provided period. Profit emergence under IFRS 17 is smoother compared with IFRS 4. The changes in estimation of future cashflows will flow through CSM adjustment before hitting income.

For IFRS 4, entities recognize new business gain or profit at inception and income from subsequent period from the release of PfADs. The experience variances and assumption updates are recognized right away.

8. Continued

(b) Explain whether the variable fee approach (VFA) can be used as the measurement approach under IFRS 17 for each of the following contracts:

(i) (**NO LONGER RELEVANT)** ~~Whole life with critical illness riders~~

(ii) (**NO LONGER RELEVANT)** ~~Payout variable annuities~~

(iii) **(LOs 1a, 1b)** Segregated funds with guaranteed minimum income benefits

~~(iv)~~ (**NO LONGER RELEVANT)** ~~Coinsurance contract on a participating life closed block~~

Commentary on Question:
Candidates generally did well on this part of the question. Candidates that did not provide any justification did not receive credit. A common error for part (iv) was providing judgement based on qualification of Par block instead of a coinsurance contract.

(i) No

There is no direct participation in underlying investments for this product

(ii) Yes, if the payment is based on underlying pool of investments participated by the policyholders with DPF involved.

Candidates answered No with validated explanation (ex. no clear information if the payment is fixed or varied with market movement with DPF involved) also received full credits.

(iii) Yes

The product meets all three VFA criteria
1. The contractual terms specify that the policyholder participates in a share of a clearly identified pool of underlying items
2. The entity expects to pay to the policyholder an amount equal to a substantial share of the fair value returns from the underlying items
3 The entity expects a substantial proportion of any change in the amounts to be paid to the policyholder to vary with the change in fair value of the underlying item

(iv) No

Reinsurance contracts never use VFA under IFRS 17. The general measurement model or Premium Allocation Approach are used for reinsurance contracts.

8. Continued

(c) (**NO LONGER RELEVANT)** A 3-year term-life contract will be issued on January 1st, 2023. The following expected cash flows are provided:

Year	**1**	**2**	**3**
Premium (Beginning of year)	300,000	290,000	280,000
Claims (End of year)	200,000	210,000	220,000
Risk Adjustment at beginning of year	260,000	170,000	90,000

The discount rate is 3%.

(i) Calculate the contractual service margin or loss component at issue as appropriate. Show all work.

(ii) The company implements an assumption change at the end of first year and reflects those changes to its CSM or loss component for the current reporting period. You are given the following revised information for this policy as at the end of year 1:

Year	**1**	**2**	**3**
-	**Actual**	**Expected**	**Expected**
Premium (Beginning of year)	300,000	285,000	275,000
Claims (End of year)	150,000	200,000	210,000
Risk Adjustment at beginning of year		170,000	90,000

Rollforward the contractual service margin or loss component from beginning of year 1 to the end of year 1. Show all work.

(iii) Determine the Year 1 Statement of Profit and Loss in the format below for this contract based on the information you calculated. Assume the insurance service result and insurance finance expense for risk adjustment are not disaggregated. Assume all assets backing this contract are in cash. Show all work.

Statement of Profit and Loss	**Year 1**
Insurance Revenue	-
Insurance Service Expense	-
Total Insurance Service Result	-
-	-
Total Insurance Finance Expense	-
-	-
Total Net Income before tax	-

8. Continued

Commentary on Question:
Part (i) of the question tested candidates' understanding of CSM or Loss Components calculation under IFRS 17. Candidates generally did well on this part of the question. Candidates were required to conclude the contract was onerous to receive full credit.

Part (ii) of the question tested candidates' understanding of the Roll Forward (RF) of Loss Component (LC) under IFRS 17. Candidates were generally unable to identify that the RF for onerous contracts was based on systematic allocation method instead of amortization method under CSM. Most Candidates were able to calculate the assumption changes from future projection years and applied the impact accurately in LC RF to receive partial credit. Partial credit was received if candidates identified the LC was floored at zero and changed to CSM at the end of the period.

For part (iii) candidates were generally able to identify and calculate the insurance revenue as expected claim and release of risk adjustment, and insurance service expense as actual claim to receive partial credits. The solution provided below was based on no CSM amortization in the P&L statement. Candidates that appropriately amortized the CSM from part (ii) received full credit. Candidates generally did not consider the loss component allocation and reversal of losses due to assumption change in the P&L statement.

(i)

PV of Premium	845,480
PV of Claims	593,451
PV of Best Estimate CF	-252,029
-	-
PV of Fulfilment CF	7,971

PV of Premium = 300,000 + 290,000/1.03 + 280,000/(1.03^2) = 845,480
PV of Claims = 200,000/1.03 + 210,000/1.03^2 + 220,000/1.03^3 = 593,451
BEL (Best Estimate Liability) = PV of Claims – PV of Premium = -252,029
FCF = Risk Adjustment + BEL = 260,000 + (-252,029) = 7,971

The CSM is negative of FCF and floor at 0. It is an onerous contract at initial recognition, with a loss component of 7,971

8. Continued

(ii)

Loss Component Rollforward	
Loss Component opening balance	7,971
Loss Component Allocation: Interest	13
Loss Component Allocation: Expected Claims	(1,868)
Loss Component Allocation: Risk Adjustment	(841)
Loss Component after Allocation	5,276
Changes in estimates of PV of future CF	(9,280)
LC closing balance	
CSM	4,005

Loss Component is based on systematic allocation factor which is initial loss component divided by total of future liability CFs and Risk Adjustment (*Other Systematic Allocation methods used by candidates received full credit.)*
= 7971 / (593,451 + 260,000) = 0.00934

Loss Component Allocation for Interest is the whole amount of insurance finance expense related to the liability for remaining coverage = (The estimates of the present value of the future cash flows on initial recognition + the cash inflows received at the beginning of Year 1) * the current discount rate * Loss Component Allocation Percentage
= (-252,029 + 300,000) * 3% * 0.934% = 13

Loss Component Allocation for Expected Claims which is the release of expected insurance service expense for the incurred claims for the year = Expected Claim * Loss Component Allocation Percentage = -200,000 * 0.934% = -1,868

Loss Component Allocation for Risk Adjustment which is change in the risk adjustment for non-financial risk caused by the release from the risk = Risk Adjustment Release * Loss Component Allocation Percentage = (170,000 – 260,000) * 0.934% = - 841

The sum of 1868 and 841 as 2,708 is the total loss component runoff included in the RF.

Loss Component after Allocation = Loss Component opening balance + Loss Component Allocation for Interest + Loss Component runoff = 7,971 + 13 + (-2708) = 5,276

8. Continued

Assumption Change impact = PV of Best Estimate Cash Flow at time 1 post assumption change – PV of Best Estimate Cash Flow at time 1 before assumption change = -159,870 – 150,590 = -9,280

-159,870 for post change at time 1
= PV of Claims – PV of Premium
= (200,000/1.03+210,000/1.03^2) – (285,000 + 275,000/1.03)

150,590 for pre change at time 1
= PV of Claims – PV of Premium
= (210000/1.03 + 220,000/1.03^2) – (290,000 + 280,000/1.03)

The changes in estimates of PV of future CF = (9,280), this would reverse the Loss Component of 5,276 to 0, then establish a CSM of – (9,280) + 5,276) = 4,005.
(*Candidates who further amortized this CSM in the period according to the Draft Amendments received full credit as well.)*

Therefore, the Loss Component closing balance = 0 and the CSM closing balance = 4,005

(iii)

Statement of P&L	Year 1
Insurance Revenue	
– Expected Claims after loss component allocation	197,292
– Change in the risk adjustment after loss component allocation	90,000
– CSM recognised in profit or loss for the services provided	-
Total Insurance Revenue	**287,292**
Insurance Service Expense	
– Incurred claims	(147,292)
– Losses on onerous contracts and reversal of those losses	5,276
Total Insurance Service Expense	**(142,016)**
Total Insurance Service Result	**145,276**
Insurance Finance Expenses	**(1,439)**
Total Net Income Before Tax	**143,837**

8. Continued

Insurance Revenue

- Expected Claims after loss component allocation = Expected Claims – Loss Component Runoff calculated from ii) = 200,000 – 2,708 = 197,292
- Change in the risk adjustment after loss component allocation = 260,000 – 170,000 which is the release of the risk adjustment in year 1.
- CSM recognised in profit or loss for the services provided = 0

Insurance Service Expense

- Incurred claims = Actual Claims – Loss Component Runoff calculated from ii) = 150,000 – 2,708 = 147,292
- Losses on onerous contracts and reversal of those losses = 5,276, from part (ii)

Total Insurance Service Result = Insurance Revenue + Insurance Service Expense, where the Insurance Service Expense is presented as a negative amount.

Insurance Finance Expenses = -(The estimates of the present value of the future cash flows on initial recognition + the cash inflows received at the beginning of Year 1) * the current discount rate = -(-252,029 + 300,000) * 3% = (1,439)
Risk Adjustment is not included as we assume the insurance finance expense for risk adjustment are not disaggregated.

Total Net Income Before Tax = Total Insurance Service Result + Insurance Finance Expenses, where the Insurance Finance Expenses is presented as a negative amount.

10. Spring 2021 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.~~

~~4. The candidate will understand U.S. financial and valuation standards, principles and methodologies applicable to life insurance and annuity products.~~

Learning Outcomes:

The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.~~

~~(4a) The Candidate will be able to describe U.S. valuation and capital frameworks, and explain their impact on the valuation of reserves, capital and financial statements.~~

Sources:

1(a), 1(b) CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts, Jun 2022

~~LFM-149-21: Insurance Contracts, PwC (Accounting Guide for Insurance Contracts), 2019, (Sections 1.1, 3.5, 5.1-5.10; Figures IG 2-1, IG 2-2)~~

~~CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts, Jun 2020~~

~~LFM-650-20 FASB in Focus – ACCOUNTING STANDARDS UPDATE NO. 2018-12 Targeted Improvements to the Accounting for Long-Duration Contracts Issued by Insurance Companies~~

Commentary on Question:
This question tested the candidates' knowledge of IFRS 17 and US financial reporting standards.

Solution:
(a) **(NO LONGER RELEVANT)** ~~Outline the ASU 2018-12 simplified DAC amortization model for insurance contracts classified as "long duration" under US GAAP.~~

~~**Commentary on Question**:~~
~~*This part of the question tested the candidates' knowledge of simplified DAC. To demonstrate knowledge, candidates had to outline the simplified DAC amortization model, which requires a more thorough discussion of the provisions below, and not merely state what DAC amortization is. Candidates providing at least 4 of the items below received full credit.*~~

~~*Candidates generally provided only 1-2 of the items below. Most candidates understood that DAC is amortized using a straight-line basis. Some candidates noted that DAC must reflect actual experience, and that amortization cannot be a function of profit emergence.*~~

~~*Some candidates noted that no interest accrues on unamortized DAC, not subject to impairment or recoverability testing, or shadow DAC no longer exists under this model. However, since the question does not ask for a comparison between this guidance and the old guidance, no credit was received for these responses.*~~

~~The ASU 2018-12 simplified DAC amortization model for insurance contracts classified as "long duration" under US GAAP comprises of the following key concepts:~~

- ~~**Deferred Acquisition Cost (DAC) is amortized using a straight-line basis** over the expected term of the related contracts.~~
- ~~**The amortization can be done on either at the individual level or grouped contract level.** The amortization may be done at the grouped contract level as long as it approximates straight-line amortization at an individual contract level. The grouping should likewise be consistent with the grouping used to estimate the liability for future policy benefits for the corresponding contracts.~~
- ~~**Assumptions used in the computation of DAC should be consistent with those used to determine the liability** for future policy benefits or related balances for associated contracts.~~
- ~~**Amortization amounts are not allowed to be a function of revenue or profit emergence.**~~
- ~~**DAC must reflect actual experience**. Unamortized DAC must be reduced for actual experience in excess of expected experience. Changes in future assumptions are applied by adjusting the amortization rate prospectively rather than through a retrospective catch-up adjustment.~~

- ~~**For deferred annuity contracts, expected term of the accumulation phase** is considered for DAC amortization. The payout phase should not be combined with the accumulation phase for this purpose.~~

(b) **(LOs 1a, 1b – partial)** Compare the IFRS 17 discount rate guidance with the ASU 2018-12 criteria for determining yield used in discounting the liability for future policy benefits.

Commentary on Question:
This part of the question requires comparisons between IFRS 17 and ASU 2018-12 guidance, which means exploring the similarities and differences between the two. To receive full credit, candidates had to provide at least 6 combined similarities and differences.

Most candidates provided differences between the two standards. Few candidates provided similarities. Candidates who attributed a particular item only to one of the standards but not both (e.g. "ASU 2018-12 reflect duration or timing characteristics") received partial credit. Candidates generally recognized that both IFRS 17 and ASU 2018-12 require the use of observable current market inputs or prices.

Candidates were generally more successful identifying the differences. Most candidates noted that ASU 2018-12 explicitly prescribes Single A as the credit rating, while most candidates did not note that IFRS 17 has no such guidance. Most candidates recognized that IFRS 17 reflects the characteristics of the insurance contracts, including liquidity, and that ASU 2018-12 does not include a liquidity adjustment. Few candidates noted that IFRS 17 applied to products with varying cash flows, as well.

Several candidates noted that IFRS 17 provides a choice of disaggregating discount rate changes between P&L and OCI, while ASU 2018-12 only prescribes OCI for such changes. Partial credit was provided for this response.

The **similarities** between the IFRS 17 discount rate guidance with the ASU 2018-12 criteria are as follows:

- Both **disconnect the discount rate from the underlying asset** or investment return or performance;
- Both require that the discount rate **reflect duration or timing** characteristics;
- Both require the use of **observable current market inputs or prices**;
- Both provide guidance on **extrapolating points on the yield curve beyond the observable period** or those with observable/active markets

The **differences** are as follows:

- IFRS 17 **does not include specific guidance** as to the credit rating or inherent risk in the discount rate, but ASU 2018-12 **explicitly prescribes** this (Single A interest yields);

- IFRS 17 **requires reflecting the liquidity characteristics of the insurance contract**, while ASU 2018-12 **does not include a liquidity adjustment**;
- IFRS 17 takes into consideration **more of the characteristics of the insurance contracts** (timing, currency, liquidity), whereas ASU 2018-12 only takes into consideration the **duration or timing**;
- IFRS 17 provides guidance for **products with varying cash flows** such as universal life contracts, while the updated ASU 2018-12 discount rate guidance applies only to **non-participating traditional insurance contracts**

(c) **(NO LONGER RELEVANT)** ~~Calculate the liability remeasurement loss which would be recorded in the year-end 2024 accounting entries. Show all work.~~

~~**Commentary on Question**:~~
~~*This part of the question required candidates to apply their understanding of ASU 2018-12 in the computation of the liability remeasurement loss for a long duration contract liability.*~~

~~*The calculation can be broken down into three steps. Candidates generally received full credit for steps 1 and 2. Common mistakes for step 3 included utilization of the incorrect discount rate, using the present value at the start of year 3 instead of year 2, and misinterpreting the present values provided in the tables and attempting to re-calculate present values.*~~

~~*Candidates were required to demonstrate that changes in the discount rate flow through differently than changes in non-economic assumptions, and as such these calculations use the original locked-in discount rate of 3%. Candidates were penalized for using the revised 3.5% discount rate in the calculation.*~~

~~*There were no penalties for rounding or not, and credit was given for step 3 if errors from steps 1 or 2 were carried through properly.*~~

~~**Step 1: calculate original Net Premium Ratio** (3%, time 0, original assumptions)~~

~~Net Premium Ratio = (PV Benefits @ 3% at time 0) ÷ (PV Gross Premium @ 3% at time 0)~~

~~Net Premium Ratio = 432.44/661.57 = 65.4%~~

~~**Step 2: calculate Revised Net Premium Ratio** (3%, time 0, actual historical & revised future assumptions)~~

~~Revised Net Premium Ratio = (PV Actual Historical & Revised Future Benefits @ 3% at time 0) ÷ (PV Actual Historical & Revised Future Gross Premium @ 3% at time 0)~~

~~Revised Net Premium Ratio = 493.11/638.20 = 77.3%~~

~~Step 3: PV to beginning of year 2 & calculate Liability Remeasurement Loss (LML)~~

~~LML = [(PV historical/revised benefits @ 3%) - (PV revised net premiums @ 3%)]~~

~~less [(PV original benefits @ 3%) - (PV original net premiums @ 3%)]~~

~~PV revised net premiums @ 3%) = (PV of year 2-4 historical/revised gross premium @ 3%) * 77.3% = 469.59 * 77.3% = 362.83~~

~~PV original net premiums @ 3%) = (PV of year 2-4 original gross premium @ 3%) * 65.4% = 488.59 * 65.4% = 319.37~~

~~LML = (396.27 - 362.83) - (343.92 - 319.37) = 33.44 - 24.55 = 8.89~~

~~The liability remeasurement loss recorded in the year-end 2024 accounting entries would be $8.89.~~

11. Spring 2021 LFMC Exam (LOs 1a, 1b, 2a)

Learning Objectives:

1(a), 1(b) The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

2(a) The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

~~1. The candidate will understand and apply pre-IFRS 17 valuation principles to individual life insurance and annuity products issued by Canadian life insurance companies.~~

~~5. The candidate will understand how to explain and apply the methods, approaches and tools of financial management in a life insurance company context.~~

Learning Outcomes:

1(a), 1(b) The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

2(a) The Candidate will be able to:

a) Explain and calculate regulatory capital using various international frameworks

~~(1a) The Candidate will be able to:~~

- ~~Compare and apply methods for life and annuity product reserves~~
- ~~Evaluate, calculate, and interpret liabilities~~
- ~~Recommend and justify appropriate valuation assumptions~~

~~(5a) The Candidate will be able to:~~

- ~~Explain and apply methods in determining regulatory capital and economic capital~~

- ~~Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital~~
- ~~Explain Canadian regulatory capital framework and principles~~
- ~~Explain and apply methods in capital management~~

Sources:

1(a), 1(b) ILA201-602-25: OSFI B-3 Sound Reinsurance Practices and Procedures

2(a) ILA201-604-25: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1-6 (excluding Sections 4.2-4.4)

~~LFM-632-12: OSFI B-3 Sound Reinsurance Practices and Procedures~~

~~LFM-645-19: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), Chapters 1-11, October 2018~~

Commentary on Question:
This question tested the candidates' knowledge of reinsurance and LICAT.

Solution:
(a) **(LOs 1a, 1b)** Critique the following statements with regards to Sound Reinsurance Practices and Procedures, as applicable to a Canadian federally regulated insurer:

A. *Senior management has delegated design and implementation of the reinsurance risk management policy to business line leaders.*

B. *Business line leaders are responsible for oversight of the reinsurance risk management policy. Each business line leader assesses their operations against the reinsurance risk management policy and reports to senior management once every two years.*

C. *Sufficient due diligence on registered reinsurer counterparties, where reinsurance treaties are already in place, is performed on an on-going basis. Due diligence includes an assessment of financial strength and capabilities of the reinsurance counterparty, supplemented with rating agencies assessments.*

D. *Reinsurance contract language is as broad as needed to reasonably capture general reinsurance terms and conditions. The reinsurance contracts outline where the agreement may adversely affect the ceding company.*

Commentary on Question:
This part of the question tested the candidates' knowledge of Sound Reinsurance Practices and Procedures and to be able to apply and analyze in difference scenarios.

Statement A: Candidates generally knew that the statement was not correct. Some candidates were able to identify the role of senior management. Some confused the role of senior management with the role of the Board. Few candidates expanded on the reason why senior management cannot delegate to business line.

Statement B: Candidates generally knew that the statement was not fully correct. Most candidates identified that senior management should review the Reinsurance Risk Management Plan (RRMP) annually. Few candidates identified the responsibility of business line officers.

Statement C: Candidates generally knew that the statement was not fully correct. Most candidates identified that performing a sufficient level of due diligence is correct and were able to point out at least one of the places where the statement was not correct.

Statement D: Candidates generally did well critiquing this statement.

Statement A: Not Correct. Delegating to business line will not support the following:

- Senior management should oversee the development and implementation of the reinsurance risk management policy.
- The reinsurance risk management policy (RRMP) should reflect the nature, scale and complexity of a federally regulated insurer's (FRI) business and have regard for its risk appetite and risk tolerance.
- The RRMP should document the significant elements of the FRI's approach to managing risks through reinsurance, including objectives, risk diversification objectives, risk concentration limits, ceding limits and practices & procedures for managing and controlling reinsurance risks.

- The FRI must address the adequacy & effectiveness of reinsurance to adequately address exposures to large and catastrophic losses.

Statement B: Partially Correct.

- Not correct: Senior management should oversee the reinsurance risk management policy.
- Not correct: Senior management is responsible for ensuring the RRMP is operationalized.
- Correct: Business line officers and managers are charged with the day-to-day responsibility of the RRMP.
- Not correct: At a minimum, senior management should review the RRMP annually. Every two years not sufficient.

Statement C: Partially Correct

- Perform a sufficient level of due diligence on its reinsurance counterparties on an on-going basis is correct.
- Not correct, as it should include regulated and nonregulated reinsurers.
- Not correct, as it should include current and prospective reinsurance counterparties.
- Correct: Business line officers and managers are charged with the day-to-day responsibility of the RRMP.

Statement D: Not correct

- Ensure the terms and conditions of the reinsurance contract provide clarity and certainty on coverage, instead of broadly set to cover general reinsurance terms and conditions.
- Ceding company should not be adversely affected by the terms and conditions of a reinsurance contract.

(b)

(i) **(LO 2a)** Calculate PBLI's LICAT Total Ratio before and after incorporating the reinsurance agreement with XYZ. Show all work.

(ii) **(LOs 1a, 1b)** Recommend whether PBLI should pursue reinsurance with XYZ from a capital perspective.

Commentary on Question:
Candidates generally understood how to calculate the LICAT total ratio. Common errors include not recognizing the 1.05 factor was already embedded in the Base Solvency Buffer and incorrectly multiplying the ceded percentage onto available capital and/or surplus allowance.

Candidates generally understood that an increase in the total ratio strengthens the capital position which is a positive for the company.

(i) LICAT Total Ratio before incorporating XYZ reinsurance agreement
= (Available Capital + Surplus Allowance + Eligible Deposits) / Base Solvency Buffer
= (530 + 50 + 0) / (500)
= 116%

LICAT Total Ratio after incorporating XYZ reinsurance agreement
= (Available Capital + Surplus Allowance + Eligible Deposits) / (Base Solvency Buffer after reinsurance)
= (530 + 50 + 0) / (450)
= 129%

(ii) The Total Ratio increased after incorporating XYZ reinsurance agreement. The reinsurance agreement helps to increase the LICAT Total Ratio, which will strengthen the capital position of the company. From capital

perspective only, PBLI may consider pursuing reinsurance with XYZ with the benefit of capital relief.

(c) **(LO 2a)** Describe key impacts of reinsurance to each of the following components of the LICAT Total Ratio, noting the difference between registered and unregistered reinsurance where applicable:

(i) Available Capital

(ii) Surplus Allowance

(iii) Eligible Deposit

(iv) Base Solvency Buffer

Commentary on Question:
Candidates generally did not do well on this part of the question. Candidates earned full credit by demonstrating how reinsurance will impact each component and explaining the impact of registered vs. unregistered reinsurance

(i) Available Capital
   a. Gross Tier 1 asset is to deduct all requirements for liabilities ceded under unregistered reinsurance arrangements, net of any applicable credits.
   b. Tier 2 asset includes all amounts deducted from Gross Tier 1 for negative reserves, offsetting policy-by-policy liabilities ceded under unregistered reinsurance arrangements, and aggregate negative reserves ceded under unregistered reinsurance arrangements.
   c. Encumbered assets are impacted by the marginal capital requirement which is based on BSB calculated net of all reinsurance for both registered and non-registered reinsurance.
   d. Negative reserves are calculated net of all reinsurance.
   e. Marginal insurance risk requirement (MIRR) is calculated net of all reinsurance.
   f. There's also a negative reserve adjustment for eligible YRT treaties, which goes to Tier 2 capital.
   g. Tier 1 capital instruments issued by subsidiary may be included in the capital of parent insurer based on a third-party Share limit that is based on the Base Solvency Buffer net of all reinsurance (registered and non-registered).

(ii) Surplus Allowance
   a. Non-economic Provisions for Adverse Deviations (PfADs) are calculated net of registered reinsurance.
   b. Economic PfADs for risk-free rates are calculated net of all reinsurance included in surplus allowance.

(iii) Eligible Deposit

a. Under unregistered reinsurance, excess deposits placed by the reinsurer that can be applied against losses under a specific reinsurance agreement may be recognized as eligible deposit.
b. Examples of eligible deposits include claims fluctuation reserves, deposits, or loss positions retained by a ceding insurer that serve to reduce the assuming insurer's risk under a reinsurance agreement.
c. For registered reinsurance, there is no recognition of eligible deposit on excess deposits and claims fluctuation reserves.

(iv) Base Solvency Buffer

a. Under registered reinsurance, all LICAT risk components are calculated net of reinsurance. For non-registered reinsurance, interest rate risk calculation is projected net of reinsurance.
b. Reinsurance credit risk is calculated as 2.5% of reinsurance assets from a registered reinsurer factors applied to reinsurance receivables. Unregistered reinsurance gets a higher factor than registered reinsurance.
c. There is some impact of reinsurance / unregistered on the currency risk.
d. Operational Risk includes General required capital, which has a factor applied to other insurance risk components net of all reinsurance. There is also a 2.5% factor applied to ceded reinsurance premiums.
e. Under a Modco agreement, or if the asset is secured by a collateral, or a LOC guarantee, then the asset credit risk may be transferred to the reinsurer.
f. All impacts due to reinsurance will also flow into the calculation for aggregation and diversification of risk. Risk diversification credit is calculated net of registered reinsurance.

Fall 2021 LFMC Exam

1. Fall 2021 LFMC Exam (LO 3b)

Learning Objectives:

The candidate will understand various approaches to manage and evaluate life insurance risks.

~~6. The candidate will understand important insurance company issues, concerns and financial management tools.~~

Learning Outcomes:

The Candidate will be able to:

b) Understand the role and framework used by regulators and credit rating agencies for evaluating life insurance companies

~~(6a) The candidate will be able to describe, apply and evaluate considerations and matters related to:~~

- ~~Insurance company mergers and acquisitions~~
- ~~Sources of earnings~~
- ~~Embedded Value determinations~~
- ~~Rating agency considerations~~

Sources:

3(b) Rating Agency Perspectives on Insurance Company Capital, SOA Research Institute, Aug 2023 (excluding Appendices)

~~LFM-147-20 Compendium of A.M. Best's Publications~~

~~LFM-106-07 Insurance Industry Mergers and Acquisitions, Chapter 4 (Sections 4.1-4.6)~~

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) **(LO 3b)** Describe the three A.M. Best Opinion Outlooks.

Commentary on Question:
This part of the question tested candidates' knowledge on rating agency outlooks and their corresponding results. Candidates generally provided the definitions of the three outlooks without stating the possible outcome. Full credit was received for providing both the definitions and outcomes.

Positive Outlook
- Indicates entity/Issuer/security is experiencing favorable financial/market trends relative to its current BCR
- If trends continue, entity/issuer/security has a good possibility of having its BCR upgraded

Negative Outlook
- Indicates entity/Issuer/security is experiencing unfavorable financial/market trends relative to its current BCR
- If trends continue, entity/issuer/security has a good possibility of having its BCR downgraded

Stable Outlook
- Indicates entity/Issuer/security is experiencing stable financial/market trends relative to its current BCR
- Entity/issuer/security has a low likelihood of having its BCR changed over an intermediate period

(b) **(NO LONGER RELEVANT)** ~~Critique each of the following statements regarding AM Best's Credit Rating process for an insurance company:~~

~~*A. A recommended rating is developed by a Rating Analyst whose interactions with the insurance company's management are restricted to ensure an independent and unbiased rating.*~~

~~*B. The Rating Analyst's recommendation is reviewed and modified, as appropriate, by a rating review committee before it is voted on and approved by the committee.*~~

~~*C. The process relies almost entirely on quantitative measures including analysis of accounting ratios, balance sheet strength and key management performance indicators.*~~

~~*D. The process only considers information available from public sources. AM Best assumes the information is reliable and does not audit it.*~~

~~*E. Upon reaching a rating decision, if the insurance company does not agree with the rating, AM Best will give the company 30 days to provide additional information that could reasonably be expected to influence the decision. If the*~~

company is able to provide such information, AM Best will reevaluate its decision; otherwise, the rating will be released to the public at the end of the 30 days.

Commentary on Question:
This part of the question tested the candidates' knowledge of the credit rating process for an insurance company. Full credit was received for correctly stating if the statement was correct as well as providing explanations on why the statement is incorrect. Candidates generally did well on this part of the question.

A. False. Rating Analyst will be in discussion with management throughout the development process

B. True

C. False. The process incorporates both quantitative and qualitative measures

D. False. The process considers private information in addition to public information. However, it is true that AM Best assumes all public information is reliable and does not audit it.

E. False. AM Best may grant an appeal if company provides additional information that could reasonably be expected to influence the decision. Once AM Best grants an appeal, the terms are totally at their discretion. Company can also withdraw the rating analysis if they do not agree with the result.

(c) **(NO LONGER RELEVANT)** Insurance company stakeholders include the following:

- Bondholders
- Stockholders
- Regulators
- Policyholders

Describe the relevance of the following ratings to each of the four stakeholders:

(i) AM Best's Issuer Credit Rating

(ii) AM Best's Financial Strength Rating

Commentary on Question:
This part of the question tested the candidates' knowledge of the Credit Rating and the Financial Strength Rating. Candidates generally did well on this part of the question. Full credit was received if candidates indicated the order of relevance for the stakeholders.

(i) AM Best's Issuer Credit Rating
- Most relevant to Bondholders because the rating focuses on the company's credit risk
- Relevant to Stockholders since the rating is one indication of how safe the company is to invest in
- Relevant to Policyholders since the rating is one indication of how safe the company is to provide insurance coverage
- One of many indicators used by Regulators to monitor the company's solvency

(ii) AM Best's Financial Strength Rating
- Most relevant to Policyholders because the rating focuses on the company's ability to meet its ongoing obligation
- Also relevant to Bondholders and Stockholders since the rating is one indication of how safe the company is to invest in
- One of many indicators used by Regulators to monitor the company's solvency

(d) **(NO LONGER RELEVANT)** Identify four differences between the inputs to an actuarial appraisal and the inputs to an AM Best Issuer Credit Rating.

Commentary on Question:
There are many differences between the inputs to an Actuarial Appraisal and the inputs to an AM Best Issuer Credit Rating. Full credited was received if any four differences were provided with an explanation. A sample of acceptable solutions are provided below.

Items in an actuarial appraisal but not in an AM Best ICR
- Assumptions: an appraisal is heavily dependent upon assumptions, but they do not play a large role in the development of an ICR
- Discounted cash flows: an appraisal is heavily dependent upon discounted cash flows, but they do not impact the development of an ICR

Items in an AM Best ICR but not in an actuarial appraisal
- Internal capital models: in an appraisal, the buyer may impose their own calculations for capital
- Interim management reports: in an appraisal, these reports may influence how major changes or management views are reflected, but they don't have a large impact on the appraisal value

(e) Describe possible reasons why DEF's appraisal value is higher than ABC's, considering each of the three main components of an actuarial appraisal.

Commentary on Question:
Candidates generally understood the three components that affect the appraisal value. Full credit was received by describing whether the components are different between the two appraisals and why they are different or similar.

Adjusted book value (ABV)
- Should be very similar between the two companies

~~- ABV is calculated on a statutory basis with minimal room for deviation~~

Value of in-force business
- Should not be too different
- Assumptions should largely be the same, though life insurer's valuation is likely to be somewhat higher due to administrative synergies resulting in lower expenses

Value of future business capacity
- Could be very different
- Life insurer's valuation could be considerably higher due to more synergies, especially in the areas of distribution channels, underwriting and administration

2. Fall 2021 LFMC Exam (LOs 2b, 2c)

Learning Objectives:

The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

~~5. The candidate will understand how to explain and apply the methods, approaches and tools of financial management in a life insurance company context.~~

Learning Outcomes:

The Candidate will be able to:

b) Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital

c) Describe the purpose and application of economic capital

~~(5a) The Candidate will be able to:~~

- ~~Explain and apply methods in determining regulatory capital and economic capital~~
- ~~Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital~~
- ~~Explain Canadian regulatory capital framework and principles~~
- ~~Explain and apply methods in capital management~~

Sources:

2(b) A Multi-Stakeholder Approach to Capital Adequacy, Conning Research, Actuarial Practice Forum

2(c) Economic Capital for Life Insurance Companies, SOA Research Paper, Oct 2016 (only sections 2 & 6)

~~A Multi-Stakeholder Approach to Capital Adequacy, Conning Research~~

~~Economic Capital for life Insurance Companies, SOA Research paper, Oct 2016 (exclude sections 5 and 7)~~

Commentary on Question:

This question tested the candidates' understanding of economic capital and applying the multi-stakeholder, multi-objective approach.

Solution:

(a) **(LO 2b)** Calculate the amount of RBC and S&P capital available for release for year 1. Show all work.

Commentary on question:
Candidates were generally able to demonstrate knowledge of all the key steps to perform the required calculations. Common errors included using the probability of downgrade or default over 1 year; not apply discounting; and using the ratio of available capital / risk threshold instead of taking the difference.

Please refer to the excel for the model solution

(b) **(LO 2b)** You are given the following additional capital information:

- Capital available for release based on the current economic capital model with VaR 99.5 over 1 year: 400,000
- Capital available for release in year 2

Financial Variable	**Year 2**
RBC (Default)	-50,000
S&P CAR (Downgrade)	500,000

Contrast the difference between PCLC's results when using the economic capital method versus the multi-objective approach.

Commentary on question:
Candidates who described the capital excess / deficiencies at each time period and how it links to multi-stakeholder generally did well on this question. Full credit was received when discussing the need to balance the objectives of the different capital metrics. Candidates generally identified the capital available for release or shortfall under EC and RBC. Few candidates noted the S&P amount for both year 1 and year 2. Candidates that did well identified that the company would require additional capital of 50K in year 2 under RBC and used that to explain the value of a multi-objective view.

Economic capital model indicates there is an excess capital of 400,000 that can be released. Capital of 379,000 can be released under the RBC model in year 1, but there is a deficit in year 2.

Under S&P, there is excess capital in both year 1 and 2 (284k and 500k).

The different capital models indicate that there is enough capital to be released in year 1 from the different stakeholder viewpoints, but not in year 2 where the challenge is on RBC where capital cannot be released. The company needs to assess their objectives, as well as meeting RBC and S&P requirements by finding the right weightings on each capital requirement and optimize what is best for the company.

(c) **(LO 2b, 2c)** Critique the following statements:

Commentary on question:
Candidates generally did well on statements A and D. For statements B and C, candidates generally only critiqued part of the statement. Candidates need to comment on the full statement to receive full credit.

For statement A, candidates who discussed the policyholder or shareholder perspective received full credit. Candidates had to discuss other uses of economic capital to receive full credit.

For statement B, candidates need to critique both sentences to receive full credit. Candidates generally did well critiquing the second sentence, but only received partial credit on the first sentence if they only mentioned that the statement is false without any reasoning related to multi-stakeholder considerations.

For statement C, full credit was received if the candidate critiqued all three parts of the statements. Partial credit was received if a candidate only mentioned both capital metrics have real consequences without substantiating those consequences. Some candidates had difficulty articulating that the RBC and S&P factors are based on industry information applied to company data. There was some confusion that the factors were based on company specific data.

For statement D, candidates generally received full credit. Some candidates gave alternative advantages instead, which received partial credit. Some candidates noted that VAR is not coherent and leads to inconsistent results when aggregating capital. Many candidates responded from the perspective of what CTE is rather than what VAR is not, which received partial credit.

A. *Economic capital is a key measure of risk from a regulatory perspective and used only for capital adequacy.*

False. Economic capital is a key measure of risk from a company perspective. It is not only used for capital adequacy, but is also used for performance measurement and management, risk-based decision making, business strategic decision making, M&A etc.

2. Continued

B. In consideration of all stakeholders' risk and capital adequacy objectives, the economic capital method is an appropriate measure. All current capital approaches apply only to the insurance industry.

Both sentences in the statement are false. The economic capital method is not an appropriate measure as it only considers one view from a company perspective. It does not consider multiple stakeholder view. Instead, a multi-stakeholder approach should be used since it produces capital indications across various key financial measures, time horizons, and risk tolerances.

Economic capital, as well as multi-stakeholder approach can be applied beyond the insurance industry to any industry where there are multiple stakeholders e.g Banking sector.

C. A similarity in the RBC ratio and S&P CAR is that both have a real consequence if you fall below a certain threshold and both have a solvency focus. Risks in RBC ratio are modeled and calibrated based on industry experience, but S&P CAR is based on company experience.

Partially correct. Both RBC and S&P CAR have real consequences under certain threshold. For RBC, this is a solvency requirement where regulatory intervention such as submission of action plans to a regulatory takeover of the management of the company can happen.

S&P CAR impacts the rating of the company. Having a lower level of capital under the threshold can lead to a rating downgrade, which has implications for the company such as the cost of attracting new capital, perception from policyholders' and agents' on the ability of the company to fulfill its obligations.

Both RBC and S&P CAR are based on industry experience rather than company experience. They are based on formula-based, fairly objective and consistently applied across the industry, making the resulting ratios more straightforward to calculate, decompose and compare. Most of the information to calculate these formulas are publicly available.

D. One of the advantages of VaR, relative to CTE, is that it can lead to consistent results when aggregating capital.

False. VaR does not lead to consistent results when aggregating capital because it not a coherent measure.

5. Fall 2021 LFMC Exam (LO 4d)

Learning Objectives:

The candidate will understand value creation and inforce management techniques for life and annuity products.

~~3. The candidate will understand Canadian taxation applicable to life insurance companies and products.~~

Learning Outcomes:

The Candidate will be able to:

(d) Understand corporate taxation, policyholder taxation and calculate investment income tax

~~(3a) The Candidate will be able to describe and apply the taxation regulations applicable to Canadian life insurance companies and life insurance products.~~

Sources:

Canadian Insurance Taxation, Swales, et. al., 4th Edition, 2015

- Ch. 4: Income for Tax Purposes – General Rules
- Ch. 5: Investment Income

Canadian Insurance Taxation, Swales, et. al., 4th Edition, 2015

- Ch. 9: Investment Income Tax

~~Canadian Insurance Taxation, Chap. 4, Chap. 24, Chap. 9, Chap. 10, Chap. 6~~

Commentary on Question:
This question tested the candidates' knowledge of Canadian policyholder taxation considerations.

Solution:

(LO 4d) Calculate the following:

(i) Premium tax payable.

(ii) Investment income tax (IIT) payable.

(iii) Net after-tax statutory income.

Commentary on Question:
For part (i), candidates generally understood to apply the Premium Tax Rate to the Net Premium for Premium Tax Payable; some candidates did not calculate the Net Premium correctly.

For part (ii), candidates generally did not use the correct Investment Income Tax (IIT) rate, using the IIT Interest Rate instead. Candidates generally struggled with the calculation of the Base to apply IIT rate.

For part (iii), candidates generally understood what components of the taxable income calculation to use and applied the correct corporate tax rate. Most candidates failed to include the correct investment income in the taxable income and adjusted the difference in change in tax reserves versus statutory reserves for the Gross Statutory Income calculation.

(i) Net Premium = Direct Written premium - Refunded Premiums - Dividend Cash - Dividends Paid-up Additions
Net Premium = 400 – 15 – 30 – 45 = 310

Premium Tax Payable = Net Premium × Premium Tax Rate
Premium Tax Payable = 310 × 4% = 12.40

(ii) Total Mean Reserves = Mean Reserves Direct + Mean Reserves Assumed (Ignoring Mean Reserves Ceded)
Total Mean Reserves = 160+10=170

Life Investment Income = Total Mean Reserves × IIT Interest Rate
Life Investment Income = 170 × 2.5% = 4.25

Include amounts reported to policyholders in income to calculate the Base
Base to apply IIT Rate = 4.25 – 2.00 = 2.25

IIT payable = IIT rate × Base
IIT payable = 0.15% × 2.25 = 0.3375

(iii) Taxable Income includes:
Direct Written Premium = 400
Assumed Premium = 40
Ceded Premium = -50
Repayment of policy loans = 20
Repayment interest on policy loans = 5

(Ignoring foreign insurance premiums)
Change in tax reserves = -40
Investment income = 3% rate × average stat reserves = 3% rate × (100+130)/2 =3.45
Premium tax = -12.4 (from i)
IIT payable = -0.3375 (from ii)

Sum the above components to calculate Taxable Income = 365.7125

Corporate Tax Payable = Corporate Tax Rate × Taxable Income
Corporate Tax Payable = 20% × 365.71 = 73.14

Adjust for difference in change in tax reserves compared to change in statutory reserves
Adjustment = (100-130) - (140-180) = 10

Gross Statutory Income = Taxable Income + Adjustment for difference in change in tax reserves vs statutory reserves
Gross Statutory Income = 365.71 + 10 = 375.71

Net Statutory Income = Gross Statutory Income - Corporate Tax Payable
Net Statutory Income = 375.71 - 73.14 = 302.57

6. Fall 2021 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.~~

Learning Outcomes:

The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.~~

Sources:

1(a), 1(b)	ILA201-600-25: International Actuarial Note 100: Application of IFRS 17 (Ch. 1, section A – Introduction to GMM only, Ch. 5, 7-9 & 16)
1(a), 1(b)	ILA201-601-25: The IFRS 17 Contractual Service Margin: A Life Insurance Perspective (Sections 2-4.8)

~~LFM-649-20: International Actuarial Note 100: Application of IFRS 17 (excluding section C chapter 11 and section D)~~

Commentary on Question:
This question tested the candidates' knowledge of IFRS 17. Candidates generally had some level of knowledge on IFRS 17, including the concept of Contractual Service Margin (CSM), IFRS 17 Groups, and Definition of Coverage Units. However, few candidates demonstrated sufficient knowledge to receive full credit.

Solution:

(a) **(LOs 1a, 1b)** Contrast the calculations between initial recognition and subsequent measurement for the Contractual Service Margin (CSM) under IFRS17 general measurement model.

Commentary on Question:

This part of question required the candidate to compare the difference between CSM at initial recognition and CSM in subsequent measurements. Most candidates received partial credit on this question. Candidates generally knew that CSM is a prospective calculation at initial recognition and a roll-forward calculation in subsequent measurements. Few candidates mentioned the interpretation of CSM. Most candidates failed to recognize that initial recognition considers past cashflows.

- Timing: Initial recognition is a point in time calculation only done at issue; Subsequent measurement is done in all future reporting periods.
- Calculation: Initial recognition is a prospective (present value) calculation. Subsequent measurement is a retrospective (rollforward) calculation.
- Actuarial interpretation: At initial recognition, CSM is established to offset initial profits, removing front-ending of profit. In subsequent measurements, CSM is released into profits based on coverage provided.
- Scope: Initial recognition considers all contractual cashflows (future and past) within the contract boundary. Subsequent measurement considers future contractual cashflows within the contract boundary.

(b) **(LOs 1a, 1b)** Critique the following IFRS17 statements.

A. *We will calculate a CSM for individual policies at contract issue to support capital requirements for the fulfilment cashflows. Fulfilment cash flows will include expected future cash outflows and inflows. At contract issue, the CSM will consider all contractual cash flows, both future and past, within the contract boundary.*

B. *For efficiencies on our closed block of Term to 100 business, we will amortize the CSM linearly over the contract boundary. If the block becomes onerous, we will continue to amortize the CSM linearly over the remaining contract boundary.*

C. *Due to a system conversion a few years ago, we were unable to retain certain historical data and, thus, at transition our universal life business will be grouped using the fair value approach. New universal life policies issued after transition will be added to the group until May 31. On June 1, our newly priced universal life product will be launched. From June 1 onwards, each reprice will be grouped separately, with a reprice every 10 to 14 months.*

Commentary on Question:

For statement A, candidates generally understood that CSM is calculated at the group level. Some candidates failed to recognize CSM is calculated at initial recognition instead of issue. For statement B, candidates generally pointed out that there will be no CSM to amortize if the block becomes onerous. Some candidates failed to explain clearly whether the linear amortization is appropriate. Candidates generally did well critiquing statement C.

A.

- First sentence:
  - CSM is for a group of contracts. One contract cannot be measured without considering others like it.
  - CSM not established at contract issue but at initial recognition.
  - CSM offsets initial profit, not capital requirements.
- Second sentence: fulfilment CFs also include risk adjustment for non-financial risk and pre-coverage cash flows.
- Third sentence: at initial recognition, not contract issue; otherwise, rest of sentence is true.

B.

- First sentence:
  - although a straight-line release is a reasonable proxy, given the long duration of a T100 contract boundary it would indicate discounting and size of blocks would impact CSM release materially.
  - CSM meant to be relative to services rendered, and liner release over that length of time would under release in early years and over release in later years.
- Second sentence:
  - An onerous contract results in a LC and is recognized as loss immediately.
  - The LC is tracked, but not amortized.
  - Only if LC goes back to CSM would you continue to amortize.

C.

- First sentence: can use FV approach as it is impractical to use full retrospective approach.
- Second sentence: new contracts cannot be added to groups measured at transition using the fair value approach.
- Third and Fourth sentences: new contracts can be added to the group after the end of the reporting period but cannot be more than one year apart.

(c) **(LOs 1a, 1b)** During 2024, the following events occur that were not forecasted or differed from forecast.

(i) An increase of 220 in the payout annuity risk adjustment due to increased uncertainty of mortality experience

(ii) An additional 60 of universal life death benefits paid due to higher than expected mortality

(iii) An experience study lowers disability termination rates and increased the liability of incurred claims by 170.

(iv) The universal life contracts issued end up being onerous by 30.

(v) Interest rates increased more than expected and reduced the disability income, payout annuity and universal life liabilities by 100, 130 and 145, respectively.

Explain how each of these events would impact the CSM roll forward in 2024.

Commentary on Question:
This part of the question required an understanding of the CSM rollforward. Candidates generally knew that unfavorable changes to onerous blocks could not affect CSM. Some candidates understood that actual experience does not directly impact CSM. Few candidates received credit for parts (iii) – (iv).

(i) Since POA is onerous and in a loss component, the increase would not impact the CSM.

(ii) The additional death benefits would not have a direct impact on the CSM. However, indirectly, additional deaths could change the coverage units and result in a release of CSM.

(iii) LIC does not impact the CSM.

(iv) The new contracts issued CSM of 50 would change to nil since onerous contracts go through P&L. Since the new business would have its own grouping, it would not reduce the existing CSM by 30. There might be secondary impacts on CSM amortization (as some of the NB CSM would have been expected to be released in 2024) and interest accretion as a result.

(v) Time value of money impacts do not go through CSM for contracts without direct participating features (or using the General Measurement Model approach). Time value of money impacts are recognized in CSM for contracts with direct participating features (or contracts using the Variable Fee Approach).

8. Fall 2021 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~1. The candidate will understand and apply pre-IFRS 17 valuation principles to individual life insurance and annuity products issued by Canadian life insurance companies.~~

Learning Outcomes:

The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(1a) The Candidate will be able to:~~

- ~~Compare and apply methods for life and annuity product reserves~~
- ~~Evaluate, calculate, and interpret liabilities~~
- ~~Recommend and justify appropriate valuation assumptions~~

Sources:

1(a), 1(b) ILA201-600-25: International Actuarial Note 100: Application of IFRS 17 (Ch. 1, section A – Introduction to GMM only, Ch. 5, 7-9 & 16)

1(a), 1(b) CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts, Jun 2022

1(a), 1(b) CIA Educational Note: IFRS 17 – Fair Value of Insurance Contracts, Jun 2022

Companion Excel Spreadsheet: Educational Note: IFRS 17 – Fair Value of Insurance Contracts - Excel file

~~CIA Educational Note: Discount Rates under IFRS 17~~

~~IAN 100 Application of IFRS 17 (exclude Section D), Jan 2019~~

~~CIA Educational Note: Comparison of IFRS 17 to Current CIA Standard of Practice, Sept 2018~~

Commentary on Question:
This question tested the candidates' knowledge of discounting under IFRS 17.

Solution:
(a) **(LOs 1a, 1b)** State the characteristics of the discount rate under IFRS17.

Commentary on Question:
Candidates were generally able to identify the first characteristics. Few candidates identified the second and third characteristics.

- reflect the time value of money, the characteristics of the cash flows and the liquidity characteristics of the insurance contracts.
- be consistent with observable current market prices (if any) for financial instruments with cash flows whose characteristics are consistent with those of the insurance contracts, in terms of, for example, timing, currency and liquidity.
- exclude the effect of factors that influence such observable market prices but do not affect the future cash flows of the insurance contracts.

(b) **(LOs 1a, 1b)**
(i) Evaluate the appropriateness of each market to be used as a reference portfolio.
(ii) Recommend the end of the observable period based on your evaluation in

Commentary on Question:
Candidates generally did not demonstrate sufficient knowledge on this part of the question.

(i) Market A: sufficient volumes relative to all 3 markets
bid-ask spread is minimal indicating an active market
Market B: sufficient volumes relative to all 3 markets
bid-ask spread is large possibly indicating an inactive market
Market C: Minimal trade volumes and large bid-ask spread indicates an inactive market

(ii) Market A is the most appropriate with the end of observable period to be set at 30 years given that there is a lack of transaction for 60 year bonds

(c) **(LOs 1a, 1b)**
(i) Replacing the YRT premium structure with a Fully Guaranteed Level Premium rate

(ii) Including a conversion option to a permanent life product with no underwriting

(iii)Including a Waiver of Premium benefit upon Job Loss & Disability

(iv)Offering a cash surrender value after five years

Commentary on Question:
For this part of question, candidates were expected to justify their response when determining if liquidity would increase or decrease.
For part (i), few candidates identified that liquidity would decrease further with the increase in contract boundary.
For part (iv) few candidates identified liquidity will be greater in the longer term.

(i)
A level premium structure and guaranteed premium feature would build up the contract's inherent value. This would decrease the liquidity characteristics of the contract
The increase in the contract boundary would further decrease the liquidity characteristics of the contract.

(ii)
The conversion option and removal of underwriting requirements would build up the contract's inherent value. This would decrease the liquidity characteristics of the contract

(iii)
The inclusion of the Waiver of Premium would build up the contract's inherent value. This would decrease the liquidity characteristics of the contract

(iv)
The inclusion of a CSV would increase the exit value. This would increase the liquidity characteristics of the contract.
The liquidity of the contract would be greater in the longer term (after 5 years) when the CSV kicks in.

(d) **(LOs 1a, 1b)** You are given:

Risk-Free Rate	5.0%
Reference Portfolio Yield	8.0%
Market Risk Premium	0.5%
Liquidity Risk Premium	0.3%
Credit Risk Premium	0.2%

Calculate the discount rate under the following approaches based on the table above:

(i) Top-down approach

(ii) Bottom-up approach

Commentary on Question:
Candidates generally did well on this part of the question.

(i) Discount Rate = Reference Portfolio Yield - Credit Risk Premium - Market Risk Premium
= 8% - 0.50% - 0.20% = 7.3%

(ii) Discount Rate = Risk-Free Rate + Liquidity Premium
= 5% + 0.3% = 5.3%

(e) Company MBX is developing a discount rate for a Yearly Renewal Term product following the hybrid bottom-up approach using a reference portfolio containing private debts and mortgages without any adjustments. Evaluate the appropriateness of the approach.

Commentary on Question:
Some candidates compared the liquidity of YRT and the reference portfolio; however, they did not discuss the discount rates need to be adjusted for the liquidity premium.

YRT is a highly liquid product. The reference portfolio is highly illiquid.
The discount rates should be adjusted for a liquidity premium

9. Fall 2021 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.~~

Learning Outcomes:

The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.~~

Sources:

1(a), 1(b)	ILA201-600-25: International Actuarial Note 100: Application of IFRS 17 (Ch. 1, section A – Introduction to GMM only, Ch. 5, 7-9 & 16)
1(a), 1(b)	CIA Educational Note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts, Jun 2022
1(a), 1(b)	CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, Jun 2022

~~CIA Draft Educational Note – IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts~~

~~LFM-649-20: International Actuarial Note 100: Application of IFRS 17 (excluding section C chapter 11 and section D)~~

~~CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, Sep 2019~~

Commentary on Question:

This question tests candidates' understanding about IFRS 17 financial reporting. Candidates were expected to evaluate the appropriateness of IFRS 17 choices while evaluating the insurance contract liabilities.

Solution:

(a) **(LOs 1a, 1b)** You are reviewing an implementation document for IFRS 17 in your company, effective January 1, 2023. Critique the following statements from the document with respect to the risk adjustment:

A. *The IFRS 17 standard prescribes the methodology for how the risk adjustment is measured in practice. Measurement requirements will be based on the contract level unit of account. Presentation and disclosure requirements will be at the total legal entity level.*

B. *The legal entity aggregate risk adjustment will be equal to the sum of the risk adjustments for all the units of account. The parent entity risk adjustment will apply a diversification benefit to the risk adjustment such that a higher confidence level of the parent risk adjustment would result in a higher diversification benefit.*

C. *The risk adjustment confidence level will be calculated and disclosed at the contract level.*

D. *For operational efficiencies, LICAT will be used as a calibration point in quantifying the confidence level, such that the aggregate base solvency buffer represents approximately an 85% confidence level on the risk adjustment.*

E. *The direct and ceded liabilities from the same contract group use the same unit of account in calculating the risk adjustment. The risk adjustment for reinsurance held will create an asset, and the risk adjustment will have the effect of increasing the value of the reinsurance asset.*

F. *The same discount curve will be used to discount the future cash flows and the risk adjustment.*

G. *The risk adjustment will include the uncertainty caused by long-term disability claimants returning to work, paying a quarterly annuity benefit monthly, and expense inflation exceeding the consumer price index.*

H. *The risk adjustment will not include the uncertainty caused by defaults on fixed income assets, and higher universal life policy lapses as a result of low investment returns.*

Commentary on Question:

Candidates generally did well in demonstrating knowledge of the following:

- *IFRS 17 does not prescribe the risk adjustment methodology.*

- *The LICAT framework can be used for calibration with modification.*
- *Distinguishing the uncertainty which should be included and the uncertainty which should be excluded from the risk adjustment.*

Candidates generally did not do well in demonstrating knowledge of the following:

- *The risk adjustment measurement and presentation can be done at lower level*
- *The relationship between diversification and confidence level*
- *The risk adjustment confidence level can be calculated and disclosed at the contract level.*
- *The required modification required to use LICAT framework for calibration*
- *Paying the quarterly claim monthly is an operational risk and should not be included in RA*

A. The IFRS 17 standard does not prescribe a methodology for how the RA would be measured in practice. Measurement requirements are based on the IFRS 17 unit of account (i.e., RA determined for a single contract or group of contracts), whereas presentation and disclosure requirements tend to be at a higher level (RA for the aggregation of portfolios of contracts, or entity-level RA).

B. When the RA is developed at the unit-of-account level, the entity's aggregate RA would be the sum of the risk adjustments for the various units of account. The more conservative view an entity takes in applying diversification at the unit-of-account level, the higher will be the resulting RA and its reported confidence level.

C. It would be at the discretion of the entity to disclose the confidence level of risk adjustments at anything less that an entity-level.

D. Only portions of LICAT framework can be used for calibration benchmarks for confidence level, particularly those with level and trend shocks (mortality, longevity, etc). Calibration of the LICAT level and trend shocks reflected a particular discount rate, diversification and LICAT credits. To the extent that these parameters are different in an entity's estimate of future cash flows, the LICAT benchmark may not necessarily correspond to a confidence level at or around 85%. If seg funds represent a non-material portion, It is OK to include. Otherwise, a more sophisticated approach required.

E. Under IFRS 17, direct liabilities must be calculated separately from ceded liabilities because these contracts would never be in the same unit of account. For reinsurance held, because the risk adjustment for reinsurance held is defined based on the amount of risk transferred to the reinsurer, the risk adjustment for reinsurance held will normally create an asset. On this basis, where a reinsurance contract held is reported as an asset the risk adjustment

will have the effect of increasing the value of the asset, and will decrease the liability value where the reinsurance contract held is reported as a liability.

F. IFRS 17 provides no direction regarding the discounting of the RA. Consequently, the use of discounting (or not) and the methodology to determine discount rates are at the discretion of the entity. The same discount curve can be used to discount the future cash flows and the risk adjustment.

G. Accidentally paying the quarterly claim monthly is an operational risk and should not include in RA. The other two statements are true.

H. policyholder behavior associated with investment returns is a non-financial risk and would be included. The other statement is true.

(b) **(LOs 1a, 1b)** You are given the following expense items:

(i) *Commissions payable to agents upon sale of policy*

(ii) *Marketing expenses for TV commercials promoting the life insurance company's philanthropic initiatives*

(iii) *Cost of fuel for the CEO's private jet*

(iv) *Rent payable on the corporate head office located in Bermuda*

(v) *Cost of mailing claim payments to clients*

(vi) *Expenses incurred from investigating employee fraud*

Assess whether the above expense items should be included in the fulfillment cash flows. Justify your response.

Commentary on Question:
Candidates generally did well in identifying that commission expense and cost of mailing claim payments should be included in the fulfillment cash flows. Candidates generally did well in excluding marketing expenses, cost of fuel, employee fraud from the fulfillment cash flows.

Candidates generally did not do well in explaining whether the rent payable should be included or not as the expense can go either way.

As a general statement, IFRS 17 valuation includes cash flows that relate directly to the fulfilment of an insurance contract. This includes expense cash flows that are directly attributable to a portfolio of insurance contracts. These include both acquisition and maintenance expenses.

(i) The expense is directly related to the sale of insurance contract.

(ii) This is an indirect cost. It is not specific for the fulfillment of insurance contract and is more general overhead for the company.

(iii) This is an indirect cost. Cost of executive perks is not directly related to the fulfillment of the contract.

(iv) It can be either direct or indirect. A portion of the overhead expense could be attributed to the insurance contract.

(v) Expense of client mailings is directly related to the administration of the insurance contract.

(vi) This is an indirect cost. It is not specific to the fulfillment of the insurance contract and is more general overhead for the company.

10. Fall 2021 LFMC Exam (LO 2a)

Learning Objectives:

The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

~~5. The candidate will understand how to explain and apply the methods, approaches and tools of financial management in a life insurance company context.~~

Learning Outcomes:

The Candidate will be able to:

a) Explain and calculate regulatory capital using various international frameworks

~~(5a) The Candidate will be able to:~~

- ~~Explain and apply methods in determining regulatory capital and economic capital~~
- ~~Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital~~
- ~~Explain Canadian regulatory capital framework and principles~~
- ~~Explain and apply methods in capital management~~

Sources:

2(a) ILA201-604-25: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1-6 (excluding Sections 4.2-4.4)

~~LFM-645-19: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), Chapters 1-11, excluding Sections 4.2-4.4 and 7.3-7.11, October 2018~~

~~CIA Educational Note: LICAT and CARLI, March 2018~~

Commentary on Question:
This question tested the candidates' knowledge of the Life Insurance Capital Adequacy Test (LICAT), including the calculation of required capital for two of the components.

Solution:
(a) **(LO 2a)** Describe the margins which are to be included in the Surplus Allowance.

Commentary on Question:
Candidates were generally able to identify the appropriate PfADs to be included but did not identify that PfADs related to non-economic assumptions are to be calculated net of registered reinsurance and that PfADs related to risk-free interest rates are to be calculated net of all reinsurance.

The specific PfADs included in the Surplus Allowance used to calculate the LICAT ratios are:

- PfADs relating to scenario assumptions for risk-free interest rates associated with insurance contracts other than segregated fund contracts, calculated net of all reinsurance; and
- PfADs for the following non-economic assumptions associated with insurance contracts other than segregated fund contracts, calculated net of registered reinsurance only: insured life mortality, annuitant mortality, morbidity, withdrawal and partial withdrawal, anti-selective lapse, expense and policy owner options.

(b) **(LO 2a)** You have split the UL block into two portfolios and calculated the following required capital components for mortality risk:

	Designation	**Level**	**Trend**	**Volatility**	**Catastrophe**
Portfolio A	Life-supported	100	50	20	5
Portfolio B	Death-supported	75	25	10	5
Total UL		175	75	30	10

(i) Explain the steps for designating portfolios as either life-supported or death-supported.

(ii) Calculate the required mortality risk capital for the total UL block using the information in the table above.

Commentary on Question:
For part (i), candidates were generally able to correctly explain the steps. Some candidates mixed up life-supported and death-supported.

For part (ii), candidates generally did not calculate the diversification credit properly, applying it to the total mortality risk capital for each block instead of just the level and trend components.

(i) The present value of cash flows for each portfolio is calculated using a -15% mortality level shock applied to the best estimate assumption for the mortality rate and a +75% mortality trend shock applied to the best estimate assumption for mortality improvement, discounted using either CALM valuation rates, or the discount rates specified in the LICAT Guideline. The result of this calculation is compared to the present value

of best estimate cash flows using the same discount rates. If the present value of the shocked cash flows is greater than the present value of the best estimate cash flows, the portfolio is designated as death supported business; otherwise, the portfolio is designated as life supported.

(ii) Undiversified Mortality Risk Required Capital =

+ Required Capital Level
+ Required Capital Trend
+ √ (Required Capital Volatility ^{2} + Required Capital Catastrophe ^{2})

= + 175 + 75 + √ ($30^2 + 10^2$)

= 281.62

There is a within-risk diversification credit between life supported and death supported level and trend mortality risk.

Diversified Level and Trend Required Capital =

√ (Required Capital Life Supported Level and Trend ^{2} + Required Capital Death Supported Level and Trend ^{2} – 1.5 * Required Capital Life Supported Level and Trend * Required Capital Death Supported Level and Trend)

= √ ($150^2 + 100^2 – 1.5 * 150 * 100$)

= 100

Diversification Credit =

+ Undiversified Level and Trend Required Capital
– Diversified Level and Trend Required Capital

= 250 – 100

= 150

Diversified Mortality Risk Required Capital =

+ Undiversified Mortality Risk Required Capital
– Diversification Credit

= 281.72 – 150

= 131.62

(c) **(LO 2a)** Assume that the death benefit for a UL policy is equal to a level amount of 100 plus an accumulated account value of 50.

Explain how the net cash flows for the LICAT interest rate risk calculation would be projected.

Commentary on Question:
Candidates generally did not do well on this part of the question. Most candidates discussed the LICAT interest rate shocks and not how the net cash flows are determined. To receive full credit, candidates were required to explain one of the two approaches below.

For the interest rate risk net cash flows projection, two approaches are possible:

- Net cash flow includes a liability cash flow on death of 150 and an offsetting asset cash flow of -50 for the release of the investment account value.
- Net cash flow includes a liability cash flow on death of 100, with no release of investment account value in the asset cash flows.

(d) **(LO 2a)** Describe the characteristics of the index-linked products which are subject to the correlation factor calculation.

Commentary on Question:
In general, candidates described the second and third characteristics below, but few candidates included the first characteristic.

The correlation factor calculation may be used for index-linked products having the following characteristics:

1. Both assets and liabilities for these contracts are held in the general fund of the life insurer;

2. The policyholder is promised a particular return in the contract, based on an index, possibly subject to a floor. The following are examples of such returns:

(a) The same return as a specified public index. This includes, but is not limited to a public stock index, a bond index, or an index maintained by a financial institution.
(b) The same return as is earned by one of the insurer's segregated funds or mutual funds.
(c) The same return as is earned by another company's mutual funds; and

3. The insurer may invest in assets that are not the same as those that constitute the indices.

(e) **(LO 2a)** You have the following information for an index-linked UL policy:

	Q3 2020	**Q4 2020**	**Q1 2021**	**Q2 2021**	**Q3 2021**
Asset Value (millions)	10	10.2	9.8	9.9	9.7
Historical Correlation between returns credited to policyholder funds and returns on asset for past 52 weeks	0.7	0.72	0.69	0.57	0.82
standard deviation of return on assets for past 52 weeks	3.2	3.4	3.6	3.9	3.1
standard deviation of return on policyholder funds for past 52 weeks	3.8	3.4	3.1	3.7	3.9

Calculate the required capital for market risk for this product for Q3 2021.

Commentary on Question:
Candidates generally did not do well on this part of the question. Common errors include omitting the "20" in the factor formula below; and identifying F as the required capital.

Firstly, the factor F is determined as follows, for each of prior 4 quarters:

$F = 20 \times (C - B + B \times \sqrt{(2 - 2A)})$

Where:

- A is the historical correlation between the returns credited to the policyholder funds and the returns on the subgroup's assets;
- B is the minimum of [standard deviation of asset returns, standard deviation of returns credited to policyholder funds]; and
- C is the maximum of [standard deviation of asset returns, standard deviation of returns credited to policyholder funds].

Q4 2020: A = 0.72, B = 3.4, C = 3.4, F = 50.89
Q1 2021: A = 0.69, B = 3.1, C = 3.6, F = 58.82
Q2 2021: A = 0.57, B = 3.7, C = 3.9, F = 72.62
Q3 2021: A = 0.82, B = 3.1, C = 3.9, F = 53.20

Index-linked required capital
= Max F in the prior 4 quarters * Account Value at Quarter-End
= 72.62 * 9.7 = 704.46

Spring 2022 LFMC Exam

1. Spring 2022 LFMC Exam (LO 2c)

Learning Objectives:

The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

~~5. The candidate will understand how to explain and apply the methods, approaches and tools of financial management in a life insurance company context.~~

Learning Outcomes:

The Candidate will be able to:

(c) Describe the purpose and application of economic capital

~~(5a) The Candidate will be able to:~~

- ~~Explain and apply methods in determining regulatory capital and economic capital~~
- ~~Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital~~
- ~~Explain Canadian regulatory capital framework and principles~~
- ~~Explain and apply methods in capital management~~

Sources:

2(c) Economic Capital for Life Insurance Companies, SOA Research Paper, Oct 2016 (only sections 2 & 6)

~~Economic Capital for Life Insurance Companies, SOA Research Paper, Oct 2016 (excluding sections 5 & 7)~~

~~Economic Capital A Case Study to Analyze Longevity Risk, Risk & Rewards, Aug 2010~~

Commentary on Question:
This question tested candidates' understanding of the Economic Capital framework, and the impact of the mortality assumption on liability cash flow projections. For the EC framework portion of this question, while most candidates were able to describe the main

difference of the two approaches and make the correct choice under each scenario, few candidates could demonstrate the in-depth understanding needed for some parts of this question. For the mortality assumption portion, most candidates showed the basic understanding, but failed to demonstrate full knowledge.

Solution:

(a) **(LO 2c)** Compare and contrast the two approaches based on each of the following management considerations:

(i) We use buy-and-hold strategy for fixed interest investment and intend to closely match assets and liabilities.

(ii) We want to know how many assets are required to cover liabilities with some degree of security.

(iii) We closely monitor changes in market conditions and respond accordingly. We want to reflect these actions in the Economic Capital framework.

(iv) We believe that yield curves eventually go back to normal after extreme market events.

(v) We want to be consistent with the reality of capital management and regulatory reporting that requires capital to be calculated on an annual basis.

(vi) We hope to easily calibrate EC to a target security level.

Commentary on Question:

Most candidates were able to demonstrate an understanding of the two approaches when it comes to the basic concepts and generally did well on parts (i), (ii), (v), and (vi).

(i)

- Even a buy-and-hold strategy is regularly monitored and rebalanced.
- A runoff EC model is more appropriately aligned with its long term focus, which would emphasize risks such as defaults over the investment horizon.
- Finite risk horizon approach suggests a strong focus on the tradeable value of the insurance portfolio, suggesting market-based values cannot be ignored, even for buy-and-hold strategies.

(ii)

- Both approaches can achieve that goal
- Run off approach investigates a runoff of the business,
- While the finite risk horizon approach looks at transfers to a third party.

(iii)

- A one-year model using market consistent valuations is inherently more aligned with financial markets and therefore with market-based risk mitigation strategies that can be or are being undertaken, including financial derivatives, reinsurance or securitization transactions
- A runoff approach with no intermediate valuation metrics may become disconnected from financial market conditions. However, it is appropriate where the management action model used is realistic and explicitly tied to a formal business strategy.

(iv)

- Both the adjusted market-based and runoff cash flow methodologies embed strong assumptions about the mean reversion of asset returns after extreme market events.
- A runoff model will typically make an assumption about the expected level of yield curves based on historic experience that is different from the future level implied by the long end of the initial market yield curve. Whereas the Solvency II adjusted market-based model incorporates these effects by ignoring parts of the initial yield curve and extrapolating quickly to real world expectations.
- The effects of both are to introduce a type of mean reversion into the measurement of capital that diverge strict short term market pricing or market implied risk levels.
- The nature of this mean reversion assumption is highly subjective and difficult to reliably estimate. The evidence for these effects is also mixed and dependent on the particular time periods, asset types and economies included.

(v)

- When applied over a one-year time period, the finite risk horizon approach acknowledges this reality and better aligns itself with the actual management of the company.
- In contrast, the liability runoff approach attempts to find the amount of capital today that will provide sufficient protection for the lifetime of the portfolio, thus ignoring the reality that capital levels will be annually reevaluated.

(vi)

- It is generally viewed as easier to calibrate EC to a target security level under a finite risk horizon approach, and there is a significant body of statistics available regarding corporate bond defaults against which a reasonable calibration can be made.
- Calibration of a liability runoff approach to an external data source is more difficult as:
    - The block of business (and therefore the risk exposure) will typically be reducing over time.
    - The projection would typically not include all risks for all time periods; in particular, new business may be included for only a limited time period, if at all.

(b) **(LO 2c)** Recommend changes to the current liability projection model in order to accomplish ABC's intended objective.

Commentary on Question:
Most candidates pointed out the assumptions based on historical experience may have deviated over time due to various reasons, and provided responses regarding how to fix/improve these assumptions. Some candidates recognized the need to use different discount rates, as well as taking into account of extreme scenarios such as a pandemic. But few candidates touched on other aspects discussed in the source material.

- Volatility can rise from a mismatch between the population used to generate the mortality table and the population of lives in ABC's customers.

- Recommend to review historical deviation of mortality from current table and incorporate volatility in based table projection.
    - May use combination of SS table and company data based on credibility.

- For mortality improvement:
    - Reflected historical levels of correlation by age and genders over time periods.
    - Then project volatility in future mortality improvement in manners consistent with how the factors were derived from the historical data.

- Reflect the possibilities of extreme mortality occurrences, such as a pandemic or earthquakes

- May use different discount rates depending on the asset portfolios, i.e. different asset portfolios may have different asset risk that would need to be reflected in Economic Capital

- Consider using formula based mortality rate depending on market condition for certain products, if historical data shows correlation between them.

4. Spring 2022 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~1. The candidate will understand and apply pre-IFRS 17 valuation principles to individual life insurance and annuity products issued by Canadian life insurance companies.~~

Learning Outcomes:

The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(1a) The Candidate will be able to:~~

- ~~Compare and apply methods for life and annuity product reserves~~
- ~~Evaluate, calculate, and interpret liabilities~~
- ~~Recommend and justify appropriate valuation assumptions~~

Sources:

1(a), 1(b) CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, Jun 2022

~~LFM-634-19: CIA Standards of Practice: Insurance Sections 2100, 2300, 2400, 2500 & 2700 Dec 2019~~

~~CIA Educational Note: Margins for Adverse Deviations (MfAD), Nov 2006~~

~~CIA Educational Note: Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies, Jul 2002 (excluding Appendices)~~

Commentary on Question:
This question tested the candidates' knowledge of pre-IFRS 17 valuation principles.

Solution:

(a) **(NO LONGER RELEVANT)** ~~Outline the requirements under the CIA Standards of Practice for the following when calculating IFRS 4 reserves for life insurance products:~~

~~(i) Reinsurance recoverables~~

~~(ii) Amount of assets required to support contract liabilities~~

~~(iii) Renewal benefits~~

~~(iv) Forecasting cashflows~~

~~(v) Adopting a scenario~~

~~Commentary on Question~~:
~~Candidates generally did well on parts (i) and (ii) of this part of the question. For part (iii), some candidates described the contract renewal and contract boundary under IFRS 17 but failed to provide any description for the requirement for renewal benefits under IFRS 4. For part (iv), candidates generally did not discuss policy owner reasonable expectations, and/or dividend treatment in cash flow forecasting. For part (v), a common mistake is that the actuary must adopt the CIA prescribed interest scenario that produces the largest insurance contract liabilities (vs. the insurance contract liabilities would not be less than those in the prescribed scenario with the largest insurance contract liabilities).~~

~~(i) The insurance contract liabilities need to be calculated net of reinsurance recoverables by the CALM.~~

~~(ii) The amount of insurance contract liabilities using CALM for a particular scenario is equal to the amount of supporting assets at the calculation date that are forecast to reduce to zero coincident with the last liability cash flow in that scenario.~~

~~(iii) The term of the liabilities should take account of any renewal, or any adjustment equivalent to renewal, after the calculation date if:~~
~~a. The insurer's discretion at that renewal or adjustment is contractually constrained; and~~
~~b. Insurance contract liabilities are larger as a result of taking account of that renewal or adjustment~~

~~(iv) In forecasting the cash flow expected to be generated by an insurance contract, the actuary should~~
~~c. Take account of policy owner reasonable expectations; and~~
~~d. Include policy dividends, other than the related transfers to the shareholders' account and other than ownership dividends, in the comprised cash flow from benefits~~

~~(v) The actuary should calculate insurance contract liabilities for multiple scenarios and adopt a scenario whose insurance contract liabilities make sufficient but not excessive provision for the insurer's obligations in respect of the relevant policies.~~

(b) The following statements summarize how a company determines its best estimate assumptions and margins for adverse deviation (MfAD). Critique the following statements.

A. **(LOs 1a, 1b – partial)** *Considerations in properly estimating best estimate morbidity assumptions include operational risks, seasonal variations in experience, and contract wording to protect against the impact of medical advances.*

B. **(LOs 1a, 1b – partial)** *Due to lack of credibility, an addition of 17.5% of the best estimate of morbidity termination rates is applied, and a subtraction of 17.5% of the best estimate morbidity incidence rates is applied. The MfAD would not reflect any expected correlation between incidence and termination rates.*

C. **(LOs 1a, 1b)** *Best estimate expense assumption in the valuation of insurance contracts considers overhead, marketing and premium taxes. Expenses are well understood and managed, so an MfAD of 2.5% is applied.*

D. **(NO LONGER RELEVANT)** ~~*Death supported products include an MfAD of $5/e_x$. Death supported products include all 20-year Term and Term-to-100 policies that are reinsured on at least an 80% quota share basis.*~~

E. **(NO LONGER RELEVANT)** ~~*The best estimate assumption for mortgage asset depreciation considers assets that are impaired at the valuation date and includes loss of interest, loss of principal, and expense of managing depreciation. The MfAD for mortgage asset depreciation considers assets that are impaired after the valuation date.*~~

Commentary on Question:
Candidates generally did well in critiquing statements A, B and C. For statement D, candidates were generally able to comment on the appropriateness of the direction of the MfAD. Some candidates were able to critique the statement on the death supported/sensitive feature of T100 and T20, and the impact of QS reinsurance on the death supported/sensitive features. Candidates generally did not demonstrate knowledge in critiquing Statement E.

A. It is correct that the operational risk and seasonal variation are considered in best estimate morbidity assumptions. However, contract wording are considered for MfAD, not best estimate assumptions.

B. It is appropriate to set the MfAD margin at the higher end of the range due to lack of credibility. However, margin should be subtracted from the termination rates and added to incidence rates. The MfAD should reflect correlation between termination and incidence rates.

C. It is correct that the best estimate assumption includes overhead and premium taxes. However, best estimate does not include marketing. Provided that expenses are well understood, setting MfAD at 2.5% is appropriate.

D. Negative MfAD for death supported is appropriate as it will increase policy liabilities. T-100 is death supported; however, T20 is not death supported. Quota Share reinsurance will not change whether the policies are death supported or death sensitive.

E. The best estimate assumption for mortgage assets depreciation considers assets that are impaired both at and after valuation date. The MfAD considers assets that are impaired at the valuation date. The rest of the statement is correct.

(c) **(LOs 1a, 1b – partial)** 10 years ago MCB Insurance entered into the annuity market in Canada.

You are given:

- There were 1,500 annuitant death claims over ten years
- A reliable administration process has been established and followed
- The business mix of the portfolio is predominantly a wide range of blue collar (i.e. manual labour) industries
- The COVID-19 pandemic has caused deaths in the portfolio; however, it is not clear if this will result in a permanent change in the expected assumption
- The current annuitant mortality Provision for Adverse Deviation (PfAD) is 5,000,000.
- The current annuitant mortality MfAD of 6.5% was set when MCB entered the annuity market 10 years ago.

(i) Provide a rationale for setting the initial MfAD at 6.5%.

(ii) Recommend an updated MfAD.

(iii) Calculate the impact on the annuity block's PfAD from the recommended MfAD.

Commentary on Question:
Candidates were generally able to provide rational for the initial MfAD in part (i). For part (ii), partial credit was received for discussing relevant considerations. Full credit was received for the final recommendation if the candidate provided appropriate considerations and justification. Candidates generally did well on part (iii); however, a

common omission was calculating the new MfAD, but not providing the final "impact" of the change.

(i) The current MfAD is greater than the average of the low and high margin (2% to 8%). The higher level of MfAD was appropriate provided that the insurer just entered the market 10 years ago and did not have sufficient credible data.

(ii) There are a few considerations:

- There is currently a significantly amount of internal company experience. The credibility is at $\sqrt{\frac{1500}{3007}} = 71\%$. Compared to 10 years ago, there is one less significant consideration.

- The company now is having a more robust admin process. Hence operational risk is less likely.
- Given the business mix of the portfolio is predominately a wide range of blue collar industries, the portfolio is not homogenous and lacks diversification.
- The current COVID situation introduces more uncertainty on the future experience.

Possible recommendation:

- Reduce MfAD to 5% to reflect internal experience, but still having existing significant considerations in place;
- No changes given the uncertainty and not being fully credible business
- Or any other recommendations with appropriate justification.

(iii) Answer depends on the recommendation provided in part (ii) above.

- If reduce to 5%, the impact is a reduction of $\$5m \times \left(1 - \frac{5\%}{6.5\%}\right) = \$1.15m$.

6. Spring 2022 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.~~

Learning Outcomes:

The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.~~

Sources:

1(a), 1(b) CIA Educational Note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts, Jun 2022

~~CIA Educational Note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts, Jul 2019~~

Commentary on Question:
This question tested the candidates' knowledge of IFRS 17.

Solution:
You are working on the implementation of IFRS 17 for the UL product at Star Life, a Canadian life insurance company. The liabilities for the UL product will be measured using the general measurement model (GMM).

(a) **(LOs 1a, 1b)**

(i) Explain the purpose of the Risk Adjustment (RA) within the GMM.

(ii) List three risks to be included in the RA

(iii) List three risks to be excluded in the RA

Commentary on Question:
Candidates generally did well on this part of the question. The most common mistake was to not specify the Risk Adjustment is for non-financial risks. Another common mistake was to say that the Risk Adjustment is an additional buffer for unexpected experience instead of recognizing it is compensation required by the insurer for bearing the risk. Full credit was received for listing a subtype of a risk instead of the risk. For example, Mortality Risk instead of Insurance Risk.

Candidates generally received full credit for part (ii) and part (iii).

(i) The Risk adjustment is the compensation to the insurer for bearing uncertainty of timing and amount of cashflow obligations. It is only applied to non-financial risks and is determined at the entity level perspective.

(ii) Risks to include: Insurance Risk, Lapse Risk, Expense Risk

(iii) Risks to exclude: Operational Risk, Market Risk, Financial Risk.

(b) **(LOs 1a, 1b)** Identify the considerations to use the current IFRS 4 MfADs as a starting point for calculating the IFRS 17 RA.

Commentary on Question:
Candidates generally realized that a confidence level is required for IFRS 17 and that diversification benefits are to be considered. Few candidates provided that the Risk Adjustment needed to reflect the entity's requirements for bearing the risk, that margins need to be split between gross and ceded, or that adjustments are required for pass-through features.

There are several considerations required when using the IFRS 4 MfADs as the starting point for the IFRS 17 Risk Adjustment including:

1) Ensure that the aggregate Risk Adjustment reflects the entity's requirements for bearing the risk uncertainty.
2) Ensure that diversification benefits are appropriately reflected.
3) IFRS 17 requires that the equivalent confidence level of the Risk Adjustment is disclosed. The IFRS 4 PfADs are converted into a confidence level.
4) Margins need to be split between gross and ceded contracts.
5) PfADs to be adjusted for pass-through features.

(c) **(LOs 1a, 1b)** Describe two techniques which can be used to set the Risk Adjustment under an aggregate approach.

Commentary on Question:
Most candidates received partial credit on this part of the question. Most candidates were able to name the two approaches, and at least partially describe how they work.

The aggregated approach calculates the Risk Adjustment at the segment level and are reliant on the precision of the aggregate calculation. There are hybrid approach options that combine the unit of account and aggregate approach. MfADs will need to be recalibrated if aggregate Risk Adjustment is outside of the target range.

Two possible aggregate approaches are:

1) Cost of Capital Approach
    a. Project Required Capital for non-financial risks for the duration of the policies
    b. Multiply the required capital by the cost of capital rate to determine the compensation required in each future period.
    c. Discount these amounts back to the valuation date to calculate the risk adjustment.

2) Quantile Technique
    a. Generate a distribution for future cash flows
    b. Determine the target confidence level that corresponds to the compensation required by the company
    c. Risk adjustment is set to VaR or CTE at the selected target confidence level minus the mean of the PV of probability weighted cash-flows (CTE 0).

(d) **(LOs 1a, 1b)** You are given the following information from a LICAT exercise:

- Present value of probability-weighted cash flows: 40,000
- Components of Base Solvency Buffer from LICAT:

Credit Risks	3,000
Market Risks	
Interest Rates	5,500
Others	3,500
Insurance Risks	
Level	10,000
Trend	8,000
Volatility	2,500
Catastrophe	2,000
Operational Risks	500
Diversification Adjustment	20%

Percentile	75%	85%	95%
Standard Normal Value	0.67449	1.036433	1.644854

(i) Describe an approach for using LICAT results to quantify an equivalent confidence level for IFRS 17 reporting.

(ii) Calculate the minimum risk adjustment for non-financial risk required to get a confidence level corresponding to the 75th percentile given the data above. Show all work.

Commentary on Question:
Candidates generally struggled with describing an approach for using LICAT results to quantify an equivalent confidence level for IFRS 17 reporting. The calculation of minimum risk adjustment was generally done either very well or not at all well. A common error was to include the Volatility and Catastrophe risks even though they are one-year risks so should be excluded.

(i) LICAT results can be used to quantify an equivalent confidence level for IFRS 17 reporting using the following steps:
   a. Assume that the probability distribution for the probability-weighted cash-flows follow the normal distribution.
   b. Treat the best estimate (BE) liability as the mean of the normal distribution
   c. LICAT + BE liability can be used as the second point of the distribution, representing the 85th percentile. For insurance risks, level and trend risk could reasonably be assumed to represent a lifetime 85th percentile shock.
   d. Calculate the Confidence Level z, by using the formula z=(x-mean)/standarddeviation, where x = LICAT + BELiability

(ii) Mean = Mean of PV of probability weighted Cash-flows = 40,000
Level + Trend = 10,000 + 8,000 = 18,000
Adjust For Diversification = 18,000*(1-20%)=14,400
Then X = 14,400+40,000=54,400

Since LICAT is calibrated to the 85th percentile:
1.036433=(54,400-40,000)/StandardDeviation
Rearranging, we get:
StandardDeviation=14,400/1.036433=13,894

Now that we have the standard deviation we can solve for the Risk Adjustment equal to the 75th percentile by multiplying the standard deviation by the Standard Normal Value for 75%:
13,894*0.67449=9,371

The Risk adjustment reflecting the 75th percentile is 9,371.

7. Spring 2022 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.~~

Learning Outcomes:

The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.~~

Sources:

1(a), 1(b) CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, Jun 2022

1(a), 1(b) CIA Educational Note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts, Jun 2022

~~CIA Educational Note: Comparison of IFRS 17 to Current CIA Standard of Practice, Sept 2018~~

~~CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, Sep 2019~~

~~The IFRS 17 Contractual Service Margin: A Life Insurance Perspective (Sections 1-4.7 & 5)~~

Commentary on Question:
This question tested the candidates' knowledge of IFRS 17.

Solution:

(a) **(LOs 1a, 1b)** Explain how the following IFRS 4 items would change under IFRS 17 for the T10 product

(i) Classification of contracts

(ii) Term of the Liability

(iii) Determination of contract cashflows, including items included or excluded

Commentary on Question:
Candidates had to distinguish the differences between classification, term of liability and setting assumptions for cashflows under IFRS4 vs IFRS17.

For part (i), candidates generally explained how the contracts are grouped instead of the classification.

Candidates generally did well on part (ii). Some candidates were able to explain the difference in general. However, they did not mention how the difference applied to the T10 product specifically.

For part (iii), candidates were generally able to point out IFRS17 restricts the expense to directly attributable portfolio, but not many candidates were able to point out the acquisition expense are required to be included. Some candidates were able to correctly list out whether IIT, premium taxes and income taxes need to be included. Few candidates mentioned that cashflows under IFRS17 should be estimated using probability weighted mean of the full range of possible outcomes whereas IFRS4 uses best estimate cashflows.

(i) The classification of these term products are not expected to change. These products are still expected to be insurance contracts under IFRS17 as there is significant mortality risk.

(ii) The contract boundary for T10 under IFRS-17 would extend for the full term of the contract including renewal periods since the option to renew and the renewal premiums are guaranteed. Under IFRS17, there is no bias towards conservatism; so in this case the contract boundary would take into account the right of the policyholder to extend the contract.

Under IFRS4, the current CIA standards require the actuary to be conservative, so future renewals would only be included if the resulting liability is larger. So the term of the liability could only be 10 years, or could be more depending on whether the renewals increase the reserves or not.

(iii) Cashflows under IFRS17 should be estimated using the probability weighted mean of the full range of possible outcomes whereas IFRS4 uses best estimate cashflows

Under IFRS4, estimates of cashflows should consider all policy related tax cashflows including income taxes. Under IFRS17, IIT and premium taxes are included in the cashflows, while income taxes are excluded
Policy maintenance expenses are included in both IFRS4 and IFRS17, although IFRS17 restricts the expense to those "directly attributable" to the portfolio
Acquisition expenses that are directly attributable to the portfolio are required to be included in the initial insurance contract valuation for IFRS17.

(b) **(LOs 1a, 1b)**

(i) Calculate the total opening CSM for the portfolio containing both the T10 and whole life products.

(ii) The insurance company updated the mortality assumption for years starting in year 2, which resulted in an increase in the best estimate liability of 1,000,000 for the T10 block, and a decrease in the best estimate liability of 1,100,000 for the whole life block.

Calculate the CSM at the end of years 1 and 2 assuming a 0% interest rate.

Commentary on Question:
For part (i), candidates were generally able to calculate the CSM/LC for T10 and whole life separately. Some candidates calculated the CSM/LC by combining T10 and whole life, receiving partial credit.
For part (ii), partial credit was received if candidates calculated T10 and whole life in one combined group.

(i) CSM at initial recognition is the best estimate present value of all cashflows less risk adjustment, floored at 0.

CSM = MAX (PV(premiums) - PV(benefits) - PV(maintenance) - acquisition expenses - risk adjustment, 0)

T10:
13,000,000 - 11,000,000 - 700,000 - 1,200,000 - 1,000,000 = (900,000) As the CSM cannot be negative, the CSM at inception for the T10 block is 0.

Whole Life:
14,000,000 - 8,000,000 - 1,200,000 - 1,700,000 - 1,600,000 = 1,500,000. The CSM at inception is 1,500,000

(ii) CSM Time 1 = MAX(CSM Time 0* (1 - (Year 1 CU / Remaining Lifetime CU)),0)

CSM Time 2 = MAX((CSM Time 1 + chg in b.e. liab) * (1 - (Year 2 CU / Remaining Lifetime CU)),0)

Term 10:

CSM Time 1 = -900,000* (1 - (20,000/250,000))= (828,000), floor at 0, CSM Time 1 = 0
CSM Time 2 = (-828,000 – 1,000,000)*(1 – 19,000/230,000) = -1,676,991, floor at 0,
CSM Time 2 = 0

Whole Life:
CSM Time 1 = 1,500,000*(1 – (5,000/100,000)) = 1,425,000
CSM Time 2 = (1,425,000 + 1,100,000)*(1 – (4,8000/95,000)) = 2,397,421

8. Spring 2022 LFMC Exam (LOs 1a, 1b)

Learning Objectives:

The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

~~2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.~~

Learning Outcomes:

The Candidate will be able to:

a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

~~(2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.~~

Sources:

1(a), 1(b) CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts, Jun 2022

~~CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts~~

Commentary on Question:
This question tested the candidates' knowledge of IFRS 17 discount rates.

Solution:
(a) **(LOs 1a, 1b)** Critique the following statements with respect to IFRS 17 discount rates:

A. The IFRS 17 discount rate applied to the estimates of future cash flows includes the effect of all factors that influence observable market prices (if any).

B. *The bottom-up approach is based on a yield curve that reflects the current market rates of return implicit in a fair value measurement of a reference portfolio of assets and adjusted with a liquidity premium.*

C. *In Canada, it's reasonable to set the last observable point for Government of Canada bonds at 30 years.*

D. *In setting the long-term risk-free rate, the 'historical real interest rate + inflation target' approach has the advantage of data being easily available.*

E. *Cash Surrender Value will increase the liquidity of a Universal Life insurance contract, and surrender charges do not affect the liquidity of a Universal Life insurance contract.*

F. *A company has a Universal Life insurance product with cash flows that vary with returns on underlying items. Under the General Measurement Model (GMM), the discount rate used must reflect that variability.*

Commentary on Question:
Candidates generally critiqued statements A, B, D, and E well. To receive full credit on statement C, candidates had to explain why they believe it is True. Few candidates critiqued statement F well.

A. False

Per IFRS 17.36(c), the IFRS 17 discount rates applied to the estimates of the future cash flows shall exclude the effect of factors that influence such observable market prices but do not affect the future cash flows of the insurance contracts.

B. False

The bottom-up approach aims to explicitly derive a liquidity premium over risk-free rates. The liquidity premium reflects the differences between the liquidity characteristics of the financial instruments that underlie the risk-free rates observed in the market and the liquidity characteristics of the insurance contracts.

C. True

The last observable point for risk-free discount rates would correspond to the term of the asset with the longest maturity for which there is a quoted price form an active market. There is only 3% volume of outstanding Government of Canada debt securities outstanding having a term in excess of 30 years. In addition, due to the fact that the Government of Canada has only issued ultra-long bonds five times, there may not be a sufficient amount of bonds that trad in the over 30-year market to be considered an active and relevant market.

D. False

This approach is using real historical interest rate, it has the disadvantage that real rates are not publicly available for a long historical period, it must be derived using the difference between historical nominal rates and inflation rates.

E. True for the first part and false for the second part.

Cash Surrender Value creates an exit value, thus increases the liquidity of a Universal Life insurance contract.
Surrender Charges create an exit cost, thus decreases the liquidity of a Universal Life insurance contract.

F. False

Per IFRS 17.B74(b), cash flows that vary based on the returns on any financial underlying items shall be:

(i) discounted using rates that reflect that variability; or
(ii) adjusted for the effect of that variability and discounted at a rate that reflects the adjustment made.

(b) **(LOs 1a, 1b)** A company is developing a reference portfolio of assets to reflect the characteristics of its insurance contracts, and is considering either the Own Assets Portfolio approach or the Reference Portfolio approach.

For each of the two approaches being considered:

(i) Describe the approach

(ii) Outline two advantages of the approach

(iii) Outline two disadvantages of the approach

Commentary on Question:
Candidates generally did well on part (i) demonstrating knowledge of the two approaches. Most candidates were able to outline some advantages/disadvantages for the two approaches. To receive full credit, candidates need to properly explain two advantages and two disadvantages for each of the two approaches.

Own Assets Portfolio

(i) The portfolio would consist of own assets
(ii) Advantages
  (a) Enables partial linkage between the insurance contract discount rates and supporting asset returns
  (b) Reduce earnings and/or balance sheet volatility as assets/liabilities will move together for changes in risk-free rates and liquidity premium.
(iii) Disadvantages
  (a) Operationally more difficult to produce as the reference portfolio must be adjusted as the asset holdings change.

(b) Actuary would need to demonstrate the portfolio reflects the characteristics of the liabilities
(c) Trading activities in the asset portfolio can affect the insurance contract value and if the impact is significant, it would be disclosed.

Reference Portfolio

(i) The portfolio would be composed of assets that best reflect the characteristics of the insurance contracts.

(ii) Advantages
(a) Operational simplicity
(b) Separation between insurance contract reference portfolio and actual asset portfolios, easier to make adjustments to align liquidity characteristics, if needed
(c) Actual trading activities will not affect the discount rates

(iii) Disadvantages
(a) Can increase earnings and/or balance sheet volatility if there are differences between underlying assets held and the custom reference portfolio.
(b) May be difficult to construct a reference portfolio for complex insurance contract portfolios

9. Spring 2022 LFMC Exam (LO 4d)

Learning Objectives:

The candidate will understand value creation and inforce management techniques for life and annuity products.

~~3. The candidate will understand Canadian taxation applicable to life insurance companies and products.~~

Learning Outcomes:

The Candidate will be able to:

d) Understand corporate taxation, policyholder taxation and calculate investment income tax

~~(3a) The Candidate will be able to describe and apply the taxation regulations applicable to Canadian life insurance companies and life insurance products~~.

Sources:

4(d) *Canadian Insurance Taxation*, Swales, et. al., 4th Edition, 2015

- Ch. 4: Income for Tax Purposes – General Rules

~~Canadian Insurance Taxation, 4th Ed: Chapter 10, The Taxation of Life Insurance Policies.~~

~~Canadian Insurance Taxation, 4th Ed: Chapter 4, Income for Tax Purposes - General Rules.~~

Commentary on Question:
This question tested the candidates' knowledge of taxation rules.

Solution:

(a) **(LO 4d)**

(i) Describe the impact of paying cash dividends with respect to Maple Leaf Life's income tax payable.

(ii) Describe the impact of taking out policy loans with respect to the policyholders' income tax payable.

Commentary on Question:
Candidates generally did well on part (i), identifying that Maple Leaf Life's income tax would decrease due to decrease in taxable earnings. In part (ii) most candidates did not identify the full effect of taking out policy loans on policyholder taxation.

Policyholder dividends on Par policies are deductible from an insurer's taxable income to the extent that the amount was not deducted in a previous year. Since the company's taxable income is lowered, tax payable will be reduced.

When a policyholder receives a policy loan, it is considered as a partial disposition of the policy for tax purpose. The proceeds of the partial disposition is the lesser of: the amount of the loan (less insurance premium paid) and the remaining cash value of the policy (after subtract the balance of any prior policy loans). If the proceeds are less than the Adjusted Cost Basis (ACB) of the policy, then no income will be included in taxable income. In this case the ACB will be reduced by the amount of the proceeds. Although there are no immediate tax consequences, the lower ACB will result in higher taxable gains from future dispositions of the policy. If the proceeds are greater than the ACB of the policy, then the excess will be included in taxable income of the policyholder.

The excess amount would then be added to the policy's ACB so that it will not be subject to tax again in the future.

(b) **(LO 4d)** Maple Leaf Life is exploring a new product to be launched in 2022 where the death benefit in any given year is indexed to the company's stock price. For a policy issued to a 50-year-old, you are given the following in the Excel file:

- The expected stock price over the projection period, which is projected to increase every five years
- The Exemption Test Policy accumulating fund rate issued at age n: ETP AF(n)
- The policy cash value rate: Pol CV
- The policy net premium reserve rate: Pol NPR

The ETP AF(n), Pol CV, and Pol NPR are expressed as rates per thousand of coverage. In addition, for tax-testing purposes, death benefit growth should be assigned to the ETP with the earliest issue date, where possible.

(i) Describe the difference in tax treatment of an exempt policy verses a non-exempt policy.

(ii) Demonstrate that the policy is projected to pass tax exempt testing in year 15, but not in year 19.

(iii) Determine a new Pol CV pattern to ensure the policy passes tax exempt testing in year 19.

(iv) Critique the product design of indexing the death benefit to the company's stock price, and the potential impact on the tax-exempt test.

Commentary on Question:
For part (i) candidates generally did well in identifying the difference between exempt and non-exempt policies but failed to mention that the amount of accrued income that is taxable is based on year of issue.
For part (ii) candidates generally did not do well. Most candidates failed to realize that in year 5 and year 10 the policy DB increased by more than 8%, therefore a new ETP would be issued in those years. Most candidates also did not complete the 250% anti-avoidance rule. Partial credit was received for listing out correct formulas and describing anti-avoidance rules.
For part (iii) most candidates simply listed a lower DV rate that would result in Pol AF ≥ ETP AF but did not show calculations on how to achieve the DV rate.
For part (iv) candidates generally did well in identifying that death benefit would be volatile and might result in policy failing tax exempt tests.

Part (i)
For exempt life insurance policies, they are allowed to build tax-deferred cash values. Income earned on life insurance policies was not taxable until it was received. For non-exempt life insurance policies, the accumulating income within the policy will generally be subjected to taxation on a full accrual basis. The determination of whether and how much of the accrued income is taxable depends on the date of issue of the policy and the type of policyholder.

Part (ii)

This is for a new product, so it would follow the New Exempt Policy Rules (apply to policies issued after 2017).

The basic principle is that a policy will qualify as an exempt policy if its accumulating fund does not exceed the accumulating fund of a hypothetical "Exemption Test Policy" (ETP). The anti-avoidance rules limit the allowable increase in death benefit (DB) to 8% each year. If the death benefit increases by more than 8%, a separate ETP is deemed to be issued at that date for the coverage in excess of 8%. In this question, the DB increased by 10% and 10.9% in year 5 and year 10 corresponding. Thus, the coverage in excess of 8% is deemed to be issued as a new ETP at those years. Another anti-avoidance rule applied if 3/20 of the total accumulating fund of ETP issued for a coverage under the policy exceeds the accumulating fund of the policy, on the 10th or any subsequent policy anniversary of the policy. The policy becomes non-exempt if the accumulating fund of the policy exceeds 250% of the accumulating fund of the policy on its third preceding policy anniversary.

Calculations
DB should be indexed to the stock price. The solution showed an initial DB of $1,000 but any value would work as long as the DB is indexed correctly to the stock price.
The DB Growth in any year must be assigned to an ETP(n) Growth up to 8%: assign to ETP(50) - as indicated in the question
Growth in excess of 8%: Assign to ETP(n) in year of the growth
The ETP AF in any year = SumProduct of all the ETP DBs and the ETP Rates provided.
The Pol AF in any year = Max(CV*DB/1000, NPR*DB/1000)

The tax-exempt test is passed at any given anniversary if the Policy AF <= ETP AF for that anniversary, and the next. So for the test to pass at year 15, the Policy AF <= ETP AF in years 15 and 16. Similarly, the test is passed at year 19 if the Policy AF <= ETP AF in years 19 and 20.

The Pol AF < ETP AF in years 15, 16, and 19. But in year 20, Pol AF>ETP AF. Therefore, the policy is projected to fail at the year 19 test.

For the 250% Test: The test is passed in all duration in this question, so no further action needed.

Attained Age	Policy Year	Death Benefit (DB)	Percentage Growth	Dollar Growth	DB Growth for ETP AF(50)	DB Growth for ETP AF(55)	DB Growth for ETP AF(60)
50	0	1,000		1,000	1,000	-	-
51	1	1,000	0.00%	-	0	-	-
52	2	1,000	0.00%	-	0	-	-
53	3	1,000	0.00%	-	0	-	-
54	4	1,000	0.00%	-	0	-	-
55	5	1,100	10.00%	100	80	20	-
56	6	1,100	0.00%	-	0	-	-
57	7	1,100	0.00%	-	0	-	-
58	8	1,100	0.00%	-	0	-	-
59	9	1,100	0.00%	-	0	-	-
60	10	1,220	10.91%	120	88	-	32
61	11	1,220	0.00%	-	0	-	-
62	12	1,220	0.00%	-	0	-	-
63	13	1,220	0.00%	-	0	-	-
64	14	1,220	0.00%	-	0	-	-
65	15	1,260	3.28%	40	40	-	-
66	16	1,260	0.00%	-	0	-	-
67	17	1,260	0.00%	-	0	-	-
68	18	1,260	0.00%	-	0	-	-
69	19	1,260	0.00%	-	0	-	-
70	20	1,280	1.59%	20	20	-	-

9. Continued

Attained Age	Policy Year	DB for ETP AF(50)	DB for ETP AF(55)	DB for ETP AF(60)	ETP AF	Pol AF	Tax Exempt?	250% Test
50	0	1,000	-	-				
51	1	1,000	-	-	60.00	10.00	Yes	Does not Apply
52	2	1,000	0	0	120.00	20.00	Yes	Does not Apply
53	3	1,000	0	0	180.00	30.00	Yes	Does not Apply
54	4	1,000	0	0	240.00	40.00	Yes	Does not Apply
55	5	1,080	20	0	324.00	55.00	Yes	Does not Apply
56	6	1,080	20	0	390.20	82.50	Yes	Does not Apply
57	7	1,080	20	0	456.40	110.00	Yes	Does not Apply
58	8	1,080	20	0	522.60	137.50	Yes	Does not Apply
59	9	1,080	20	0	540.20	165.00	Yes	Does not Apply
60	10	1,168	20	32	602.68	213.50	Yes	Does not Apply
61	11	1,168	20	32	624.00	244.00	Yes	177%
62	12	1,168	20	32	645.32	305.00	Yes	185%
63	13	1,168	20	32	666.64	366.00	Yes	171%
64	14	1,168	20	32	686.76	427.00	Yes	175%
65	15	1,208	20	32	730.28	504.00	Yes	165%
66	16	1,208	20	32	751.20	567.00	Yes	155%
67	17	1,208	20	32	772.02	630.00	Yes	148%
68	18	1,208	20	32	792.84	693.00	Yes	138%
69	19	1,208	20	32	812.54	787.50	Yes	139%
70	20	1,228	20	32	844.64	896.00	No	142%

9. Continued

Part (iii)
Only the CV rate in year 20 needs to be lowered, since that was the only year where the Pol AF > ETP AF. We can solve for the CV rate that sets the Pol AF = ETP AF.
Pol AF = Max(CV*DB/1000, NPR*DB/1000) = 844.64
= Max(CV*1280/1000, 500*1280/1000) = Max(CV*1.28, 640)
CV = 844.64/1.28 = 659.875
Therefore, lowering the Year 20 CV rate from 700 to 659.875 or less would be appropriate.

Part (iv)
An uncertain death benefit pattern could cause frequent and uncertain 8% and 250% test failures. While this wouldn't necessarily mean the policy would fail tax testing, if the stock price rises significantly, the policy would almost certainly fail.

10. Spring 2022 LFMC Exam (LO 4e)

Learning Objectives:

The candidate will understand value creation and inforce management techniques for life and annuity products.

~~6. The candidate will understand important insurance company issues, concerns and financial management tools.~~

Learning Outcomes:

The Candidate will be able to:

e) Describe and apply the methods and principles of embedded value for an insurance enterprise

~~(6a) The candidate will be able to describe, apply and evaluate considerations and matters related to:~~

- ~~Insurance company mergers and acquisitions~~
- ~~Sources of earnings~~
- ~~Embedded Value determinations~~
- ~~Rating agency considerations~~
- ~~Model Audit Rule and Sarbanes-Oxley Section 404 Considerations~~
- ~~Source of Earnings analysis~~

Sources:

4(e) Embedded Value: Practice and Theory, Actuarial Practice Forum, Mar 2009

~~Embedded Value: Practice and Theory, SOA, Actuarial Practice Forum, March 2009~~

Commentary on Question:
This question tested the candidates' knowledge of embedded value. Candidate generally did will on this question.

Solution:

(LO 4e) Critique each statement. Justify your answer.

A. The traditional, formula-based approaches of US statutory reserving provide a commonly used basis for assessing company solvency, but they fail to distinguish movements in reserve margins from economic earnings

in a reporting period.

B. Embedded Value is a more effective accounting basis that addresses the criticisms of current accounting methods.

C. Embedded Value is the same as the actuarial appraisal value of a company when used for mergers and acquisitions.

D. When calculating the Adjusted Net Worth, both the Required Capital and Free Surplus are assumed to earn market rates of return.

E. It is common to use a Risk Discount Rate that is consistent with the reporting entity's cost of equity capital, provided that the rate reflects the risks inherent in the business.

F. *It is essential to have a clearly defined process for the selection of assumptions in the calculation of the Embedded Value.*

G. All non-economic assumptions used in the Embedded Value calculation should be based on industry data plus a provision for adverse deviations.

H. When calculating the Time Value of Financial Options and Guarantees (TVFOG) using stochastic scenarios, it is recommended to use "real-world" scenarios.

I. The accurate calculation of the final Embedded Value is more important to investors than adequate disclosure of the movement.

J. There is substantial subjectivity on the part of the company for the disclosure of sensitivity tests for assumptions used in their Embedded Value calculations.

(A)
Commentary on Question:
Many candidates commented that RBC would be more commonly used to assess solvency than US Stat and received partial credit. Discussing transition to PBR and VM-20 also received partial credit if statements were true and relevant.

This statement is true.

US Stat reserving focuses on cost-based approaches to measuring earnings and does not directly reflect changes in the economic environment (i.e. changes in prevailing interest rates) as economic assumptions are locked in.

(B)
Commentary on Question:

Candidates generally performed well on this part of the question.

This statement is partially true. While EV addresses some of the criticisms of current accounting methods/standards, it also has shortcomings. For example, EV may be difficult to compare between companies or subject to manipulation. EV is not technically an accounting basis but has evolved to embody a codified collection of rules and practices that are almost universally recognized.

(C)
Commentary on Question:
Candidates generally recognized the EV excludes the value of future NB. Some candidates also identified other differences.

This statement is false. EV and AAV differ in three key ways: (1) AAV includes the value of future NB while EV does not; (2) AAV generally uses a higher discount rate; (3) EV and AAV generally use different assumptions. Particularly for expenses, EV assumptions tend to be company-specific while AAV assumption tend to reflect market sentiments.

(D)
Commentary on Question:
Few candidates described the reason for treating FS and RC differently.

This statement is partially true. Two approaches have emerged in practice. Since the entire ANW is not distributable, the literal approach is to use tax-effected marked-to-market only for Free Surplus and use book value for Required Capital (since only FS is distributable). A more practical approach is to use market returns for both.

(E)
Commentary on Question:
Candidates generally did well on this part of the question. Many candidates discussed CAPM or cost of debt capital, which also received credit.

This statement is true. The RDR is often assumed to be consistent with the reporting entity's cost of equity capital. Sometimes the RDR is defined as the Weighted Average Cost of Capital (WACC) as opposed to the equity cost of capital. Sometimes the RDR varies by term and sometimes it is kept constant. It is usual to use different RDRs for each country for multinational companies. RDRs may also vary by product line or inforce/new business.

(F)
Commentary on Question:
Most candidate recognized that the statement is true, but many candidates struggled to explain why.

This statement is true. Selecting appropriate assumptions is one of the most important elements of EV calculation. Because the process involves considerable judgement and subjectivity, a clearly defined process for selecting assumptions is critical to ensure EV remains a reliable measure of performance over time. EV can be very sensitive to key assumption, so even a small shift can have a large impact. Care must be taken to set assumptions properly and consistently.

(G)
Commentary on Question:
Candidate generally did well on this part of the question. The most common error was stating that EV assumptions should include a margin or PfAD.

This statement is false. EV assumptions should be best-estimate (no PfAD) and company-specific. This means that they should reflect management's unbiased estimate of future experience based on the specific circumstances of the company. The assumptions need not be consistent with the market's perception of what such assumptions should be. Observed trends (such as mortality improvement) may be extrapolated, though it is not typically considered appropriate to assume unit expense improvement beyond the valuation date, except for start-up operations.

(H)
Commentary on Question:
Candidates did not need to discuss the CFO Forum's EEV principles to receive full credit. Full credit was received for recommending risk-neutral scenarios to produce market consistent results, relying on the evolution of practice in that direction.

The CFO Forum's EEV principles from 2004 suggest using real-world scenarios. However, actuarial practice has evolved towards valuing TVFOG on a market-consistent basis, using risk-neutral scenarios

(I)
Commentary on Question:
Most candidates recognized that understanding the movement was more important, but many candidates did not explain why. Many candidates did not demonstrate they understood that EV is used externally.

This statement is false. Using EV to assess the performance of an entity requires the observer to have access to the analysis of movement, and that changes to methodology and assumptions are included in such analysis. A single point-in-time value of EV is not usually as useful as understanding how EV emerges over time when evaluating an entity's performance.

(J)
Commentary on Question:
Most candidates understood the important of disclosures, but many candidates did not discuss the subjectivity involved in choosing what to disclose.

10. Continued

This statement is partially true. Different observers will find different disclosures more or less helpful in understanding EV. This is partially down to personal preference. However, in general, items that have the most material impact are most important to disclose. This means that when an assumption is particularly critical, companies should disclose sensitivity testing to enable outside users to draw their own conclusions.

Understanding the sources of these items will lend insight into the comparability of results across companies and across time periods and may provide an indication of how likely a company is to be able to maintain or improve its financial performance, as measured by the change in EV, in the future.

The CFO Forum provides some guidance on sensitivities, however these are not binding. EV is not subject to regulatory requirements.

11. Spring 2022 LFMC Exam (LO 2a)

Learning Objectives:

The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

~~5. The candidate will understand how to explain and apply the methods, approaches and tools of financial management in a life insurance company context.~~

Learning Outcomes:

The Candidate will be able to:

a) Explain and calculate regulatory capital using various international frameworks

~~(5a) The Candidate will be able to:~~

- ~~Explain and apply methods in determining regulatory capital and economic capital~~
- ~~Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital~~
- ~~Explain Canadian regulatory capital framework and principles~~
- ~~Explain and apply methods in capital management~~

Sources:

2(a) ILA201-604-25: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1-6 (excluding Sections 4.2-4.4)

~~LFM-645-21: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), Oct 2018, Ch. 1-11 (excluding Sections 4.2-4.4 & 7.3-7.11)~~

~~IAIS – International Capital Standard, ComFrame, Holistic Framework for Systemic Risk in the Insurance Sector, Sullivan & Cromwell LLP, Dec 2019, Only pages 1-3, 8-28~~

Commentary on Question:
This question tested the candidates' knowledge of LICAT and ICS.

Solution:
(a) **(LO 2a)** Describe the calculation of the components of the aggregate capital requirements in the Base Solvency Buffer used in the LICAT Total Ratio for company AWH.

Commentary on Question:
This part of the question focused on aggregating the Base Solvency Buffer components specific to AWH, which is a company that sells annuities. However, most candidates answered this question by providing all of the LICAT BSB components for a life insurance company. Full credit was received if candidates described the key characteristics of longevity risk, expense risk, Interest Rate risk and Credit risk

Interest risk:
The insurance risk on annuities is longevity risk and expense risk.
The longevity risk component = level risk component + trend risk component.
The level risk component is calculated as the difference between the present value of the shocked cash flows and the present value of the best estimate cashflows. The required shock is a permanent decrease in best estimate assumptions for mortality rate based on geography at each age.

The Trend risk component is calculated as the difference between the present value of the shocked cash flows and the present value of the best estimate cashflows. For the trend risk component, the required shock is a 75% increase in best estimate assumption for mortality improvement.
The discount rates are level rates and are prescribed by geography.

Expense risk required capital is calculated in aggregate for level, trend and volatility. The combined shock is an increase of 20% in the first year followed by a permanent increase of 10% in all subsequent policy years applied to maintenance expenses. The required capital for expense risk is the difference between the present value of best estimate cashflows and the shocked cashflows.

Interest rate risk:
The most significant aspect of the interest rate risk is the net effect of potential changes in interest rates on the values of assets and liabilities whose cashflows may be mismatched. The required capital for interest rate risk is calculated as the maximum loss under the four different prescribed stress scenarios. The net position used to measure the loss in each scenario is equal to the difference between the present value of asset cashflow and liability cashflows. The discount rate is changed from those of the initial scenario to those of the 4 stress scenarios; where the discount rates are defined in term of risk-free interest rates plus a spread. The stress scenarios test out changes in short term, long term, and ultimate reinvestment rates.

Credit risk:
For credit risk, credit risk factors that differ by bond rating and effective maturity are applied to the balance sheet carrying amounts.

(b) **(LO 2a)** Describe the calculation of the capital requirements for company AWH under the International Capital Standard (ICS).

Commentary on Question:

Candidates generally did not do well on this part of the question.

The capital requirement for ICS is based on the impact of adverse changes to the company's qualifying capital resources. The target criterion is 99.5% value at risk over a one year time horizon of adverse changes in the company's net assets calculated by taking the difference between the current balance sheet and the post-stress balance sheet.

Longevity risks will be stress tested using unexpected changes in the level, trend or volatility of mortality rates. Expense risk should be tested using changes in the incidences of expenses incurred. The interest rate risk should be tested using unexpected changes in the level or volatility of interest rates.

The changes are tested using current estimates only. Current estimates are calculated using probability weighted average of the present values of future cashflows. An adjusted risk-free yield curve is used to discount the current estimates.

(c) **(LO 2a)** Discuss why the level of the following required capital components may change if the company were to move from LICAT to ICS:

(i) Insurance risk component

(ii) Interest rate risk component

(iii) Credit risk component

Commentary on Question:
Candidates generally did not do well on this part of the question, especially part (ii). Full credit was received if candidates provided the key differences / similarities with reasonable explanations.

Insurance Risk:
For the insurance risks (longevity and expense risks) that the insurer is exposed to, stress tests are used under both LICAT and ICS. The LICAT capital required could be more or less than the ICS capital required depending on how close the LICAT factors align to the CTE 99 level for the block of business that the company sells.

Interest Rate risk:
The ICS interest rate risk is based on the change in balance sheet net value (ie value of both the payout liability and bonds) stemming from the changes in level or volatility of interest rates from the stress test. The current estimate of insurance liabilities will change as the adjusted risk-free yield curve changes from the stress test. The bond market values will change as well due to the interest rate shocks from the stress test.

The change in net balance sheet position from the interest rate change approach is therefore similar to the LICAT discounting approach using risk-free rates. ICS and

LICAT should produce similar interest rate impacts, if the highest of the 4 prescribed scenarios under LICAT aligns to the CTE 99 level for this particular block of business.

Credit risk component
Both LICAT and ICS use factors for credit risk. The difference between LICAT and ICS will stem from the difference in factors.

Fall 2022 LFMC Exam

7. Fall 2022 LFMC Exam (LO 1a, 1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
(1a). Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b). Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts, Jun 2022

CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, Sep 2019

Commentary on Question:
This question tested the candidates' knowledge of IFRS 17.

Solution:
(a) **(LO 1a, 1b)** Identify the cash flows included for the UL product under the:

(i) Whole Contract view

(ii) Core Cash Flows view

Commentary on Question:
Candidates received full credit by providing a complete description of cash flows included in both views.

(i) The whole contract view includes all cashflows transferred between the insurer and the policyholder. This view includes cash flows that do not vary such as premium, fixed death benefit costs and expenses; and cash flows that do vary such as account value payable on death.

(ii) The core cash flows view includes just cash flows transferred between the insurer and the product's account value. Transfers in and out of the account value by the policyholder are excluded. The fees collected from the account value. This view includes cash flows that do not vary such as

fixed death benefit, cost of insurance (COI rate x net amount at risk); and cash flows that do vary such as the annual management Fee charge (MER x account value).

7. Continued

(b) **(LO 1b)** Calculate the Best Estimate Liability at issue using:

(i) The Whole Contract view

(ii) The Core Cash Flows view

Commentary on Question:
Candidates generally did well on this part of the question. Common errors for this part of the question include:

1. *In the Whole contract view, the COI charge is calculated based on (DB + Account Value) or (DB – Account Value);*
2. *The MER % or Credit rate is applied to Premium rather than (Premium – COI charge);*
3. *The survival benefit is not considered when calculating the Best Estimate Liability for the whole contract view.*

(i) The Whole Contract view

t =	0	1	2	3	4	5
Premium – (A)	3,000	3,000	3,000	3,000	3,000	3,000
Death Benefit – (B)	50,000	50,000	50,000	50,000	50,000	50,000
COI rate – (C)	4%	4%	4%	4%	4%	4%
COI charge = C x B	2,000	2,000	2,000	2,000	2,000	2,000
Account Value (EOP)		1,059	2,181	3,370	4,629	5,963

Where

$$AV_t = AV_{t-1} + (Premium - COI\ charge) \times (1 + Credit\ rate) \times (1 - MER\%)$$

t =	0	1	2	3	4	5
Mortality rate	0%	0%	0%	0%	0%	10%
Mortality costs	= (DB + AV_5) x q_5					5,596.30
Prob of Survival	100%	100%	100%	100%	100%	90%
Survival Benefit	= AV_5 x tPx					5,366.73

7. Continued

Discount factors

t =	0	1	2	3	4	5
Discount rate		5%	5%	5%	5%	5%
Discount Factor	1	95%	91%	86%	82%	78%

Therefore,

PV (Premiums) = $13,637.85
PV (Death Benefits) = $4,384.85
PV (Survival Benefits) = $4,204.97

Best Estimate Liability
= PV (Survival Benefits) + PV (Death Benefits) - PV (Premiums)
= $4,204.97

(ii) The Core Cash Flows view

The core cash flow view includes just cash flows transferred between the insurer and the product's account value

t =	0	1	2	3	4	5
COI charge = C x B	2,000	2,000	2,000	2,000	2,000	2,000
Death Benefit – (B)	50,000	50,000	50,000	50,000	50,000	50,000
Account Value (EOP)		1,059	2,181	3,370	4,629	5,963
MER %	1%	1%	1%	1%	1%	1%
MER charge		10.6	21.8	33.7	46.3	59.6

Discount factors

t =	0	1	2	3	4	5
Discount rate		5%	5%	5%	5%	5%
Discount Factor	1	95%	91%	86%	82%	78%

Therefore,

PV (COI charge) = $9,091.90
PV (Death Benefits) = $3,917.63
PV (MER charge) = $145.25

Best Estimate Liability
= PV (Death Benefits) - PV (COI charge) - PV (MER charge)
= -$5,319.52

7. Continued

(c) **(LO 1a)** Describe the approach for deriving the discount rates applied to cash flows that do not vary with returns on underlying items using the following two approaches:

(i) Top down approach

(ii) Bottom up approach

Commentary on Question:
Most candidates provided general descriptions for top-down and bottom-up approaches. For the top-down approach, candidates received full credit if they identified and describe the approaches to derive the credit risk adjustment. For the bottom-up question, candidates received full credit if they described:

1. *the approach to derive the risk-free risk from the observable market*
2. *examples for the approach(s) used to calculate the illiquidity premium*

(i) In the top-down approach, a reference portfolio of assets is selected with characteristics that are similar to those of the insurance contract liability. The yield on the reference portfolio would be adjusted to remove the portion of the yield attributed to credit and market risks on the assets.

There are two approaches to derive the credit risk adjustment:

1. a credit loss model can be used to calculated credit losses which are then deducted from the yield or
2. a market-based approach where the credit default swap is used to determine the adjustment.

(ii) In the bottom-up approach, a risk-free discount curve is adjusted by adding an illiquidity premium that reflects the characteristics of the insurance contract liabilities.

The risk free discount curve is typically based on government bonds or swaps, and the actuary would have to use an ultimate reinvestment rate if there is a need to extend the yield curve beyond the observable period

The liquidity premium can be calculated using the difference between an asset reference portfolio spread and the risk-free rate, while adjusting for credit risk and the difference between the liquidity characteristics of the insurance contract and the asset reference portfolio.

The liquidity premium can also be calculated using market-based techniques, which quantify the liquidity premium using the spread difference between covered bonds (where there is no credit risk) and the risk-free rates.

8. Fall 2022 LFMC Exam (LO 1a, 1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
(1a). Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b). Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
ILA201-601-25: The IFRS 17 Contractual Service Margin: A Life Insurance Perspective (Sections 2-4.8)

Commentary on Question:
This question tested the candidates' knowledge of contractual service margins under IFRS 17

Solution:
(a) **(LO 1a, 1b)** Determine each of the following for Group B at initial recognition:

(i) The profitability classification of the group (with respect to Level of Aggregation).

(ii) The impact to the Insurance Service Result.

Commentary on Question:
Candidates generally calculated the CSM correctly. Few candidates identified the three groups of contracts. Candidates that did not identify the classification of the group received partial credit.

(i) Paragraph 16 requires entities to divide a portfolio of insurance contracts issued into a minimum of three groups of contracts:
• Loss-making contracts (if any).
• Contacts without significant risk of becoming onerous subsequently (if any).
• all remaining contacts (if any).

CSM at initial recognition is the best estimate present value of all cashflows less risk adjustment, floored at 0.
CSM = MAX (PV(premiums) - PV(benefits) - PV(maintenance) - acquisition expenses - risk adjustment, 0)

T10: 1,300,000 - 1,100,000 - 70,000 - 120,000 - 100,000 = (90,000)

As the CSM cannot be negative, the CSM at inception for the T10 block is 0.

(ii) This group of contracts is loss-making (onerous). The CSM at initial recognition is not allowed to be negative; this loss must be recognized in the P&L (Insurance Service Results) immediately.

(b) **(LO 1a, 1b)** Explain possible reasons why the CSM at initial recognition for Group B is not proportional to the CSM at Transition for Group A.

Commentary on Question:
Some candidates explained that past experience variances and changes in assumptions may have affected the CSM roll-forward under the full retrospective method. Few candidates explained that the company may choose to use the Fair Value Method.

Where full retrospective method was used for Group A, past experience variances and changes in assumptions may have affected the CSM roll-forward.

If full retrospective method is not practicable, company may choose to use Fair Value Method; methodology is different than calculation of CSM at initial recognition.

It is uncommon for Fair Value method to produce a loss component at transition. Same product can have a positive CSM at transition even if it is generally loss making.

(c) **(LO 1a, 1b)** Explain the impact on the CSM or loss component at the end of year 1 and the Insurance Service Result in year 1 of each of the following separately:

(i) Actual death claims are increased by 1,000,000 in Group A.

(ii) Actual attributable maintenance expenses are increased by 100,000 in Group A.

(iii) Additional premium-related expenses of 100,000 in Group A.

(iv) A favorable change in non-financial assumptions of 1,000,000 in Group A.

(v) A favorable change in non-financial assumptions of 150,000 in Group B.

Commentary on Question:
Many candidates explained the impact on parts (i), (ii) and (iv) correctly. For part (iii), some candidates identified the CSM impact correctly. Few candidates explained that there is no impact on P&L. For part (v), few candidates explained that there was no impact on P&L. Most candidates explained that the CSM will be established and loss component is fully reversed.

8. Continued

(i) Additional claims would impact P&L (insurance service expenses), profit decreases by 1,000,000.

No direct impact to CSM for claim payment. CSM would change slightly because coverage units would change and additional deaths affect future cash flow projections.

(ii) No impact to CSM

Additional expenses would impact P&L (Insurance Service Expenses)

(iii) Experience variance would increase by $100,000 and reduce CSM by that amount. CSM amount is sufficient to absorb this; group remains in profitable status

No impact to P&L

(iv) Favorable change in NFS; CSM increases by 1,000,000

No direct impact to P&L from 1,000,000 assumption change itself. P&L changes slightly due to amortization of additional CSM

(v) 150000 does not impact P&L directly. 150000 impact of assumption change will first be applied to the loss component roll forward. Reversal of loss component will impact P&L. If loss component is fully reversed, the group will become profitable and a CSM will be established. In this case, the impact of the change in assumptions exceeds the amount of the loss component at initial recognition.

(d) **(LO 1a, 1b)** Explain how the calculation of the IFRS 17 liabilities would change for new business if the renewal premium rates after 10 years were no longer guaranteed and could be repriced at that time.

Commentary on Question:
Candidates generally explained that the contract boundary will end when the insurer has the right to reprice. However, few candidates explained that the risk adjustment will likely be reduced.

The Best Estimate Liability and CSM can only take into account cash flows that fall within the IFRS 17 contract boundary. The contract boundary will now end when the insurer has the right to reprice.

8. Continued

A substantive obligation to provide insurance contract services ends when:

a) The entity has the practical ability to reassess the risks of the particular policyholder and, as a result, can set a price or level of benefits that fully reflects those risks; or
b) Both of the following criteria are satisfied:
   (i) the entity has the practical ability to reassess the risks of the portfolio of insurance contracts that contains the contract and, as a result, can set a price or level of benefits that fully reflects the risk of that portfolio; and
   (ii) the pricing of the premiums up to the date when the risks are reassessed does not take into account the risks that relate to periods after the reassessment date.

The risk adjustment will likely be reduced to reflect the reduced risk given the insurer's right to reprice

(e) **(LO 1a, 1b)** Explain why the Risk Adjustment for Group A at transition may be different from the current Margins for Adverse Deviation (MfAD) under IFRS 4.

Commentary on Question:
Most candidates explained RA is for non-financial risk only.Few candidates explained other differences.

Risk adjustment is for non-financial risk only. C-3 margins should be excluded.

Margin approach may not be used to determine risk adjustment. A variety of methods are acceptable.

Reflection of diversification benefits may differ from IFRS-17 approach.

Entity's Confidence level for Risk Adjustment may not be consistent with that inherent in IFRS-4 margins.

10. Fall 2022 LFMC Exam (LO 4d)

Learning Objectives:
4. The candidate will understand value creation and inforce management techniques for life and annuity products.

Learning Outcomes:
(4d) Understand corporate taxation, policyholder taxation and calculate investment income tax.

Sources:

Canadian Insurance Taxation, 4th Ed: Chapter 4, Income for Tax Purposes - General Rules

Canadian Insurance Taxation, 4th Ed: Chapter 5, Investment Income

Canadian Insurance Taxation, 4th Ed: Chapter 9, Investment Income Tax

Commentary on Question:
This question tested the candidates' understanding of how different provincial tax rules can impact business decisions, and how different forces (internal and external) can impact an insurer's taxable income. Candidates generally did well on this question.

Solution:
(a) **(LO 4d)**

(i) Discuss the circumstances under which a Canadian Life Insurance company is subject to premium taxes.

(ii) Explain the impact of paying premium taxes on the company's net income for tax purposes.

Commentary on Question:
Most candidates did well on this part of the question.

(i) Premium taxes are assessed on premium paid on life insurance products, net of premium refunds and the cash value of policy dividends, and gross of reinsurance. Premiums taxes are not charged on annuity contracts. The definition of premium can vary by province.

(ii) Paying premium taxes will decrease the company's net income. Any taxes paid are deducted from net income for both federal and provincial tax purposes.

10. Continued

(b) **(LO 4d)** Oakville Life is a Canadian-resident life insurer which sells business in Canada and the United States.

Discuss the potential impact on the Canadian taxable income of Oakville Life for each of the following events:

A. *Incurred But Not Reported (IBNR) claims on Canadian life insurance policies for the following year are expected to increase.*

B. *A Canadian group insurance policyholder uses their experience rating refunds to reduce upcoming premium payments.*

C. *The cost to Oakville Life of mandatory underwriting for Canadian life annuities increases.*

D. *Universal Life sales increase for Oakville Life's United States-based insurance business.*

E. *Oakville Life reduces premium rates on their Canadian Term Life products in the hopes of selling more policies.*

F. *Oakville Life increases interest rates charged on policy loans for their Canadian policies.*

Commentary on Question:
Most candidates did well on this part of the question. A few candidates discussed concepts for premium taxes instead of corporate income taxes.

A:
Current year's taxable income will decrease, because the expected reserve will increase due to the expected claims increase.

However, because IBNR reserve has an MTAR, the increase may cause the MTAR to be positive, and the deducted reserve in that year may have to be added to next year's taxable income. As a result, the following year's taxable income may increase.

B:
The taxable income may decrease. This is because the insurer is permitted a deduction for the portion of the experience rating refund for experience tied to the past year.

10. Continued

However, if the portion of ERR is not for experience tied to the past year, the insurer may not be eligible to claim a deduction. The insurer may be able to set up a reserve instead.

C:
Increase in underwriting will decrease taxable income because underwriting is a policy acquisition expense and deducted from taxable income.

D:
There is no impact to taxable income, because the foreign-earned insurance income is not subject to Canadian income tax for Canadian-resident insurers.

E:
Net impact depends on whether the premium reduction strategy is successful or not. Sales premiums are included in taxable income so a decrease in premium rate will decrease the taxable income. But if the strategy works and more policies are sold that more than fully offset the decrease in premium rates, taxable income will increase.

F:
Increase in interest payments or policy loan repayments will increase taxable income for the insurer, because policy loan interest and repayments are included in taxable income.

11. Fall 2022 LFMC Exam (LO 2a)

Learning Objectives:
2. The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies

Learning Outcomes:
(2a) Explain and calculate regulatory capital using various international frameworks

Sources:
ILA201-604-25: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1-6 (excluding Sections 4.2-4.4)

CIA Educational Note: LICAT and CARLI, March 2018 (not on syllabus)

Commentary on Question:
This question tested the candidates' knowledge and application of LICAT.

Solution:
(a) **(LO 2a)**

(i) Calculate the mortality risk solvency buffer for the company, without diversification credit between life-supported and death-supported business.

(ii) Calculate the diversification credit between life-supported and death-supported business

(iii)For the company:

- Calculate the lapse risk solvency buffer
- Calculate the expense risk solvency buffer

Commentary on Question:
Candidates generally did well on this part of the question. Candidates generally demonstrated understanding of the concepts of required capital and were able to apply the appropriate shocks to calculate the solvency buffer. However, many candidates were not able to calculate the individual volatility component correctly and determine the correct the level risk shock for Business B as it was a Life-supported business.

11. Continued

	Business A	Business B
(i) Mortality risk	Death-supported	Life-supported
Calculate the individual volatility component for Business A & B:	Required capital for volatility risk (RC_vol) = 2.7 * Standard deviation of the upcoming year's projected net death claims * NAAR/net face amount	
	=2.7*1.5*(1100-1500)/1100 = -1.4727	=2.7*1.2*(10,600-(-90))/10,600 = 3.2675
Shock on base mortality for level risk	-15%	Min (25%, 11%+20% x RC_vol /The following year's net expected claims)
		=Min (25%, 11%+20%*3.2675/17)=14.84%
Required capital for level risk	= 1115-1070 = 45	= -184 - (-210) = 26
Shock on mortality improvement for trend risk	+75% at all policy durations	- 75% for 25 years, followed by -100% (i.e. no mortality improvement) thereafter.
Required capital for trend risk	= 1095 - 1070 = 25	= -196 - (-210) = 14
Catastrophe Shock	0% + 1 additional death per thousand	
Required capital for catastrophe risk for A&B	= 1069 -1070 = -1	=-200-(-210) = 10
Mortality risk solvency buffer for A & B	Mortality risk RC = sqrt(RCcat^2+RCvol^2)+RClevel+RCtrend	
	=sqrt((-1+10)^2+(-1.4727+3.2675)^2)+(45+26)+(25+14) = 119	

(ii)	Business A	Business B
Calculate the Required Capital	Required capital for level risk + Required Capital for trend risk	
	= 45+25 = 70	= 26+14 = 40
Calculate $RC_{Aggregate}$	sqrt(Life Supp RC ^2 + Death Supp RC ^2 - 1.5*LifeRC*DeathRC)	
	=sqrt(40^2+70^2-1.5*40*70) = 48	
Diversification Credit	=70+40-48 = 62	

(iii)

	Business A	Business B
Lapse risk	Lapse-supported	Lapse-sensitive
Shock on lapse for level risk and trend risk	±30% in all policy years	
Required capital for level risk and trend risk	=1085-1070 = 15	=15-(-210) = 225
Shock on lapse for volatility risk	±60% in the first year - ±30% in the first year	
Required capital for volatility risk	=1072-1071 = 1	= -160-(-180) = 20
Shock on lapse for catastrophe risk	-40% in the first year	An absolute addition of 20% to the lapse rate in the first year only
Required capital for catastrophe risk	= 1080-1070 = 10	=-185-(-210) = 25
Lapse risk solvency buffer	= sqrt(RC vol^2 + RC cata^2) + RC level& trend	
	=sqrt(1^2+10^2)+15 = 25	=sqrt(20^2+25^2)+225 = 257
Lapse risk solvency buffer for the company	=25+257 = 282	

Shock on expense	+20% in the first year followed by a permanent +10% in all subsequent policy years	
Expense risk solvency buffer	= 1075-1070 = 5	=-200-(-210) = 10
Expense risk solvency buffer for the company	= 5 +10 = 15	

(b) **(LO 2a)**Assume that:

- All policies are individually underwritten Canadian life business
- Tax rate = 20%
- No change in negative reserve reduction limit

You are given the three following independent events:

- Event 1: Negative reserve changed from 1000 to 1200. No change in net reserve.
- Event 2: Credit spread PfAD increased by 20.
- Event 3: Interest rate PfAD increased by 30.

11. Continued

Describe the impact on the following for each independent event:

(i) Total LICAT ratio

(ii) Tier 1 capital ratio

Commentary on Question:
Candidates were generally able to quantify the impact under Event 1. Few candidates demonstrated enough knowledge on Events 2 and 3. A common error was not considering the tax impacts. One of the key concepts was to identify which PfAD should be included in the Surplus Allowance, but few candidates were able to make the correct decisions.

Total LCAT Ratio:

- Event 1:

No impact on Total LICAT ratio as negative reserve is subtracted from Tier 1 available capital and added back to Tier 2 available capital. Hence, there is no impact to total available capital.

- Event 2:

Increase in credit spread PfAD results in an after-tax loss of $20M x (1-20%) = $16M. Credit spread PfAD is not included in the surplus allowance. Hence, no offsetting impact to the after-tax loss. This causes total LICAT ratio to decrease.

- Event 3:

Increase in risk-free PfAD results in an after-tax loss of $30M x (1-20%) = $24M, but 100% Risk-free rate PfAD is included in the surplus allowance for the total LICAT ratio calculation. Hence, the numerator in the LICAT formula is going to change by -$24M + 100% x 30M = $6M. Therefore, the Total LICAT ratio will increase.

Tier 1 Capital Ratio:

- Event 1:

Tier 1 ratio should decrease as negative reserves are deducted from Tier 1 available capital.

- Event 2:

Increase in credit spread PfAD results in an after-tax loss of $20M x (1-20%) = $16M. Credit spread PfAD is not included in the surplus allowance. Hence, no offsetting impact to the after-tax loss. This causes Tier 1 ratio to decrease.

- Event 3:

Increase in risk-free PfAD results in an after-tax loss of $30M x (1-20%) = $24M, but only 70% Risk-free rate PfAD is included in the surplus allowance for the Tier 1 ratio calculation. Hence, the numerator in the Tier 1 formula is going to change by -$24M + 70% x 30M = ($3M). Therefore, the Tier 1 ratio will decrease.

Spring 2023 LFMC Exam

1. Spring 2023 LFMC Exam (LO, 2b, 2c, 3c)

Learning Objectives:
2. The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.
3. The candidate will understand various approaches to manage and evaluate life insurance risks.

Learning Outcomes:
The Candidate will be able to:
(2b) Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital
(2c) Describe the purpose and application of economic capital
(3c) Explain and understand the use and application of the Own Risk Solvency Assessment (ORSA) report

Sources:
ILA201-606-25: OSFI: Own Risk and Solvency Assessment (E-19) (LO 3c)

A Multi-Stakeholder Approach to Capital Adequacy, Conning Research (LO 2b)

Economic Capital for Life Insurance Companies, SOA Research Paper, Oct 2016 (only sections 2 & 6) (LO 2c)

Commentary on Question:
This question tested the candidates' understanding of capital management.

Solution:
(a) **(LO 3c)** List the key elements of Own Risk and Solvency Assessment (ORSA).

Commentary on Question:
Candidates generally listed some of the major areas. Some candidates missed the major areas and listed minor parameters such as "scope of the report", "time horizon", "accounting basis", etc. which did not receive credit.

The ORSA should contain, at a minimum, certain key elements and considerations, including:

- Comprehensive Identification and Assessment of Risks
- Relating Risk to Capital
- Oversight

1. Continued

- Monitoring and Reporting
- Internal Controls and Objective Review

(b) **(LO 2b, 2c)** Critique the following statements:

A. The results of an economic capital model could lead to forced receivership of the company or downgrade of the company.

Commentary on Question:
Candidates generally did well in their critique of this statement.

False. Economic capital models take a customized view of the insurer's need for capital, but, unlike the standardized regulatory and rating agency models, have no real consequences for the insurer. The results of the economic capital model are currently used only to provide information to the company.

B. Company ABC determines its interest rate risk as a fixed 10% of reserves factor. The risk assessment is deemed as realistic as the reserves reflect the risk.

Commentary on Question:
Most candidates correctly identified that this statement was false but did not provide sufficient rationale to receive full credit.

False. We do not classify this as a realistic risk assessment because it does not consider the specific risks faced by the company, is not based on current market data or historical analysis and is not updated frequently.

C. Both rating agencies and shareholders consider the more capital an insurer has, the better.

Commentary on Question:
Most candidates correctly distinguished the difference in objectives between rating agencies and shareholders and addressed the opposing objectives shareholders face.

False (True for rating agencies but false for shareholders).

Rating agencies, like regulators, are concerned with the ability of the insurer to meet its obligations. Generally, from a rating agency perspective, more capital is the favored position

1. Continued

The shareholders' objective is to maximize their return on capital while maintaining enough capital to absorb unexpected, non-diversifiable risk. In addition, shareholders want enough capital to support growth of new and existing operations that will meet their return-on-capital requirements. Shareholders thus have multiple objectives that pull the amount of required capital in opposing directions. That is, some objectives are satisfied with higher capital levels, some objectives are satisfied with lower capital levels.

D. The "correlation matrix approach" is a common approach used for evaluating the diversification benefit. The correlation assumptions are often set by a combination of historical data or expert forecasts that analyze the relationship between risk scenarios. The correlations are applied to the risk scenarios.

Commentary on Question:
Candidates generally did not do well in their critique of this statement.
Most candidates correctly identified that the first sentence was correct. Many candidates identified the second sentence as incorrect when in fact it was correct. Many candidates did not identify the last sentence as incorrect. For the second and third sentences, a common mistake was around understanding how risk scenarios are related to the Correlation Matrix Approach.

True statement for how the correlation assumptions are set. False statement for how the correlation assumptions are applied, the correlations are applied to the standalone capital amount not the risk scenarios itself. The implication of this approach is that balance sheets respond linearly to risk scenarios, which can be a severe approximation for some types of business, creating a diversification amount which is a function of individual exposures rather than the underlying relationship between risk drivers.

E. Under the finite risk horizon approach, the Economic Capital represents the current market value of assets required to ensure that the value of liabilities can be covered at a finite point in the future, at the chosen security level, less the current value of liabilities. Under this approach, a run off projection is still required.

Commentary on Question:
Candidates generally did not do well in their critique of this statement. The most common error was to state that a run-off project was not required.

True. It is important to note that even under the finite risk horizon approach, a runoff projection is still required, since a terminal value of liabilities at the end of the risk horizon is needed. Future uncertainty surrounding the risk beyond the risk horizon is captured within the value of the liabilities at the end of the year.

1. Continued

(c) **(LO 2c)** Describe how Economic Capital can be used as a risk management tool in the following areas below.

(i) Capital adequacy

(ii) Risk appetite

Commentary on Question:
Candidates generally did not do well on this part of the question. Many repeated or rephrased answers already given in previous parts of the question.

(i)
Capital adequacy is the core use of EC for most insurers—providing a measure of capital that truly captures the risk of the insurer's own portfolio, free from the distortions of regulatory reserving and capital requirements and the simplified approximations within most rating agency models.

Effective use of EC in measuring capital adequacy requires the EC measure to be integrated into the capital management process, with potential EC requirements along a number of scenario paths being developed and capital funding strategies developed to address these. EC can also be used to help determine asset allocations by lines of businesses.

EC often features strongly in discussions on capital adequacy with regulators, rating agencies, and plays an important role in discussions with shareholders and investment analysts.

(ii)
EC is a key measure of risk from a policyholder perspective and therefore frequently features as an important component of an insurer's risk appetite framework and in the monitoring processes implemented to ensure the insurer remains within that risk appetite.

To do this, target ranges for EC utilization need to be established for each geography, business unit and/or risk, and actual EC monitored against these target ranges. The setting of such ranges and limits needs to consider the expected level of diversification between risks as well as the level of granularity. EC can also be used to develop a tiered approach of deploying capital.

As risk profiles of the organization changes, the use of EC for this purpose requires an ability to update EC.

2. Spring 2023 LFMC Exam (LO, 1a,1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
(1a). Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b). Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
ILA201-601-25: The IFRS 17 Contractual Service Margin: A Life Insurance Perspective (Sections 2-4.8)

Commentary on Question:
This question tested the candidates' knowledge of IFRS valuation principles.

Solution:
(a) **(LO 1a, 1b)** Consider each of the following:

- A direct insurance contract which is profitable at issue
- A direct insurance contract which is not profitable at issue

(i) Explain how profit or loss is recognized both at issue and over the duration of the contract under IFRS 17.

(ii) Explain how the recognition of profit or loss will change if you cede mortality risk through a reinsurance contract held.

Commentary on Question:
In general, candidates could distinguish features of profitable versus onerous contracts. Most candidates explained how CSM releases into profits but neglected the risk adjustment releases. In general, candidates explained the systematic tracking of a loss component but did not explain that favorable changes to future assumptions can offset the loss component completely and that the re-established CSM will be amortized gradually again.

2. Continued

(i) Under IFRS17, insurance contracts can be classified as profitable or onerous at contract inception.

- For profitable policies:
    - PV of fulfilment cashflows will be negative and a contractual service margin (CSM) will be established at inception, in lieu of an initial profit being recognized in the P&L. Profit recognition will be deferred
    - CSM will be amortized gradually as insurance services are provided and the CSM will also be adjusted to reflect gains/losses from future service changes. Other experience variances (not reflected in the CSM) will flow through the P&L or OCI
    - Besides the CSM releases, risk adjustment releases also contribution to the P&L of a contract over time as an additional source of profit.
- For non-profitable contracts:
    - CSM calculated at inception is negative and since the CSM cannot be negative, its floored at 0 and an equivalent loss component will be established. While positive CSM is released at profit gradually, the loss component is recognized in its entirety in the P&L.
    - Other changes which would have been reflected by adjusting the CSM go to the P&L and OCI to adjust (offset) the loss component
    - If the contract has positive adjustment to future service that can fully offset the Loss Component, a positive CSM can be re-established and amortized over the future contract duration via the P&L
    - Risk adjustment release will provide additional profits in the P&L over time.

(ii) Reinsurance treatment under IFRS17,

- CSM will be established for Reinsurance Contract Held (RCH) regardless of the RCH being profitable or not
- Any adjustments to current or future service will adjust the CSM or flow through the P&L or OCI as appropriate
- CSM under the RCH can be negative and will continue to be amortized like a profitable IFRS17 contract (i.e. loss component not established)
- Ceded and direct IFRS17 profits are reported separately unlike IFRS4. Therefore, reinsurance contracts will have no impact on the reporting of the direct contracts

2. Continued

(b) **(LO 1a, 1b)**

(i) Describe the necessary steps and requirements in determining the level of aggregation.

(ii) You are provided with the following target profit margins for the products sold by your company, expressed as a percentage of the present value of premium:

Issue Age Band	Whole Life	Group Health Insurance	Payout Annuities
<=45	5.00%	50.00%	1.00%
46-65	3.00%	45.00%	1.00%
66+	-5.00%	5.00%	2.00%

Assume actual experience is consistent with the target profit margins.

Recommend how the contracts should be allocated for IFRS 17 measurement purpose. Justify your response.

Commentary on Question:
Candidates generally did well on this part of the question. Candidates were able to describe the key steps involved in setting levels of aggregation and allocate the portfolio by risk differences and profitability gaps. For part (ii) some candidates mentioned the required allocation in the groupings but did not identify which groups the risk would be allocated to (i.e., onerous, or profitable with no significant risk of being onerous or other).

Some candidates grouped all ages in Group Health together as "profitable with no risk of being onerous" since the question stated that experience would emerge as expected. This implied profit margins would not become loss making in the future. Credit was received if this reasoning was provided along with all ages being combined into one group.

(i) Level of aggregation can be determined using two main steps:

- Companies need to identify portfolios – These portfolios should consist of risks of a similar nature, profile, etc. The risks in a portfolio would be managed together.

2. Continued

- Above portfolios would be allocated into groups. These groups would be
  - Based on the profitability of the underlying contracts
  - Profitability based contract groups would be:
    - Onerous contracts
    - Profitable contracts with no significant possibility of being onerous
    - Other; at the very least
  - Contracts in a given group would not be issue more than 12 months apart
  - Additional grouping maybe be set up as deemed appropriate

(ii) All three products represent materially different risk profiles and should split into three groups at the very least. Profitability within the products is varied and justifies further splits. Recommended grouping:

- Whole Life:
  - Ages <=45 & 46-65 : Other
  - Ages 66+ : Onerous
- Group Health
  - Ages <=45 & 46-65 : Profitable with no significant risk of becoming onerous
  - Ages 66+ : Other
- Payout annuities
  - All Ages : Other

(c) **(LO 1b)** You are given the following information for a group of insurance contracts:

- Contractual Service Margin (CSM) at issue: 1,000
- The CSM is amortized linearly over a 10-year period
- The locked-in interest rate = 4%
- Current interest rates are the same as the locked-in interest rates
- Basis changes are effective at the end of the year
- For simplicity, the risk adjustment is set to 0

For each of the following outcomes:

1) Actual death claims during the year are 300 greater than expected death claims
2) A favorable mortality basis change of 400
3) An unfavorable mortality basis change of 1,500

(i) Calculate the impact on profitability at the end of the first year

(ii) Calculate the impact on insurance contract liabilities at the end of the first year

Commentary on Question:
Candidates generally did not do well on this part of the question. Many candidates combined the three outcomes into one outcome. For candidates that addresses each outcome separately, most failed to identify the offsetting BEL impact of positive or negative changes to the mortality basis which would dilute the impact of the basis change on the ICL.

	Base	Case 1	Case 2	Case 3
CSM BoY	1,000	1,000	1,000	1,000
Interest	40	40	40	40
Basis Change	0	0	400	-1,500
P/L Release	104	104	144	0
Loss Component	0	0	0	460
CSM EoY	936	936	1,296	0
Ins Revenue	104	104	144	0
Ins Expenses	0	-300	0	0
Loss Component				-460
IFRS17 P&L	**104**	**-196**	**144**	**-460**
P&L Impact		**-300**	**40**	**-564**
BEL Impact	0	0	-400	1,500
CSM Impact	0	0	360	-936
RA Impact	0	0	0	0
ICL Impact		**0**	**-40**	**564**

** impact relative to base case*

(1) Current period change, no impact to CSM. $300 in claim variance will directly flow into P&L and drop profits by 300 compared to base scenario. ICL will remain unchanged
(2) Favorable basis change $400 will increase CSM as it is a future service change. Increase CSM will amortize i.e. CSM increase by 40 (10% x 400) compared to base case. Basis change would increase EoY CSM balance by 360 (400 – 40) and BEL would be lowered by 400. Net ICL impact = - 40
(3) Unfavorable impact will wipe out CSM and loss component of 460 would be established. BEL would increase by 1500 and CSM drops off by 936. Net ICL impact would be 564

5. Spring 2023 LFMC Exam (LO 2a)

Learning Objectives:
2. The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies

Learning Outcomes:
(2a) Explain and calculate regulatory capital using various international frameworks

Sources:
ILA201-604-25: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1-6(excluding Sections 4.2-4.4) (LO 2a)

LFM-636-20: OSFI Guideline A-4 Internal Target Capital Ratio for Insurance Companies, December 2017 (not on syllabus)

Commentary on Question:
This question tested the candidates' understanding of various capital management approaches.

Solution:
(a) **(LO 2a)** For each of OSFI's capital targets specified below:

- Minimum Capital
- Supervisory Target Capital
- Internal Capital targets

(i) Explain the purpose of the target and the minimum thresholds for each.

(ii) Describe the impact of having capital levels fall below the target.

Commentary on Question:
Candidates generally did well on this part of the question. Candidates generally provided the purpose of each capital target and the impact of having capital levels fall below the target. Few candidates explained that internal targets should be set above supervisory targets based on the ORSA.

(i) Minimum Capital
90% Total / 55% Core

- Minimum level necessary to cover the risks specified in the guidelines.

Supervisory Target
Total 100% / Core 70%

- Minimum level necessary to cover the risks specified in the guidelines and provide a margin for other risks.

Internal Capital targets

- Target level of capital needed to cover all risks of the insurer
- Internal targets should be set above supervisory targets based on the ORSA

(ii) Minimum Capital

- OSFI would be very concerned if capital was to fall below the minimums.

Supervisory Target

- Insurer would undergo in creased supervision if capital levels fall below supervisory targets.

Internal Capital targets

- Insure should provide regulator with plan to increase capital if level falls below internal target

(b) **(LO 2a)** You are given the following information for a Canadian stock life insurance company with respect to the LICAT requirements:

Base solvency buffer	8,000
Surplus allowance	1,000
Eligible deposits	1,000
Contributed surplus	3,000
Adjusted retained earnings	3,000
Adjusted other comprehensive income (AOCI)	1,000
Goodwill	2,000
Policy-by-policy negative reserves	2,000
Tier 2 capital instruments	2,500

Assume:

- All business is individually underwritten Canadian life business
- Negative reserves are not recoverable on surrender

(i) Calculate the Total Ratio.

(ii) Calculate the Core Ratio.

(iii) Outline the implications of the company's current capital ratios.

Core ratio is below supervisory target. Company will be subject to increased supervision

(iv) Recommend two actions that could be taken to improve current capital ratios

Show all work.

Commentary on Question:
Candidates generally applied the correct formulas to calculate the total ratio and core ratio. Few candidates performed the cap on Tier 2 and 70% on negative reserves.

(i) Total Ratio = (Available Capital + Surplus Allowance + Eligible Deposits)/Base Solvency Buffer
Available Capital = Tier 1 + Tier 2

Tier 1 = Contributed surplus + Adjusted Retained Earnings + Adjusted AOCI

Tier 1 deductions = 70% negative reserves + Goodwill
Tier 2 = tier 2 capital instruments + 70% Negative reserves

Tier 2 cannot be more than 100% of tier 1 capital

	Gross Tier 1	7,000
1	Deductions from Tier 1	3400
2	Net Tier 1	3,600
	Tier 2 capital instruments	2,500
1	Negative reserves	1400
2	Total Tier 2	3,900
2	Limited to a max tier 1	3,600
	Total ratio	
	Total Capital	7,200
	Eligible Deposits	1,000
	Surlus Allowance	1,000
	Base solvency Buffer	8,000
3	Ratio	115

(ii) Core Ratio = (Tier 1 Capital + 70% Surplus Allowance + 70% Eligible Deposits)/base Solvency Buffer

	Core Ratio	
	Tier 1 Capital	3,600
	70% Eligible Deposits	700
	70% Surplus allowance	700
	BSB	8,000
3	Ratio	62.5

(iii) Core ratio is below supervisory target. Company will be subject to increased supervision

(iv) Obtain more capital and cede more business.
In this case, accept moving the ceded reinsurance to a registered reinsurer (the question assumes eligible deposits) to provide full capital relief

6. Spring 2023 LFMC Exam (LOs 1a,1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
(1a). Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b). Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
CIA Educational Note: IFRS 17 – Fair Value of Insurance Contracts, Jun 2022
- Companion Excel Spreadsheet: Educational Note: IFRS 17 – Fair Value of Insurance Contracts (LO1a, 1b)

LFM-106-07: Insurance Industry Mergers and Acquisitions, Chapter 4 (Sections 4.1-4.6) (not on syllabus)

Commentary on Question:
This question tested the candidates' knowledge of appraising a book of business and cost of capital.

Solution:
(a) **(NO LONGER RELEVANT)**

~~(i) Identify and briefly describe the components of an actuarial appraisal value (AAV).~~

~~(ii) List the information typically included in an actuarial appraisal report.~~

~~**Commentary on Question**:~~
~~*Generally, candidates correctly defined the actuarial appraisal value (AAV) and its components for part (i). Alternative names were acceptable as long as candidates were able to correctly describe the components. For part (ii), most candidates identified the disclosure items for AAV rather than the information included in an actuarial appraisal report.*~~

~~(i) The components of the actuarial appraisal value (AAV) are the Adjusted Book Value (ABV), the Value of Inforce Business (VIB) and the Value of New Business (VNB).~~

~~ABV is the net worth of a company on a statutory basis, or the excess of statutory asset over statutory liabilities.~~
~~VIB is the present value of future profits of business that is currently on the insurance company's books.~~

~~VNB is the present value of profits of expected future new business.~~

~~(ii) Typical actuarial appraisal reports include the following information:~~
- ~~Actuarial Appraisal Value~~
- ~~Projection of statutory earnings and capital requirements~~
- ~~Sensitivity analysis of critical assumptions.~~

(b) **(LO 1a,1b)** You are provided with the following information for a life insurance company:

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Base Solvency Buffer	1000	800	600	400	200	0
Surplus Allowance	50	40	30	20	10	0

Target Capital ratio	150%
Pre-tax earned rate on assets supporting capital	4%
Effective tax rate	25%
Weighted average cost of capital	10%

Assume there is no reinsurance.

Calculate the cost of capital. Show all work.

Commentary on Question:
Most candidates applied an adequate evaluation of the cost of capital for a life insurance company. Common mistakes included not discounting, incorrect computation of cost of capital rate and/or miscalculation of the required capital.

The cost of capital is calculated as follow

$$CoC = \sum \frac{r_t \times C_t}{(1 + d_t)^t}$$

where r_t is the cost of capital rate, which is equal to
= WACC – after-tax earnings on assets supporting surplus
= 10% - (1-25%)*4%
= 7%
d_t is the discounting rate at 10%.
C_t is the projected required capital
= Target Capital Ratio* Base Solvency Buffer – Surplus Allowance

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
BSB	1000	800	600	400	200	0
Surplus Allowance	50	40	30	20	10	0
Required Capital (C_t)	1450	1160	870	580	290	0
r_t x C_t	101.5	81.2	60.9	40.6	20.3	0
PV (CoC)	**$245.47**					

The cost of capital is 245.

7. Spring 2023 LFMC Exam (LO 4d)

Learning Objectives:
4. The candidate will understand value creation and inforce management techniques for life and annuity products.

Learning Outcomes:
(4d) Understand corporate taxation, policyholder taxation and calculate investment income tax.

Sources:
Canadian Insurance Taxation, 4th Ed, 2015, Chapter 4,5,&9

Commentary on Question:
This question tests candidates' understanding of the ACB calculation on life insurance policies, and the general mechanics for performing the tax-exempt test on life insurance policies.

Solution:
(a) **(LO 4d)** Explain how an exempt test policy (ETP) would be constructed.

Commentary on Question:
Candidates generally did well on this part of the question. Most candidates explained that the criteria must be met from issue and at every policy anniversary.

Endowment policy at age 85 / 20 pay was accepted as an alternative to endowment policy at age 90 / 8 pay.

Exempt Policy

- A policy is qualified as an exempt policy if its accumulating fund does not exceed the accumulating fund of a hypothetical exempt test policy.
- To remain exempt, the policy must meet this test at the time of issue and at each succeeding policy anniversary until the life insured reaches age 85.

Exempt Test Policy

- Endowment policy at age 90 / 8 pay
- Issued at the same time as the real policy

(b) **(LO 4d)** Critique each of the following statements:

A. *A policy is considered exempt if the accumulating fund of the policy is less than the accumulating fund of the ETP.*

B. *Death benefits received on a non-exempt policy are fully taxable.*

C. *Additional ETPs are deemed to be issued if the death benefit increases by any amount from the previous year.*

Commentary on Question:
Candidates generally did well in their critique of statements A and C. Candidates generally struggled to explain why B is false. A non-exempt policy would have been subject to accrual taxation, and this would have reduced the taxable amount on disposition.

A. Partially True
   (i) The accumulating fund of the policy must be less than the accumulating fund of the exempt test policy
   (ii) This must be true on a projected basis to age 85
   (iii)These must have always been true

B. False
   (i) Only death benefits up to the untaxed gains that have accrued are taxable.

C. Partially True
   (i) Increases up to 8% increase the death benefit of the existing ETPs.
   (ii) Any increases above 8% result in an additional ETPs

(c) **(LO 4d)** You are given the following information for a UL policy:

- The policy is issued on January 1, 2020 to a female non-smoker, age 50.
- The policy has a level death benefit of 100,000.
- The cost of insurance is deducted at the beginning of the year
- Interest is credited at the end of each policy year at a rate of 5%.
- The policy is funded with a single premium of 10,000.
- The policy is considered to be an exempt policy.
- There are no policy loans.

	Rates / 1000 of death benefit	
Age	Cost-of-Insurance	Net cost of pure insurance (NCPI)
50	0.5	1.0
51	1.0	1.5
52	1.5	2.0

Assume that the policy is surrendered at the end of year 3.

Determine the taxable income of the policyholder at time of surrender.
Show all work.

Commentary on Question:
Candidates generally did well on this part of the question. A common error was calculating the cost of insurance based on the face amount instead of the NAAR.

Face Amount = 100,000
Interest Credited Rate = 5%
Premium = 10,000

$NAAR_t$ = Face Amount – Fund at beginning of $year_t$
Insurance $costs_t$ = $NAAR_t$ × Cost-of-Insurance $Rate_t$
$Interest_t$ = (Fund at beginning of $year_t$ – Insurance $costs_t$) × Interest Credited Rate
Fund at end of $year_t$ = Fund at beginning of $year_t$ – Insurance $costs_t$ + $Interest_t$
$NCPI_t$ = $NAAR_t$ × NCPI $Rate_t$

	Fund at beginning of year	Net amount at risk (NAAR)	Insurance costs	Interest	Fund at end of year	NCPI
1	10,000	90,000	45	498	10,453	90
2	10,453	89,547	90	518	10,881	134
3	10,881	89,119	134	537	11,285	178

Proceeds of disposition on surrender at the end of year 3 = CSV_3 = 11,285
Adjusted Cost Basis (ACB) = Premium – Total NCPI = 10,000 – (90 + 134 + 178) = 9,597
Income = Proceeds of disposition – ACB = 11,285 – 9,597 = 1,688

9. Spring 2023 LFMC Exam (LO 1a,1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
(1a). Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b). Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
CIA Educational Note: IFRS 17 – Fair Value of Insurance Contracts, Jun 2022
• Companion Excel Spreadsheet: Educational Note: IFRS 17 – Fair Value of Insurance Contracts

Commentary on Question:
This question tests candidates' understanding of fair value approaches for the transition to IFRS17.

Solution:
(a) **(LO 1a, 1b)**
(i) Describe the two commonly used approaches for determining the fair value of a block of contracts.

(ii) Explain how each of the two approaches can be used to determine the CSM at transition.

Commentary on Question:
Candidates who understood the two approaches generally did well on this part of the question.

CSM = PV(CoC) - PV(after tax profits in FCFs) and CSM = PV(CoC) - PV(RA releases) were both accepted for the Appraisal Value Approach CSM.

<u>Adjusted Fulfilment Cash Flow Approach</u>
- Fair value determined by adjusting fulfilment cash flows to reflect market participant perspective
- Adjustments can be made by a simple add-on, adjusting IFRS 17 assumptions and / or a cost of capital approach
- CSM = FV - FCF

9. Continued

Appraisal Value Approach

- Price established by a buyer to acquire a block of business
- Present value of inforce = PV(profits) - Cost of Capital
- CSM = PV(CoC) - PV(after tax profits in FCFs)

(b) **(LO 1a, 1b)** Assess whether each of the following items should be reflected when determining the fair value of a group of contracts:

A. An outsourcing agreement with a third party which reduces the level of expected directly attributable maintenance expenses
B. A lapse assumption based on the most recent industry study
C. A mortality assumption based on a blend of the Company's internal data and the most recent industry study
D. A mortality improvement assumption based entirely on the Company's own internal methodology

Justify your response.

Commentary on Question:
This part of the question tested candidates' understanding of fair value of insurance contracts. Candidates confused fair value with considerations in assumption setting for new product development, and therefore, did not demonstrate adequate knowledge on this question.

Expense synergy

- This arrangement is unique to the Company
- This should be adjusted to reflect the full level of expenses

Lapse assumption

- This is based on the industry experience
- No need to adjust

Mortality assumption

- Most companies will use a blend of industry and internal data
- Left to the judgement of the Company

Mortality Improvement

- Not reflective of market participant
- This should be adjusted to reflect a more current market view

9. Continued

(c) **(LO 1b)**You are provided with the following cash flow information for a group of contracts at the transition date (time period 0):

Time period	**0**	**1**	**2**	**3**	**4**	**5**
Best estimate cash flows		1,000	1,000	1,000	1,000	1,000
Risk adjustment		25	25	25	25	25
Non-Directly Attributable Expenses		50	50	50	50	50
Target Capital	1,500	1,000	800	600	300	0

You are given:

- IFRS 17 discount rate = 5%
- Hurdle rate = 10%
- Earned Rate on Surplus = 4%
- Tax rate = 25%
- Own Credit Risk = 0%

Determine the CSM at the transition date. Show all work.

Commentary on Question:
Candidates generally correctly calculated BEL, RA, FCF, and Cost of Capital rate. Common errors included not applying the appropriate rate for the present value calculation. Few candidates demonstrated sufficient understanding of adjusted FCF, profit margin, FV, and CSM calculation. Some candidates demonstrated knowledge of the CSM methodology but did not complete the calculations correctly.

At the transition date:
Best Estimate Liabilities (BEL) = PV (Best estimate cash flows @ IFRS 17 discount rate) = $4,329.48
Risk Adjustment (RA) = PV (Risk adjustment @ IFRS 17 discount rate) = $108.24
Non-Directly Attributable Expenses = PV (Non-Directly Attributable Expenses @ IFRS 17 discount rate) = $216.47
Adjusted fulfilment cash flows = BEL + RA + Non-Directly Attributable Expenses = $4,654.19

Cost of Capital rate = Hurdle rate – Earned Rate on Surplus × (1 – Tax rate) = 10% - 4% × (1 – 25%) = 7%
Cost of Capital = Cost of Capital rate * PV(Target Capital @ hurdle rate) = $260.82

9. Continued

Profit Margin = Cost of Capital – PV (Risk adjustment @ hurdle rate) = $260.82 – $94.77 = $166.05

Fair Value (FV) = Adjusted fulfilment cash flows + Profit margin = $4,820.23
Fulfilment Cash Flows (FCF) = BEL + RA = $4,437.71
CSM = FV – FCF = $382.52

Fall 2023 LFMC Exam

3. Fall 2023 LFMC Exam (LO 4d)

Learning Objectives:
4. The candidate will understand value creation and inforce management techniques for life and annuity products.

Learning Outcomes:
(4d) Understand corporate taxation, policyholder taxation and calculate investment income tax.

Sources:
Canadian Insurance Taxation, 4th Ed, 2015, Chapter 4,5 and 9

Commentary on Question:
This question tested the candidates' knowledge on Canadian insurance taxation. Candidates generally did well on this question.

Solution:
(a) **(NO LONGER RELEVANT)**

~~(i) List the requirements for an annuity to be recognized as a prescribed annuity.~~

~~(ii) Describe the differences in the tax treatment between prescribed and non-prescribed annuities.~~

~~**Commentary on Question**:~~
~~*Most candidates listed some of the requirements and obtained at least partial credit.*~~

~~(i) The first category of prescribed annuities is RRSPs, RPPs and similar annuities. Payments received from these plans are fully subject to tax with no tax-free capital portion.~~

~~To qualify as a prescribed annuity contract (PAC) under the second category:~~

- ~~be an annuity certain or a life annuity~~
- ~~have a payout period~~
- ~~have been issued by a financial institution or other prescribed entity~~
- ~~have equal annuity payments at regular intervals, not less frequent than yearly~~
- ~~the annuitant must be the owner & deal with issuer at arms length~~
- ~~the annuitant must be an individual, specified trust, or qualified disability trust~~
- ~~no loans permitted under the contract~~

3. Continued

(ii) The differences between the tax treatment of prescribed and non-prescribed annuities include:

- Prescribed annuities are more commonly taxed under the proportional method, with lower taxes in early stages
- Non-prescribed annuities can be taxed under the accrual or proportional methods, depending on when the contract was issued.
- For level payment products, the differences between accrual and proportional methods is less significant
- Under accrual taxation (for non-prescribed), interest on purchase money borrowed is tax-deductible

(b) **(NO LONGER RELEVANT)**

A policyholder purchases a payout annuity for 10,000. You are given the following information as of the first anniversary:

Accumulating fund	Payment during the year	Mortality gain
9,700	1,000	200

Calculate the taxable income to the policyholder assuming the policyholder survives to the end of the first year:

Commentary on Question:

Candidates generally did well on this part of the question. Partial credit was received if the formulas were provided but the calculations were not correct.

AF = 9700

ACB = 10,000 - 1,000 + 200 = 9,200

Taxable income = AF - ACB = 500

(c) **(NO LONGER RELEVANT)**

You are given the following for a 5-year prescribed annuity certain contract:

- Purchase price = 10,000
- Monthly income = 200

Calculate the policyholder's annual taxable income. Show all work.

Commentary on Question:

Most candidates calculated the taxable income correctly. Some candidates had difficulty calculating the non-taxable capital portion. A few candidates calculated the monthly taxable income instead of annual taxable income. Partial credit was received if the formulas were provided but the calculations were not correct.

3. Continued

~~Capital (non-taxable) portion~~
~~= annuity payment × (adjusted purchase price ÷ total expected payments)~~
~~= (12×200) × (10000 ÷ (60×200))~~
~~= 2000~~

~~Taxable income = total income less capital portion = (12×200)-2000 = 400~~

(d) **(LO 4d)** You are given the following information for a block of life insurance policies issued in 2020:

Maximum Tax Actuarial Reserves (MTAR)	
31-Dec-20	31-Dec-21
30,000	25,000

- Average interest rate on long term government of Canada bonds = 4.8%
- Investment income reported to policyholders during 2021 = 100

Calculate the amount of Investment Income Tax (IIT) payable for the 2021 taxation year. Show all work.

Commentary on Question:
Most candidates answered this question correctly, demonstrating how the net income is calculated. Common errors included using one of the reserves instead of the average reserve and not applying the 55% factor. Partial credit was received if the formulas were provided but the calculations were not correct.

Average reserves = (30,000 + 25,000) ÷ 2 = 27,500
IIT rate = 4.80%
Investment income = Average reserves x IIT rate x factor
= 27,500 × 4.80% × 55% = 726
Investment income reported amount = 100
Net income = Investment income – Investment income reported amount = 626
IIT Taxable payable = Net income × 0.15 = 93.9

4. Fall 2023 LFMC Exam (LO 1a, 1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
(1a). Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b). Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
The IFRS 17 Contractual Service Margin: A Life Insurance Perspective
OSFI B-3 Sound Reinsurance Practices and Procedures
IFRS 17 Insurance Contracts – IFRS Standards Effects Analysis, May 2017

Commentary on Question:
This question tested the candidates' knowledge of IFRS 17. Candidates generally did well on parts (a), (b) and (c) of the question. Most candidates demonstrated an understanding of CSM concept and contract boundary under IFRS17.

Solution:
(a) **(LO 1a, 1b)** Explain in general how profit is recognized over the duration of the contract for policies that are directly issued and profitable at issue.

At issue, there is no impact to P&L from writing profitable contracts. The profit is deferred via CSM.
Subsequently, experience relating to future service adjusts CSM and does not flow through P&L, unless the CSM is exhausted.
CSM is amortized into P&L according to coverage units over the lifetime of the group (unless the CSM is exhausted by other impacts). This CSM amortization flows into P&L.
Additionally, RA release and experience items related to current period are reported in P&L.

(b) **(LO 1a, 1b)** Recommend a contract boundary for Easy-Term. Justify your response.

The contract boundary can be set at the renewal point (after three years) as long as XYZ has the practical ability to adjust premiums based on the medical questionnaires.
If XYZ does not have the practical ability to adjust premiums based on a reassessment of mortality risk at renewal, then the contract boundary should be 6 years.

4. Continued

(c) **(LO 1b)** Determine the impact to profit or loss at initial recognition for each group. Show all work.

	Group A – New Business Issued in Year 1 following transition (values at initial recognition)	Group B – New Business Issued in Year 1 following transition (values at initial recognition)
PV of premiums	2,500	2,500
PV of benefits	1,000	1,200
PV of directly attributable maintenance expenses	450	450
PV of non-attributable maintenance expenses	50	50
Directly attributable acquisition expenses	510	510
Non-attributable acquisition expenses	35	35
Risk Adjustment	400	400
CSM at Initial Recognition (no floor)	=2500-1000-450-510-400 =140	=2500-1200-450-510-400 =-60
CSM at Initial Recognition (cannot be less than zero)	140	0
Loss Component At Initial Recognition	0	60
P&L impact	0	-60

Group A:
CSM at initial recognition is positive.
No Impact on insurance service result at initial recognition since CSM defers profit.

Group B:
This group of contracts is loss-making (onerous). The CSM at initial recognition is not allowed to be negative; no CSM is established at initial recognition.
Loss component must be established at initial recognition; this loss must be recognized in the P&L (Insurance Service Result) immediately.

(d) **(LO 1b)** XYZ Insurance issues another group of life insurance contracts in 2024 with a loss of 100 on the date of issue. A reinsurance treaty covers these contracts from issue.

4. Continued

You are given the following information with respect to the reinsurance contract:

Proportion of loss covered	75%
PV of reinsurance premiums payable	800
PV of reinsurance claims recoverable	900
Risk Adjustment ceded	20

(i) Discuss the setting of assumptions used for the valuation of reinsurance contracts held and the underlying direct insurance contracts.

(ii) Calculate the impact of the reinsurance contract to the company.

(iii) Determine the impact to profitability to the group of contracts of the reinsurance contract held. Show all work.

Commentary on Question:
For part (i) candidates understood that the valuation of reinsurance contracts held and the underlying direct insurance contract are separate, but did not discuss the assumption setting.
Candidates generally did not do well on parts (ii) and (iii). Few candidates were able to calculate the correct treaty CSM and the correct loss recovery component.

i)
Assumptions should be consistent but not necessarily identical.
Differences need to be justified.
Applies to assumptions at initial recognition and subsequent measurement.
Mortality assumptions: Assumptions could be identical but reinsurance assumptions would be adjusted for non-performance risk of reinsurer
Discount rates: Locked in rates could be different based on effective date of treaty even if methodology is identical.
ii)
No Zero Floor applied (CSM's can be positive or negative)
Treaty = - (800 - 900 - 20) = 120 gain
iii)
Loss component for direct issued contracts is 100 (given in stem of part (d))
Impact can be determined based on percentage of claims reinsured since reinsurance is proportional
Loss recovery component from 120 * 75% = 90
Reduces loss to 100 - 90 = 10

4. Continued

(e) **(LO 1a, 1b)** Critique the following statements with respect to XYZ Insurance's reinsurance policies.

A. The Assistant Vice President of Reinsurance oversees XYZ Insurance's reinsurance risk management policy. The reinsurance risk management policy specifies which XYZ Insurance products can be reinsured and the ceding limits.

B. Reinsurers are chosen based on the reinsurer's published capital ratio and external ratings.

C. All reinsurance contracts are required to be fully executed by all parties prior to the effective date of the contract.

Commentary on Question:
To receive full credit candidates had to justify their critiques.

A)
OSFI expects senior management to oversee the development and implementation of the RRMP. At a minimum, senior management should review the RRMP annually.
It's appropriate for the AVP to handle day-to-day responsibilities, but senior management must provide oversight, ensure the RRMP is operationalized by providing sufficient resources, and ensure that there are adequate controls to monitor both compliance with and effectiveness of the RRMP.

B)
This is not appropriate. FRIs should not rely solely on external ratings but are required to perform their own due diligence.
Need to consider more than published capital ratios. Other factors that should be considered include claims payment records, funding sources and access to capital, management, retrocession, etc.
OSFI expects a high level of due diligence and evaluation of counterparties should be updated throughout the life of the reinsurance contract.

C)
While it is best practice to have reinsurance contracts fully executed prior to the effective date, OSFI recognizes that this is not always possible.
In order to mitigate the risk arising from not fully executing, company should:

- obtain contractually binding summary documents prior to the effective date of the reinsurance coverage;
- address, within the summary document, any material issues most likely to arise, including all variable or unique agreement terms;
- ensure that all final comprehensive reinsurance contracts, including any amendments thereto, bear the duly authorized signature of both the ceding company and the reinsurer.

6. Fall 2023 LFMC Exam (LO 1a, 1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies

Learning Outcomes:
(1a). Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b). Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, June 2022 (1a, 1b)

IFRS 17 Insurance Contracts Example (Spreadsheet Model) ((not on syllabus – although on GH 201C syllabus))

CIA Draft Explanatory Report: IFRS 17 Expenses, Apr 2021 (not on syllabus)

Commentary on Question:
This question tested the candidates' knowledge of IFRS17.

Solution:
(a) **(LO 1a, 1b)** Critique each of the following statements with respect to IFRS 17. Justify your response.

A. *The estimate of future cash flows must incorporate the full range of possible outcomes. Therefore, we need to develop stochastic models to estimate the value of each non-financial assumption.*

B. *Identifying onerous contracts will require individual testing of each contract.*

C. *All taxes paid by the company, such as premium taxes, Investment Income Taxes (IIT), and incomes taxes, should be included in the future cashflows.*

Commentary on Question:
Candidates generally did well on this part of the question. To receive full credit, the candidate must clearly state whether the statement is correct or incorrect, and provide appropriate justification.

6. Continued

A. While estimates of future cash flows under IFRS17 should be unbiased and represent a reasonable estimate of the mean of the cash flow distribution, scenarios are not required to be stochastically generated, and development of stochastic models is not expected for all IFRS17 reporting.

The guideline does not require that all possible (or even any) scenarios be explicitly constructed.

If the actuary expects that the cash flow distribution is materially skewed, then the mean of the probability-weighted cashflows should account for such skewness.

For offsetting tail risks, if there is an expectation of potentially significant offsetting exposures in the tails of the cash flow distribution (i.e., upside risk and downside risk from extreme scenarios), then this may not impact the expected value, but the risk adjustment may be higher than if there were no exposure to extreme scenarios

B. The guideline allows an entity to identify the group of onerous contracts by measuring a set of contracts rather than individual contracts.

The entity must have reasonable and supportable information to conclude that a set of contracts will all be in the same group.
If the entity does not have this reasonable and supportable information, then determination must be made at individual contract level.

C. IFRS17 excludes income taxes from estimates of future cashflows. Transaction based taxes such as premium taxes that arise directly from insurance contracts are included in future cashflows.

IIT is a Canadian-specific consideration. IIT is directly related to insurance contracts and would be included in the estimates of future cashflows, based on the following considerations:

IIT is not considered an Income tax per IAS 12 Income Taxes
While IIT is the entity's obligation, it is intended to tax the build-up of investment income within life ins contract, and it arises directly from existing insurance contracts.

6. Continued

(b) **(LO 1a, 1b)** Assess how each of the following expenses would be treated under IFRS 17, including any areas of judgement. Justify your response.

(i) Business expenses for developing a new universal life product that was never launched.

(ii) Acquisition costs incurred by a company from engaging external auditors and lawyers for acquiring a block of in-force segregated fund policies from another company.

(iii) Costs from a risk and control peer review of ALM processes.

(iv) An advertising campaign aimed at increasing brand awareness.

Commentary on Question:
Candidates generally did well on this part of the question. Expenses described in parts (i) and (ii) required candidates to clearly state the specific treatment to receive full credit. Expenses described in parts (iii) and (iv) are grey areas (could be either attributable or not). Full credit was received for either assessment as long as the appropriate justification was provided.

(i). These expenses are incurred with the main purpose being issuing of new insurance contracts. However, since they don't ultimately sell the business, there are no insurance contracts actually issued to attribute the expenses to.

These would be product development cash flows that cannot be directly attributed to a block of business.

(ii). The incurred expenses arise as a direct result of acquiring new business. These costs are required by XYZ to administer the business, as without the costs they would not own the block.

Therefore, these costs are directly attributable.

(iii). This is outlined in the source as a grey area and could be either attributable or non-attributable. Reasoning:

Non-attributable: These costs are not related to the issuance of contracts (two-steps removed)

Attributable: XYZ could not fulfill their obligations of the contracts without these costs, so should be attributable.

6. Continued

(iv). Similar grey area as iii) (listed as "generic marketing" in the source)

Non-attributable: The campaign's purpose is brand-awareness, which does not have a direct influence on a particular product to allocate the expenses to.

Attributable: Without brand awareness, XYZ might not sell any policies. These costs, while being one-step removed from actual sales, are required to grow the business, and should be allocated accordingly.

(c) **(NO LONGER RELEVANT)** ~~You are given insurance cash flow projections in the Excel spreadsheet.~~

~~Assume the following:~~

- ~~The contractual service margin and acquisition expenses are amortized linearly over the 5-year duration of the contract~~
- ~~The risk adjustment is 10% of expected future claims~~
- ~~The locked-in discount rate is 5%~~
- ~~All expenses in the table are attributable.~~
- ~~Claims and maintenance expenses occur at the end of the year. Premiums and acquisition expenses occur at the beginning of the year.~~
- ~~Actual claims are 110% of expected in year 1; no change to expected claim cash flows after year 1.~~
- ~~Actual maintenance expenses are 95% of expected in year 1; no change to expected maintenance expense cash flows after year 1.~~
- ~~Actual investment yields in year 1 are 6%~~
- ~~Income tax rate is 0%~~

~~Calculate the profit or loss in year 1 under IFRS 17. Show your work.~~

~~**Commentary on Question**:~~
~~*In general, candidates calculated the initial CSM correctly. Partial credit was received for demonstrating knowledge that the key components of the P&L are Insurance Service Result and Net Financial Result, and Insurance Service Result is Insurance Revenue net Insurance Service Expense. Common mistakes include:*~~
~~*1) Interest rate accrued on CSM is overlooked in CSM amortization;*~~
~~*2) Insurance Financial Expense is not deducted from Financial Gain/Loss;*~~
~~*3) Accretion of interest is overlooked in Acquisition Expense Amortization.*~~

~~*The excel workbook provided has more detailed calculations as well as an alternative solution.*~~

6. Continued

Expected Cashflows (Initial Recognition)

time	0	1	2	3	4	5
Premiums		295,000	280,191	266,125	252,753	240,052
Acquisition Expenses Attributable		(250,000)				
Maintenance Expense Attributable		(41,000)	(47,490)	(45,106)	(42,839)	(40,687)
Claims		(60,000)	(56,988)	(67,659)	(64,259)	(73,236)
Total Net CFs		(56,000)	175,713	153,360	145,654	126,129

Actual Cashflows

time	0	1
Premiums		295,000
Acquisition Expenses Attributable		(250,000)
Maintenance Expense Attributable		(38,950) = (41,000) × 0.95
Claims		(66,000) = (60,000) × 1.1
Total Net CFs		(59,950) = Premiums Acquisition Expanses Maintenance Expense Attribuable Claims

Expected Risk Adjustment CFs (Initial Recognition)

	0	1	2	3	4	5
Claims = Risk Adjustment (10%) × Expected Claims		(6,000)	(5,699)	(6,766)	(6,426)	(7,324)

Liability on Initial Recognition

PV of Premiums	1,219,061 = NPV (Locked in Rate, Premium CFs)
PV of Maintenance Expense Attributable	(188,210) = NPV (Locked in Rate, Maintenance Expense Attributable CFs)
PV of Claims	(277,528) = NPV (Locked in Rate, Claims CFs)
PV of Attributable Acquisition CFs	(250,000)
PV of Risk Adjustment CFs	(27,753) = NPV (Locked in Rate, Expected RA CFs)
Total	
CSM at Initial Recognition	475,570
Best estimate liabilities (BEL)	(503,324)

CSM Roll forward

Opening	0
Changes related to Future Services: NB	475,570
Changes related to Future Services: Assumptions	0
Expected Cash Inflows	0
Expected Cash Outflows	0
Insurance Finance Expense = Locked in Rate × (Opening + Changes related to Future Services: NB)	23,779
Changes Related to Current Services: Experience	0
Changes Related to Current Services: Release = - 20% × all above items	(99,870)
Closing = sum of all above items	399,479

6. Continued

Profit and Loss Statement (year 1)	
CSM release	99,870
RA release	6,000
Expected claims release	60,000
Expected maintenance expense release	41,000
Amortization of deferred acquisition expense	50,000
Insurance Revenue	**256,870**

Actual claims incurred	(66,000)
Actual maintenance expense incurred	(38,950)
Amortization of deferred acquisition expense	(50,000)
Insurance Service Expense	**(154,950)**

Insurance Service Result = Insurance Revenue + Insurance Service Expense
= 256,870-154,950
= 101,920
Investment Income = Investment Yield Rate × (Premium - Maintenance Expense Attributable)
= 6% × (295,000-25,000)
= 2,700

BEL Interest accretion	= Locked-in Rate × (Premiums - Acquisition expense - BEL) = 5% × (295,000-250,000-503,324) = 22,916
RA Interest accretion	= Locked-in Rate × (RA) = 5% × (27,753) = (1,388)
CSM Interest accretion	= Locked-in Rate × (CSM) = 5% × (475,571) = (23,779)
Insurance Finance Expense	**= (2,250)**

Net financial result = Investment Income + Insurance Finance Expense = 2,700-2,250 = 450

Net income (before tax & OCI) = Insurance Service Result + Net Financial result
= 101,920 + 450
= 102,370

8. Fall 2023 LFMC Exam (LO 2a, 3c)

Learning Objectives:

(a) The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

(c) The candidate will understand various approaches to manage and evaluate life insurance risks.

Learning Outcomes:

(2a) Explain and calculate regulatory capital using various international frameworks

(3c) Explain and understand the use and application of the Own Risk Solvency Assessment (ORSA) report

Sources:

OSFI: Own Risk and Solvency Assessment (E-19), December 2017 (3c)

ILA201-604-25: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1-6 (excluding Sections 4.2-4.4) (2a)

OSFI Guideline A-4 Internal Target Capital Ratio for Insurance Companies, December 2017 (2a)

Commentary on Question:

This question tested the candidates' knowledge of the methods, approaches and tools of financial management.

Solution:

(a) **(LO 2a)** Critique each of the following approaches for setting an internal capital target:

A. *Set the target at a fixed percentage of the OSFI core ratio supervisory target capital requirement*

B. *Set the target to the average of its three biggest competitors' ratios*

C. *Set the target considering expected new business*

D. *Set the target to 140% of the LICAT total ratio.*

Commentary on Question:

Candidates generally did well on this part of the question and were able to critique each approach while providing rationale. Most candidates were able to critique whether the approach is correct/incorrect and provide rationale of supporting such. To receive full credit, candidates must provide rationale to support their assessment of whether an approach is correct or incorrect.

A. Internal Targets should be based on an insurer's assessment of its own capital needs. For example, Internal Targets should normally not be determined by simply adding a margin on the Supervisory Targets.
B. Once an insurer has determined its own capital needs, these initial results should be assessed to determine if they are appropriate in relation to external or third-party capital expectations, including OSFI's expectation that Internal Targets exceed Supervisory Targets. In setting Internal Targets, an insurer should assess the adequacy of its Capital Resources for supporting its current risk profile and enabling it to continue its current operations in the normal course, under varying degrees of stress and under a wind-up scenario.
C. The assessment of adequacy of capital should consider the capital needed to support an insurer's longer term business strategies and new business and planned growth.
D. While 140% could be a possible target, it should be based on scenarios while assessing its own capital needs. Also, life insurers are expected to also determine an Internal Target of core capital

(b) **(LO 2a)** You are provided with the following mortality capital components:

	Life	Annuity
Level	100	50
Trend	75	40
Volatility	25	10
Catastrophe	10	5

Assume that the life block is life supported and the annuity block is death supported.

Calculate the LICAT total mortality buffer for the combined blocks.
Show all work.

Commentary on Question:
Most candidates were able to demonstrate their understanding of the LICAT mortality capital calculation by determining the mortality capital for the life block and annuity block separately; and received partial credit. However, many candidates were not able to determine and calculate the aggregate capital, diversification credit and final mortality buffer for the combined block.

RC mort = Sqrt (RC vol ^ 2 + RC cat ^2) + RC level + RC trend
RC aggregate = Sqrt (RCL life ^ 2 + RCL death ^ 2 - 1.5 × RCL life × RCL death)
Diversification credit = RCL life + RCL death - RC aggregate

Mortality BSB = RC mort for life + RC mort for annuity - diversification credit

8. Continued

RC mort for life = sqrt (25^2 + 10 ^2) + 100 +75
RC mort for life = 201.93

RC mort for annuity = sqrt (10^2 + 5 ^2) + 50 +40
RC mort for annuity = 101.18

RC aggregate = sqrt ((100+75)^2 + (50 + 40)^2 -1.5 × (100+75) + (50+40))
RC aggregate = 122.88

Diversification credit = (100+75) + (50+40) - RC aggregate
diversification credit = 142.12

Mortality Buffer for the combined block = 160.99

(c) **(LO 2a, 3c)** ABC Life is considering reinsuring a block of business with an unregistered reinsurer. Assume that the ceded liabilities are positive.

(i) Describe the impact of using an unregistered reinsurer on ABC Life's total LICAT capital ratio as compared to using a registered reinsurer.

(ii) Identify the available options to limit any adverse capital impacts from using unregistered reinsurance.

Commentary on Question:
Candidates generally did not do well on part (i). Most candidates did not demonstrate their understanding of the differences between registered reinsurance and unregistered reinsurance, and the capital implications of using either. Candidates must explain the impacts on required capital and available capital when using an unregistered reinsurance (vs. a registered reinsurance) to receive full credit. For part (ii) most candidates were able to identify the options to limit adverse capital impacts from using unregistered reinsurance and received full credit by identifying them.

(i) ABC will lose their capital credits for registered reinsurance, resulting in an increase in required capital.

ABC will have to adjust their available capital to account for ceded liabilities arising from unregistered reinsurance, resulting in a reduction of available capital.

(ii) Available options include:

- Obtaining a letter of credit. A letter of credit must be issued by or have a separate confirming letter from a Canadian Bank. Capital credit for letter of credit is limited to 30% of the gross requirement for aggregate positive liabilities ceded to unregistered reinsurers

plus 30% of the gross requirement for offsetting liabilities ceded to unregistered reinsurers.

- Obtaining collateral. Collateral assets must be held in Canada, be owned by the unregistered reinsurer, be held to secure payments, and be freely transferrable.

Spring 2024 LFMC Exam

2. Spring 2024 LFMC Exam (LO 1a, 1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
(1a). Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b). Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts, Jun 2022

Commentary on Question:
This question tested the candidates' understanding of IFRS 17 discount rates for life and health insurance contracts.

Solution:
(a) **(LO 1a, 1b)** Evaluate the impact of each of the following changes to the product features of an annual renewable term (ART) product with respect to liquidity characteristics:

(i) Replace the ART premium structure with a level premium structure

(ii) Add a term conversion option

(iii) Add a waiver of premium benefit

(iv) Add a return of premium rider that refunds 100% of the last three years of premiums upon termination

Commentary on Question:
Candidates generally did well on this part of the question. To receive full credit, candidates had to identify what the change will do to the exit costs, the inherent value and the liquidity characteristics of the insurance contract. Many candidates provided accurate comments on how liquidity would change but did not consistently explain the cause by describing changes to exit costs.

2. Continued

(i) A level premium structure and guaranteed premium feature would build up the contract's inherent value. This would decrease the liquidity characteristics of the contract

(ii) The conversion option and removal of underwriting requirements would build up the contract's inherent value. This would decrease the liquidity characteristics of the contract

(iii) The inclusion of the waiver of premium would build up the contract's inherent value. This would decrease the liquidity characteristics of the contract

(iv) Inclusion of return of premium would create an exit value and increase liquidity characteristic of the policy

(b) **(LO 1a, 1b)** A company's liabilities are backed by a portfolio of 50% Government of Canada bonds and 50% corporate A bonds. You are given the following information:

Yield on Government of Canada Bond	5.00%
Corporate A spread	0.40%
Mortgage-backed securities spread	0.70%
Yield on credit default swaps	5.40%
Average market risk premium for equities and real estate	0.50%
Yield on mortgage-backed securities insured by Canada Mortgage and Housing Corporation	5.30%
Yield on mortgage-backed securities not insured by Canada Mortgage and Housing Corporation	6.00%

Calculate the discount rate under the following approaches. Show all work.

(i) Top-down approach

(ii) Hybrid approach

Commentary on Question:
Candidates generally did not do well on this part of question. Many candidates understood the correct general formulas to calculate the discount rate under top-down approach, but many candidates calculated the market risk premium and credit premium incorrectly. Many candidates applied incorrect formulas to calculate the discount rate under the Hybrid approach.

2. Continued

(i) Top-down approach

Discount Rate = Reference Portfolio Yield - Credit Risk Premium - Market Risk Premium

Use own asset as Reference Portfolio (no other options based on available information)

Reference Portfolio yield =50% *(Yield on Government of Canada Bond) + 50% *(Yield on Government of Canada Bond + Corporate A spread) = 50% * 5.00% + 50% * (5.00% + 0.40%) = 5.20%

Market risk premium=0.00%

Liquidity premium = Yield on mortgage-backed securities less risk-free-rate = 5.30%-5.00%= 0.30%

Total spread = Corporate A spread = 0.40%

Credit premium = Total spread - Liquidity premium = 0.40% -0.30%= 0.10%

Discount rate = 5.20% - 0.10% -0.00% = 5.10%

(ii) Hybrid approach

Yield on Government of Canada Bond= 5.00%

Liquidity premium = 0.30%

Discount rate = Risk free + liquidity premium = 5.00% + 0.30% = 5.30%

(c) **(LO 1a, 1b)**

(i) Explain why an ultimate risk-free rate is needed.

(ii) Describe the key principles and desirable characteristics when setting the ultimate risk-free rate.

Commentary on Question:

Candidates did well in part (i). but had difficulty with part (ii).

(i) Duration of cash flows will extend beyond observable period.

Risk free rates are only observable up to about 30 years.

Beyond that point, actuary needs to develop an ultimate risk-free rate. (URFR)

Actuary would interpolate from last observable point to URFR

(ii) Key Principles:

- Maximize use of observable inputs
- Reflect current market conditions from the perspective of a marker participant
- Use best information available to develop unobservable inputs
- Place more weight on long term estimates than short-term fluctuations

2. Continued

Characteristics:

- Stability: URFR should have less variability than short term rates
- Smoothness: Interpolation from the observable point to URFR should be smooth
- Simplicity: easy to understand, implement and forecast

3. Spring 2024 LFMC Exam (LO 1a, 1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
(1a). Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b). Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
LFM-658-23: Risk Adjustments For Insurance Contracts Under IFRS 17, Chapter 2

ILA201-600-25: International Actuarial Note 100: Application of IFRS 17 (Ch. 1, section A – Introduction to GMM only, Ch. 5, 7-9 & 16)

CIA Educational Note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts, Jun 2022

Commentary on Question:
This question tested the candidates' knowledge on IFRS 17. Candidates generally did well in part a, as they were able to provide explanation and justifications on the statements. Many candidates had difficulty with the calculation for part b.

Solution:
(a) **(LO 1a, 1b)** Critique the following statements with respect to IFRS 17:

A. *All liability cash flows should be discounted at a rate that reflects the variability of cash flows.*

B. *The risk adjustment reflects impacts of aggregation and therefore may reduce liability cash flows after accounting for diversification benefits.*

C. *Insurance profits under IFRS 17 are calculated and earned at initial recognition.*

D. *When the underlying contract uses the variable fee approach (VFA), the associated reinsurance contracts held must also use the VFA to avoid measurement mismatches.*

3. Continued

E. The premium allocation approach is a simplified alternative to the general measurement model and can only be used for contracts with coverage periods 12 months or less.

Commentary on Question:
Candidates generally did well on this part of the question.

A. Cashflows that do not vary should be discounted at rates that do not reflect variability.

Cashflows that do vary based on returns on the any financial underlying items, should be discounted at :

1) Discount rates that reflect the variability
2) Or cashflows should be adjusted for the effect of the variability and discounted at a rate that reflects the adjustment made

Nominal cashflows are to be discounted at rates that include the effect of inflation. Real cashflows are to be discounted at rates that exclude the effect of inflation.

B. The Risk Adjustment (RA) only adjusts valuation of liabilities where the adjustment is positive, otherwise the risk adjustment would be zero. So the RA would never reduce liability cash flows. Aggregation does impact the RA. Diversification does impact RA.

C. Expected profits are calculated at initial recognition. Expected profits are calculated at initial recognition. Positive profits are earned over time (not at initial recognition). If profits are negative, the loss is recognized immediately.

D. Underlying contracts may use the Variable Fee approach, while associated reinsurance held contracts are not eligible to use the Variable Fee approach. This can create measurement mismatches due to significant differences in treatment of investment related impacts.

An area of possible economic mismatch: For reinsurance contracts held, the contract boundary definition means that the measurement of reinsurance contracts held will typically extend to include cash flows associated with future projected cessions up to the point at which the reinsurance contract can be exited for new business. The valuation of underlying insurance contracts will not include any cash flows related to these future projected cessions, since the underlying insurance contracts are only valued as written. This creates a mismatch in terms of timing of recognition of cessions versus underlying contracts.

3. Continued

An area of possible economic mismatch: For underlying contracts, losses are recognised at inception when contracts are onerous at inception, whereas any offsetting net gain on related reinsurance contracts held will be reflected in the CSM and recognised over the lifetime of the reinsurance contract held. This can create a mismatch in terms of timing of profit and loss on contracts that may be economically linked (e.g., pricing of underlying contracts frequently reflects impact of associated reinsurance, particularly for proportionate coverages).

E. The described main approach of IFRS 17 is referred to as General Measurement Approach (GMA). IFRS17 allows for a simplified alternative approach to be used for contracts of short coverage period (typically not more than 12 months), known as the Premium Allocation Approach (PAA). The PAA is similar to the unearned premium method in that the measurement of the liability for remaining coverage of short duration contracts might be simplified by distributing premiums over the coverage period in line with passage of time or in proportion to expected benefits. The PAA only applies to the part of the total measurement of the contract referred to as liability for remaining coverage, with the liability of incurred claims following the GMA.

(b) **(LO 1a, 1b)** You are given the following about DJS, a Canadian life insurance company:

- DJS uses the cost-of-capital approach to determine its risk adjustment
- There are two product lines: life insurance and life annuities.
- The risk adjustment is calculated from annual cash flows.

Target rate of return on capital for life business	6%
Target rate of return on capital for annuity business	10%
Discount rate	5%

- Required capital for both life insurance and annuities is given on a quarterly basis over four years in the Excel spreadsheet.

(i) Calculate the risk adjustment for DJS.

(ii) Describe the disadvantages of using the cost-of-capital approach for determining the risk adjustment.

(iii) Explain why the target return on capital may be different for life insurance and annuity contracts.

3. Continued

Commentary on Question:
Candidates generally had difficulty with this part of the question. Many candidates did not reflect the weighted average cost of capital and did not properly reflect discount rates.

Part (i)
The solution to this part of the question is in Excel.

Part (ii)
Required Capital for a Canadian insurer is LICAT. LICAT uses a total asset requirement, which may increase complexity in the calculation of Ct. Ct may rely on the Risk Adjustment, which it's trying to calculate.

Part (iii)
Risk aversion = Risk aversion can be described as the preference to avoid or mitigate the impact of unfavourable outcomes as compared to favourable outcomes.
Risk appetite = Risk appetite can be described as the decision-making preferences for taking risk to achieve a return.
Risk tolerance = Risk tolerance considers the measure of unfavourable results and the probabilistic measure of risk.
Level of Risk aversion could be different for the two products in question.

4. Spring 2024 LFMC Exam (LO 4d)

Learning Objectives:
3. The candidate will understand value creation and inforce management techniques for life and annuity products.

Learning Outcomes:
(4d) Understand corporate taxation, policyholder taxation and calculate investment income tax

Sources:
Canadian Insurance Taxation, Swales, et. al., 4th Edition, 2015
• Ch. 4: Income for Tax Purposes – General Rules
• Ch. 5: Investment Income

Commentary on Question:
This questions tested the candidates' understanding of Canadian taxation applicable to life insurance companies and products.

Solution:

(a) **(LO 4d)** Critique the following statements:

A. Any business income earned by a non-resident insurer in Canada will always be treated as taxable income in Canada.

B. A Canadian resident insurance company is subject to income tax on all worldwide income.

Commentary on Question:
To receive full credit, the candidates must clearly state whether the statement is correct or incorrect, and provide appropriate justification. Candidates generally did better critiquing statement A. A common mistake for candidates with statement B was stating that a Canadian resident insurance company is only subject to income tax on earnings in Canada.

Statement A: This statement is partially true.
The business income of a non-resident insurer in Canada will be taxable if the following conditions satisfied:

1. The non-resident insurer is carrying-on business in Canada.
2. Either a tax-treaty between Canada and the non-resident insurer's home country does not apply or the non-resident insurer has a permanent establishment in Canada.

Statement B: This statement is partially true.

A Canadian insurer is subject to income tax on all insurance business earned in Canada as well as subject to income tax on all non-insurance business earned worldwide.

(b) **(LO 4d)** A Canadian resident life insurer only does business in Canada and acquired a property on July 1, 2023.

You are given:

Cost of the property	10,000
Expenditures during the year	1,500
Income earned during the year	50
Average annual rate of interest	5%

Calculate the imputed cost for income tax reporting in 2023. Show all work.

Commentary on Question:
*Most candidates were able to come up with the general formula as the Imputed Cost for Income Tax = Net Cost during the year * Annual rate – Income earned during the year.*

However, many candidates could not correctly calculate all components in the formula. Common mistakes included:
1) Subtracting (instead of adding) the Expenditures from the Cost of the property when calculating the Net Cost during the year.
2) Including a full year of interest on the Net Cost even though the question indicated that the property was acquired on July 1, 2023.

Partial credit was received if candidates could identify (but not necessarily accurately calculate) the key components of the Imputed Cost for Income Tax.

A. Identify the interest rate to be used: i = 5%
B. Calculate the average net cost during the year (July 1 – Dec 31):

Net Cost = 10000 + 1500/2 = $10750

C. Calculate the number of days during the year from July 1 to Dec 31.

183/365 = 0.5014

D. Calculate the Gross Benefit = A × B × C = $10750 × 5% × 0.5014 = $269.49
E. Identify the Income derived during the period = $50
F. Calculate the final imputed cost for income tax = D – E = $269.49 - $50 = $219.49

(c) **(LO 4d)** Explain how an insurance company would classify and treat each of the following for taxable income reporting:

(i) A corporate bond with fixed semi-annual coupons that will be held to maturity.

(ii) A corporate bond with fixed semi-annual coupons held at fair value.

(iii) A share of a corporation where the insurer holds an immaterial interest.

(iv) Property acquired with the intent of generating rental income.

Commentary on Question:
This question requires candidates to not only identify the treatment of each listed taxable income but also provide proper explanation to the treatment. For example, simply stating that "this type of income is treated as Special Debt Obligation" is not sufficient to receive full credit. Candidates also need to provide some explanation that under SDO, the asset is held to maturity and its income will be carried at amortized cost, etc.

(i) Corporate bond with fixed semi-annual coupons held to maturity
Corporate bond will be treated as Specified Debt Obligation (SDO). Since the corporate bond will be held to maturity, it is considered SDO that is not marked to market. This asset is carried at amortized cost. Income from this asset (fixed semi-annual coupons) is determined using a level yield method.

(ii) Corporate bond with fixed semi-annual coupons held at fair value
Since the corporate bond is held at fair value, it is treated as SDO that is marked to markets. The value of this assets is determined on a fair value basis. All changes in the value will flow through income and be taxed immediately.

(iii) Share of a corporation where insurer holds an immaterial interest
Share where the insurer does not hold a material interest should be treated as marked to market. The value of the share is carried at fair value and any changes in the value of the share will flow through income and be taxed immediately.

(iv) Property acquired with the intent of generating rental income
Since the property was acquired with the intent of generating rental income, it will be treated as a capital property. Income will be determined on a realized basis, and only 50% of the capital gain will be subject to income tax.

5. Spring 2024 LFMC Exam (LO 2a)

Learning Objectives:
2. The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

Learning Outcomes:
(2a) Explain and calculate regulatory capital using various international frameworks

Sources:
Understanding IFRS 17: Solving for New Challenges, Fiera Capital, Oct 2021 (not on syllabus)

OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1–6 (excluding Sections 4.2–4.4)

Commentary on Question:
This question tested the candidates' knowledge of IFRS 17 and LICAT. In general, candidates did well on this question.

Solution:

(a) **(LO 2a)** Critique the following proposed actions.

A. *Moving a portion of the portfolio from provincial to investment grade corporate bonds will increase returns. ABC can still maintain the same asset liability matching policy so net income volatility will not be affected.*

B. *Acquiring private debt would decrease the IFRS 17 discount rates to reflect the illiquid nature of these assets, which would increase liabilities.*

C. *High yield bonds are highly correlated with other fixed income assets and would introduce additional interest rate sensitivity.*

D. *Acquiring preferred shares will increase yields in a low interest rate environment. However, in a rising and volatile interest rate environment, they do not offer any advantages over higher yielding bonds.*

E. *Changing the investment strategy will change the length of the observable period of the IFRS 17 discount rate due to changes in the asset portfolio duration.*

F. Moving a portion of the portfolio from provincial bonds to investment grade corporate bonds will have no impact on LICAT required capital if the assets and liabilities remain duration matched.

G. Establishing stable long-term assumptions for the ultimate period will decrease the liability duration and allow assets and liabilities to be duration matched without the need for derivatives.

Commentary on Question:
For this part of the question, candidates needed to provide appropriate justification to receive full credit. Most candidates were able to apply their knowledge of IFRS 17 and LICAT to assess the proposed actions with justification.

Statement A

- Use of corporate bonds will increase expected yield related to the additional credit exposure;
- Magnitude of credit spread changes tends to be larger in corporate bonds vs provincial bonds;
- Volatility of results will increase because IFRS 17 Liabilities are not affected by credit risk spreads (not included in discount rates).

Statement B

- Liquidity premium in IFRS 17 discount rates reflects liquidity characteristics of insurance contracts, not assets;
- IFRS 17 discount rates would not decrease due to use of private debt.

Statement C

- High yield bonds can be a good option to increase investment returns;
- High yield bonds have a low to negative correlation to other fixed income assets
- Liabilities with cash flows in the 10-20 year range are highly sensitive to interest rate changes;
- To minimize volatility high yield bonds should be used for liabilities that have low interest rate sensitivity. (cash flows at the short and long end of the curve)

Statement D

- Preferred shares are a higher yielding asset class offering a significant source of income in a low-yield environment;
- Portfolio diversification is an advantage - preferred shares have a negative correlation with traditional bonds; (preferred share price can rise in an increasing interest environment when bond price fall);
- Preferred shares can reduce volatility relative to other high yielding assets.

Statement E

- The general consensus in Canada is that the observable period is 30 years. This would not be affected by changes in asset strategy;
- Using long-term historical averages of nominal Government bonds is one approach to setting the ultimate rate. However, other approaches may also be appropriate.

Statement F

- While there would be no impact on interest rate risk, there would be impacts to market risk (asset risk) as corporate bonds would have a different factor than provincial bonds.

Statement G

- True. If the ultimate rate is stable, the liability duration is decreased because the discount rate would not change as much in response to change in interest rates, lowering the liability duration.

(b) **(NO LONGER RELEVANT)** ~~You are given:~~

~~ABC is evaluating 3 proposed investment portfolios:~~

	~~Current Portfolio~~		~~Proposed Portfolio 1~~		~~Proposed Portfolio 2~~		~~Proposed Portfolio 3~~	
~~Asset Class~~	~~Allocation~~	~~Expected Return~~	~~Allocation~~	~~Expected Return~~	~~Allocation~~	~~Expected Return~~	~~Allocation~~	~~Expected Return~~
~~Provincial bonds~~	~~100%~~	~~2.60%~~	~~60%~~	~~2.60%~~	~~30%~~	~~2.60%~~	~~20%~~	~~2.60%~~
~~Corporate bonds~~	~~0%~~	~~3.40%~~	~~40%~~	~~3.40%~~	~~50%~~	~~3.40%~~	~~30%~~	~~3.40%~~
~~High yield bonds~~	~~0%~~	~~4.30%~~	~~0%~~	~~4.30%~~	~~20%~~	~~4.30%~~	~~25%~~	~~4.30%~~
~~Private debt~~	~~0%~~	~~4.25%~~	~~0%~~	~~4.25%~~	~~0%~~	~~4.25%~~	~~25%~~	~~4.00%~~
~~Total~~	~~100%~~	~~2.60%~~	~~100%~~	~~2.92%~~	~~100%~~	~~3.34%~~	~~100%~~	~~3.62%~~
~~Standard deviation of asset returns~~	-	~~10.00%~~	-	~~10.80%~~	-	~~11.40%~~	-	~~11.80%~~

~~Recommend which one of the 3 proposed portfolios should be implemented by ABC. Justify your response.~~

~~**Commentary on Question**:~~
~~*To receive full credit on this part of the question candidates needed to calculate the return per unit of risk correctly, and to appropriately justify their recommendation. Candidates may make a different recommendation than the one in the model solution as long as adequate justification was provided. Most of the candidates gave the correct calculation of return per unit of risk and recommended portfolio 3 based on the calculation.*~~

~~Return per unit of risk = Portfolio Return / Standard Deviation of Returns~~

- ~~Current portfolio = 26.00~~
- ~~Proposed Portfolio 1 = 2.92% / 10.8% = 27.04~~

- Proposed Portfolio 2 = 3.34% / 11.4% = 29.30
- Proposed Portfolio 3 = 3.62% / 11.8% = 30.64

Proposed Portfolio 3 maximizes return per unit of risk

Recommendation

Recommend Portfolio 2; Return per unit of risk is significantly higher than portfolio 1.

Portfolio 3 has slightly higher return per unit of risk but other factors weigh in:

- Private debt has low volatility but is short duration. Suitable for portfolio where interest rate exposure is to be limited.
- Allocation to private debt in portfolio likely exceeds short-term liabilities - probably excessive for this liability portfolio. May be difficult to maintain duration matching with this allocation.
- Volatility of financial results for portfolio 3 may exceed volatility of returns captured in return per unit of risk measure due to asset liability mismatches and due to differences in asset returns and effect of discount rate changes on liabilities.

6. Spring 2024 LFMC Exam (LO 4e)

Learning Objectives:
4. The candidate will understand value creation and inforce management techniques for life and annuity products.

Learning Outcomes:
(4e) Describe and apply the methods and principles of embedded value for an insurance enterprise

Sources:
Embedded Value: Practice and Theory, SOA, Actuarial Practice Forum, March 2009
Will IFRS 17 replace EV, Milliman, Sep 2018 (not on syllabus)

LFM-106-07: Insurance Industry Mergers and Acquisitions, Chapter 4 (Sections 4.1-4.6) (not on syllabus)

Commentary on Question:
This question tested the candidates' understanding of insurance company issues, concerns and financial management tools.

Solution:

(a) **(LO 4e)** Describe the treatment for each of the following items under Market Consistent Embedded Value (MCEV), fulfilment value (IFRS 17) and fair value (IFRS 13) by completing the table below:

	Market Consistent Embedded Value	Fulfillment Value (IFRS17)	Fair Value (IFRS 13)
Future Renewal of In-force Business			
Future New Business			
Expense Assumption			
Profit Emergence			

6. Continued

Commentary on Question:
Candidates showed good understanding of the treatment for Future Renewal of IF business and Expense Assumption. Many candidates pointed out whether Future NB is included/excluded without providing more clarification, such as future NB is included to some extent in case of M&A, and thus partial marks were received. For Profit Emergence, only a few candidates were able to point out the variance from expected values which are recognized in subsequent period under MCEV.

	Market Consistent EV	**Fulfillment Value (IFRS17)**	**Fair Value (IFRS 13)**
Future Renewal of IF business	Included.	Excluded if out-of-boundary conditions such as fully repriceable are met.	Included.
Future NB	Excluded, but NBV in past year is separately calculated.	Excluded, but change of elements due to new business acquisition in the reporting period is disclosed.	In the case of M&A, future new business value is included to some extent (based on ability to acquire NB.)
Expense Assumption	All overhead included.	Only directly attributable expenses are included.	All overhead is included, economic efficiency of 3rd party reflected.
Profit Emergence	Recognized when NB is acquired. Variance from expected values are recognized in subsequent periods.	Profits due to NB acquisition are deferred as CSM, and recognized over insurance period. If losses are expected, they are recognized immediately.	n/a

(b) **(LO 4e)** Using the financial information for the block of business given in the Excel spreadsheet:

(i) Calculate the actuarial appraisal value. Show all work.

(ii) Calculate embedded value. Show all work.

Commentary on Question:
Few candidates received full credit for this part of the question. Many candidates knew that the difference between AAV and EV. Some candidates were not able to use the data provided in the questions correctly. Partial marks were received for the calculations.

Calculations are provided in the Excel spreadsheet.

PV of DCF = PV of After-tax earnings minus Increase in Required Capital
DCF = premium + investment income – benefits – expenses – commissions – increase in statutory reserves – taxes – increase in required capital

(i)

PV of DCF = Appraisal value = 101.15

(ii)

PV of DCF = NB = 23.17

EV = Appraisal value – NB = 77.98

(c) **(NO LONGER RELEVANT)** ~~Critique the decision to set the bid price for this block of business at the actuarial appraisal value.~~

~~**Commentary on Question**:~~
~~*Candidates generally recognized that AAV is not the most appropriate for bid price. Many candidates provide 1 or 2 adjustments outside the scope of AAV. Full marks received if 3 or more adjustments were provided.*~~

~~The total value for a company will reflect adjustments for items outside the scope of the appraisal that increase or reduce value such as:~~

- ~~Value associated with branding or market position~~
- ~~A buyer's synergies~~
- ~~Or general market conditions~~

~~Therefore, AAV is not the most appropriate for bid price, as it does not reflect these important items.~~

7. Spring 2024 LFMC Exam (LO 1a, 1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
(1a). Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b). Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, Jun 2022

CIA Educational Note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts, Jun 2022

CIA Educational Note: IFRS 17 Market Consistent Valuation of Financial Guarantees for Life and Health Insurance Contracts, Jun 2022

Commentary on Question:
This question tested the candidates' knowledge of IFRS17

Solution:

(a) **(LO 1a, 1b)** Critique the following statements with respect to IFRS 17. Justify your response.

A. For products with asymmetrical cash flows, the risk adjustment should include a provision to account for this risk.

B. Cash flows that are assumed to vary with assumptions related to financial risk should be projected using returns on assets backing the cash flows.

C. Insurance contracts have the same contractual service margin (CSM) at initial recognition when measured with either the variable fee approach or the general measurement model. The CSM will be different in subsequent periods under the two approaches.

D. The ceded risk adjustment will always be proportional to the direct risk adjustment.

Commentary on Question:

For statement A, most candidates correctly identified that risk adjustment is for non-financial risks only; however, most candidates did not identify that the asymmetry of cashflows should not be part of risk adjustments.

For statement B, most candidates did not identify that returns on assets backing the cashflows should not be used under IFRS 17.

Most candidates correctly critiqued statement C.

Most candidates did not correctly critique statement D. Most candidates mentioned some high-level differences such as risk of non-performance or accounting mismatches without adequately explaining how it would affect the proportionality of the reinsurance.

A. Incorrect.

Under IFRS 17, it would be included in the estimate of future fulfillment cash flows rather than the risk adjustment under IFRS 17. Risk adjustment is for non-financial risks under IFRS 17. The actuary should also determine if the adjustment due to asymmetry of the cashflows is material or not.

B. Incorrect.

These cash flows would be projected consistent with observable market prices under IFRS 17 and reported as part of the estimates of future cash flows.
Possible approaches include deterministic projection with implied market rates, or stochastic modelling under either a risk-neutral or real world with deflators framework.
IFRS 17 does not prescribe the methodology to value the cost of options and guarantees. judgement is required to determine the technique that best meets the objective of consistency with observable market variables in specific circumstances.

C. Correct.

Subsequent measurement differs under the two approaches: GMM recognizes the interest accretion on the CSM measured using locked-in rates. VFA adjusts the CSM for changes in the entity's share of fair value, which implicitly reflects interest accretion, and is measured using current rates.

D. Partially correct.

Where the price of reinsurance is proportional to the level of risk being ceded from the direct entity's perspective, the ceded RA would be proportional to the direct RA, and the direct RA would be unaffected by the presence of reinsurance unless the reinsurance affects the level of compensation required on the direct contract.
When the price of reinsurance is not proportional to the level of risk being ceded from the direct entity's perspective, then the ceded RA may not be proportional to the direct RA.

(b) **(LO 1a, 1b)** You are given the following information for a potential 50% coinsurance arrangement.

Assume the net risk adjustment is calculated and apportioned between the direct and ceded amounts on the basis of the amount insured.

(i) Complete the following chart in the Excel spreadsheet:

	Direct	Ceded	Net
PV Premium		1,250	(1,695)
PV Claims		(1,250)	1,250
Best estimate liability		0	
Risk adjustment		(320)	320
CSM before reinsurance offset			125
Reinsurance offset (Loss Recovery Component)			
CSM after reinsurance offset			
CSM after zero floor			

(ii) Recommend whether to proceed with the 50% coinsurance arrangement. Justify your response.

Commentary on Question:
Most candidates correctly calculated the Direct PV Premium, Direct PV Claims, BEL, RA, and CSM before reinsurance offset.

*Most candidates calculated the reinsurance offset incorrectly. The most common mistake was to set the Ceded reinsurance offset to be 50% of Direct CSM, when the correct calculation should be: Direct reins offset = 50%*direct CSM = 97.7. Ceded reins offset = net - direct = 0 - 97.7 = (97.7).*

Another common mistake was that the Net CSM after zero floor was set equal to the Net CSM after reins offset when the correct calculation should be that Net CSM after zero floor = Ceded CSM after zero floor.

Most candidates' calculations led to them correctly stating that the reinsurance arrangement is beneficial to the company, but to receive full credit, candidates must also identify that the reinsurance turned the contract from onerous to profitable.

(i)

	Direct	Ceded	Net
PV Premium	(2,945)	1,250	(1,695)

PV Claims	2,500	(1,250)	1,250
BEL	(445)	0	(445)
RA	641	(320)	320
CSM before reinsurance offset	(195)	320	125
Reinsurance Offset	98	(98)	0
CSM after reinsurance offset	(98)	223	125
CSM after zero floor	0	223	223

PV direct premium = net prem - ceded prem = (1,695) - 1,250 = (2,945)
PV direct claims = net claim - ceded claim = 1,250 - (1,250) = 2,500
Direct BEL = net - ceded = net prem + net claim - ceded = (1,695) + 1,250 - 0 = (445)
Direct RA = net RA - ceded RA = 320 - (320) = 640
Direct CSM before reins offset = net - ceded = 125 - (RA) = 125 - 320 = (195)
Direct reins offset = 50%*direct CSM = 98
Ceded reins offset = net - direct = 0 - 98 = (98)
Direct CSM after reins = CSM before reins – reins offset = (195)- 98 = (98)
Ceded CSM after reins = CSM before reins – reins offset = 320- (98) = 223
Direct CSM after zero floor = 0
Ceded CSM after zero floor = Ceded CSM after reins offset = 223
Net CSM after zero floor = ceded CSM after zero floor = 223

(ii)
The company should proceed, as the reinsurance arrangement changes the contract from onerous to profitable.

8. Spring 2024 LFMC Exam (LO 1a, 1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
(1a). Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b). Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
LFM-151-22: IAIS—International Capital Standard, ComFrame, Holistic Framework for Systemic Risk in the Insurance Sector, Sullivan & Cromwell LLP, Dec 2019, Only pages 1-3, 8-28 (not on syllabus)

OSFI Guideline E15: Appointed Actuary - Legal Requirements, Qualification and External Review (Aug 2023) (1a, 1b)

OSFI Guideline E16: Participating Account Management and Disclosure to Participating Policyholders and Adjustable Policyholders, OSFI, 2023 (not on syllabus)

LFM-632-23: OSFI B-3 Sound Reinsurance Practices and Procedures (1a, 1b)

Commentary on Question:
This question tested the candidates' knowledge of international capital standards and valuation principles.

Solution:

(a) **(NO LONGER RELEVANT)** ~~You are given:~~

- ~~Five years ago, MLL introduced a life insurance product, Super Life (SL), with high guaranteed cash surrender values, targeting the top 5% of income-earners in Canada.~~
- ~~No other insurers offer a similar product to SL in the market.~~
- ~~Approximately half of all Canadians in the target demographic have purchased an SL policy from MLL.~~
- ~~MLL cedes 80% of SL's mortality risk to a single Canadian reinsurer and retains the remaining 20%.~~
- ~~MLL follows a very low risk investment strategy with 70% invested in fixed income assets and the remaining 30% held in cash.~~

(i) Describe the three key exposures that can lead to systemic risk for MLL under the Holistic Framework from the IAIS.

(ii) Recommend an approach for applying each of the three key elements of the Holistic Framework to manage systemic risk.

Commentary on Question:
Candidates generally received partial credit for part (i). Few candidates successfully stated the 3 key exposures with sufficient detail.

Candidates generally did not do well on part (ii). Most candidates confused key elements for key exposures.

Three key exposures leading to systemic risk for MLL:

Exposure 1: Liquidity Risk
- The risk an insurer is unable to realize its investments/assets when financial obligations come due
- Risk is higher if assets backing liabilities are illiquid
- Maple Leaf Life's investment strategy is very liquid (70% FI, 30% cash), so risk is low

Exposure 2: Interconnectedness
- How connected the financial system and real economy are
- Macroeconomic exposure (i.e. correlation with the economy)
  - Investment strategy is fixed income assets, but the exact holdings are unknown
  - The product is sold to half of the top 5% income earners in Canada, so the product's failure could have unknown impacts on the economy since many of the wealthiest Canadians own it
- Counterparty exposure (i.e. reliance on counterparties sharing correlated risk among each other)
  - 80% of the mortality risk is reinsured, so there is a dependency on the reinsurer to fulfil its obligations to MLL and its other clients

Exposure 3: Limited Substitutability
- Inability to continue the supply of insurance products if one insurer fails
- If MLL were to fail, there's no guarantee another insurer would launch a similar product (though they could), and currently 2.5% of all Canadians are benefiting from the product

Approach for applying the three key elements of the Holistic Framework:

Element 1 – an enhanced set of supervisory policy measures to prevent systemic risk, including supervisory powers of intervention to respond when a potential risk is identified

- ~~MLL can enhance their ERM policies to include risk identification of systemic risk, including governance, liquidity stress testing, liquidity portfolio, contingency fund planning, or liquidity risk management report~~
- ~~MLL can develop a counterparty risk appetite statement~~

~~Element 2 – a global monitoring exercise to assess global trends and detect build-up of systemic risk~~

- ~~MLL can implement "Individual Insurer Monitoring" of their own, focusing on the key elements of that framework (including size, global activity, etc.)~~
- ~~MLL can also monitor global trends where they may have exposure to changes in economic environment and the associated potential risks~~

~~Element 3 – an implementation assessment, where the IAIS will assess the implementation of enhanced supervisory policy measures and powers of intervention~~

- ~~– Internally, Maple Leaf Life can establish an auditing process to ensure the measures identified (in Step 1) are monitored and implemented correctly~~

(b) **(LO 1a, 1b)** MLL is launching a new participating whole life product.

- The launch date is January 1, 2025.
- MLL requires the project manager to secure reinsurance.
- The project manager has decided the following:
  - Reinsurers should provide quotes by the launch date
  - Reinsurers to be selected no later than January 31, 2025
  - Reinsurance treaties are to be fully executed by June 30, 2025
- Senior management will recommend to the Board a policy for determining dividends and managing the participating account
- As part of the annual year-end President's Report to the board, the CEO will include a disclosure on the fairness of proposed policyholder dividends and the allocation of investment income and expenses
- The Appointed Actuary will perform a triennial review of the fairness of any changes made to the participating product
- Policyholder disclosures on the management of the participating account will be based on excerpts taken from internal company documentation, with redactions from the legal team to remove proprietary details

Critique the proposed product development decisions with respect to the relevant OSFI guidelines. Justify your answer.

Commentary on Question:
This part of the question tested the candidates' understanding of how reinsurance contracts are established and the role of the appointed actuary. Most candidates performed well on this part of the question.

Based on how the project manager appears to have official responsibility for determining when reinsurance is secured during the product development process, MLL may need to establish a Reinsurance Risk Management Policy or revise it to ensure better oversight over this aspect of product development. This is also apparent as the proposed timelines do not comply with OSFI Guideline B-3. A binding "summary document" (e.g. letter of intent) should be in place by the launch date (i.e. when the reinsurance becomes effective) which doesn't appear to be the case, and the fully executed treaty should be signed within 120 days; June 30 is therefore too late.

MLL is correct to develop a policy for managing dividends and the par fund which must be approved by the board of directors. However, the annual disclosure must come from the Appointed Actuary, not the President/CEO. In most cases, the CEO may not be the Appointed Actuary.

While the Appointed Actuary must periodically opine on the impact to fairness of product changes, it must be at least annual rather than triennial.

Although MLL is required to provide certain disclosures to policyholder including on how the participating account is managed, taking excerpts from technical documentation may not satisfy the requirement to be understandable with a rudimentary knowledge of life insurance (i.e. not being a technical expert). Moreover, by having the legal team redact the language, it may lead to the disclosure being too generic or boilerplate.

9. Spring 2024 LFMC Exam (LO 2c)

Learning Objectives:
2. The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

Learning Outcomes:
(2c) Describe the purpose and application of economic capital

Sources:
Economic Capital for life Insurance Companies, SOA Research paper, Oct 2016 (only sections 2 and 6)

Commentary on Question:
This question tested the candidates' understanding of economic capital and the Canadian regulatory capital framework. Overall, candidates demonstrated a moderate understanding on part (a) and a good understanding on parts (b) and (c).

Solution:

(a) **(LO 2c)**
(i) Describe the components of an economic capital calculation

(ii) Describe the economic capital considerations pertaining to the term life acquisition.

Commentary on Question:
For part (i) of the question, most candidates were able to identify that economic capital is determined from the point of view of the company which; however, most candidates did not describe the components of the calculation sufficiently to demonstrate full knowledge. Some candidates confused economic capital with the Canadian regulatory capital framework (LICAT) which resulted in no credit.
For part (ii) of the question, candidates did well to describe the diversification benefit that would be realized from the term life acquisition, but few candidates were able to provide sufficient considerations.

Part (i):
- Important to distinguish between the available capital (excess of assets over liabilities held by the insurer) and the required capital (the amount of assets in excess of liabilities needed to withstand future adverse outcomes)
- The accounting valuation of assets and liabilities used will not necessarily agree with the baseline valuation that is preferred for EC
- The most important feature is that the correct total asset requirement (liabilities plus required capital) at time 0 is derived

- EC attempts to measure a capital requirement based on the most realistic assessment of future economic risks
- The effect of real world risks is measured and the capital required to cover these outcomes with a specified degree of security is then calculated
- EC is measured consistently with the economics of the company
- The valuation basis should allow a realistic assessment of the risks in a way that provides a meaningful perspective across a potentially diverse set of exposures

Part (ii):
- Need to consider the EC requirements of the target company from XYZ Life's perspective
- Need to consider the result of aggregating the acquired block on XYZ's own capital requirements
- Diversification impacts of the acquisition when appropriate should be taken into consideration
- Can be EC offsets when combining different aspects of the same risk
- An increase in capital may be required if acquired business is lower than XYZ's target

(b) **(LO 2c)** Critique each of the following statements pertaining to LICAT required capital. Justify your answer.

A. XYZ's lapse risk required capital component will decrease due to the acquisition.

B. For the purpose of determining the lapse designation, XYZ will test whole life and term life on a combined basis.

C. XYZ is not allowed by regulation to acquire the term block if it would cause capital to decrease below the Internal Capital Target.

Commentary on Question:
Most candidates were able to receive partial credit for each of the three statement critiques s by providing a valid explanation for each statement. No credit was received if candidates did not provide proper justification.

A. Disagree
- Lapse risk component applies to both lapse-supported & lapse-sensitive products.
- Since the new business is being added, the risk will increase, and this required capital component would increase.

B. Disagree
- Lapse supported and lapse sensitive products are assumed to be negatively correlated for LICAT.
- Lapse supported products should be shocked with a decrease in lapse rates while lapse sensitive products should be shocked with an increase in lapse rates.

C. Disagree

- Internal Capital Target is not a regulatory requirement.
- Capital resources may fall below the Internal Target, the insurer has to inform OSFI promptly along with a plan on how it expects to manage the risks and/or restore its Capital Resources to its internal targets levels within a relatively short period of time.

(c) **(LO 2c)** Premium data, required capital components and capital factors are given in the Excel spreadsheet.

Calculate the Total Operational Risk Capital for XYZ as of December 31, 2024. Show all work.

Commentary on Question:
Most candidates provided the formula for the calculation of the operational risk required capital. The business volume required capital calculation and the general required capital calculation were performed well in general. However, the calculation for the large increase in business volume required capital was not well applied by most of the candidates. Even if they were able to demonstrate the knowledge that the exposure is the excess of current year's premiums over 120% of the prior year's premiums, which provided them with partial credit, most candidates did not split the businesses between the individual and group business segments. Another common mistake for this calculation was including the 2023 premiums for the Term Life that were not part of XYZ's business in that year.

1) General formula for the calculation of the operational risk required capital

$$Operation\ Risk\ RC = Business\ Volume\ RC + Large\ Increase\ in\ Business\ Volume\ RC + General\ RC$$

2) Calculate the business volume required capital

$$Business\ Volume\ RC = Factor * Premiums\ (over\ last\ year)$$
$$Business\ Volume\ RC = 2.50\% * (400 + 250 + 250) = 22.50$$

3) Calculate the large increase in business volume required capital

$$Large\ Increase\ in\ Business\ Volume\ RC = Factor * [Premiums\ in\ excess\ of\ a\ 20\%\ year - over - year\ increase]$$

→ This formula should be applied separately for Individual Life, Group Life and Other business.

$$Large\ Increase\ in\ Business\ Volume\ RC\ (Individual) = Max(0; 2.50\% * \{(400 + 250) - 1.2 * (500 + 0)\}) = 1.25$$

$$Large\ Increase\ in\ Business\ Volume\ RC\ (Group) = Max(0; 2.50\% * \{250 - 1.2 * 200\}) = 0.25$$

$$Large\ Increase\ in\ Business\ Volume\ RC = 1.25 + 0.25 = 1.50$$

4) Calculate the general required capital

$$General\ RC = Factor_1 * [Credit, Market, Insurance\ RC\ net\ of\ reinsurance\ \&\ credit] + Factor_2 * [Seg\ Fun\ Guarantee\ RC] + Factor_3 * [Premiums\ for\ reinsurance\ held\ contracts]$$

$$General\ RC = 5.75\% * (100 + 320 + 130 - 20) = 30.475$$

5) Calculate the operational risk required capital

$$Operation\ Risk\ RC = 22.50 + 1.50 + 30.475 = 54.475$$

Fall 2024 LFMC Exam

2. Fall 2024 LFMC Exam (ILA 101 LO 1a-1d, 201l 1a-1b, 2a)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
The Candidate will be able to:
(1a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(2a) Explain and calculate regulatory capital using various international frameworks

Sources:
Can 1-8 CIA Report - Lapse Experience Study for 10-year Term Insurance, Jan 2014, pp. 6 -32 (not on syllabus)

Can 1-7 CIA Educational Note: Selective Lapsation for Renewable Term Insurance Products, February 2017 ((on ILA 101 syllabus LO 1a-1d)

ILA201-603-25: OSFI Guideline E15: Appointed Actuary – Legal Requirements, Qualifications and External Review, Aug 2023 (LO 1a-1b)

ILA201-604-25: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1-6 (excluding Sections 4.2-4.4) (LO 2a)

Commentary on Question:
The question tested the candidates' knowledge of determining mortality deterioration assumptions and their application.

Solution:
(a) **(ILA 101 LO 1a-1d)** Compare and contrast Dukes-Macdonald (DM) and VTP2.

Commentary on Question:
Candidates were expected to describe both similarities and differences between the two methods for determining mortality deterioration assumptions.
Most candidates identified the segments of cohorts (S, A, U and P) and described the differences in the methods in this context. Most candidates identified the differences between DM1 and DM2 which earned credit. Fewer candidates described the similarities between the methods.

Full marks were provided for identifying at least four similarities and four differences.

2. Continued

Similarities between the methods:

- Have similar concepts and require similar parameters.
- Are based on underlying base mortality tables that do not contain experience from products exhibiting high lapses (and associated mortality) resulting from an increase in premium
- Are based on knowing the underlying lapse rates (i.e. lapses consistent with the base mortality table)
- Keep track of notional cohorts that lapse and persist (P)
- Further segment the cohorts that lapse into those with select mortality (S) or average (i.e. attained age) mortality (A)
- Decrement the cohorts at their respective mortality rates and at the underlying lapse rates
- Assume that all lapses other than the underlying lapses occur just prior to the end of the policy year
- Apply the principle of conservation of deaths to the cohorts to solve for the mortality of the residual persisting (persisters) cohort
- Result in excess mortality that grades off to nil after the select period of the base table
- Assume no grace period
- Do not provide for skew lapses
- Understate persister mortality

Differences between the methods:

- Unlike VTP2, DM1 assumes that the underlying lapses occur immediately prior to the selective lapses.
- The most important difference between VTP2 and DM1 resides in the occurrence of the underlying lapses. VTP2 assumes:
- The average and selective lapse rates are applied to the population persisting just prior to the anniversary and acted on instantaneously at the anniversary
- The underlying lapse rate, like the mortality rate, applies continuously
- A subtle but important difference between the methods is the definition of residual mortality and simultaneously, the size of the cohort of persisters.
- DM accounts for the group who lapse with underlying mortality (U), i.e. those lapses already accounted for in the construction of the base mortality table, whereas VTP2 ignores U
- DM2 ignores A in determining the size of the cohort of persisters
- DM1 overstates persister mortality compared to DM2 and VTP2

2. Continued

(b) **(LO1a-1b, 2a)** DEF Life sells two 10-year renewable term products:

- Basic Term:
  - Maximum face amount of 500,000
  - Guaranteed issue
  - Renewal premium = 800% of the initial premium
  - Grace period of 30 days

- Premium Term
  - Maximum face amount of 2,000,000
  - Full underwriting
  - Renewal premium = 300% of the initial premium
  - Grace period of 100 days

Critique the following statements regarding selective lapsation and mortality deterioration for these products:

A. Selective lapses occur only at renewal and are highly skewed towards the end of policy year 10 and beginning of policy year 11.

B. Policies with larger premium increases at renewal will have higher lapse rates. It is appropriate to assume that lapse rates increase linearly with the size of the premium increases.

C. Mortality, mortality deterioration, and lapse assumptions should be set together for the entire term portfolio to increase credibility. Differences in product features are not expected to have a material impact on lapse rates or mortality.

D. Deaths during the grace period can be ignored when calculating mortality deterioration.

E. The underlying base mortality table used to calculate mortality deterioration should be based on experience data from the term products.

F. The shape of the underlying base mortality table does not affect how quickly the excess mortality wears off.

2. Continued

Commentary on Question:
Candidates generally did well critiquing statements A, B, and C. For statement D, many candidates failed to mention that the impact of grace period deaths is minimal if lapse rates are low. For statement E, many candidates incorrectly stated that the basis of the assumptions should be term products from the company and/or industry experience. For statement F, most candidates correctly identified that the shape of the underlying base mortality table does affect how quickly the excess mortality wears off; however, for full credit candidates had to discuss that unusual run-off pattern may occur if there are discontinuities in the shape of the table.

Statement A

- The first part of the sentence is incorrect: selective lapses may occur at time other than renewal.
- The second part of the sentence is true: lapses for renewable Term are highly skewed around the premium jump.

Statement B

- While lapse rates do increase with the premium jump, it is not appropriate to assume that they increase linearly.
- Lapse rates increase very quickly at the lowest premium jumps, begin to level off as jumps begin to increase, and then level off at the highest premium jump levels.

Statement C

- It is not appropriate to set the same assumptions for the entire term portfolio.
- Both lapse and mortality (including mortality deterioration) assumptions should reflect the product differences.
- Provide at least one example of how assumptions could differ between the products:
    - Mortality rates increase significantly as the premium jump ratio increases.
    - Level period mortality will vary between the two products due to only one being underwritten.
    - Difference in lapsation due to differences in face amounts, which will also impact mortality and mortality deterioration.

2. Continued

Statement D

- It is not true that deaths during the grace period are insignificant unless lapse rates are small.
- If lapse rates are low, modelling deaths during the grace period is insignificant. This is not the case when excess lapses are very high.
- The mortality add-on for the grace period can be added to the persister cohort mortality.
- All mortality deterioration methods assume no grace period.

Statement E

- Incorrect
- All methods of calculating mortality deterioration are based on underlying base mortality tables that do not contain experience from products exhibiting high lapses (and associated mortality) resulting from an increase in premiums.
- It would not be appropriate to construct the underlying base mortality table from Term data.

Statement F

- Incorrect
- A consequence of all the methods is that the level and run-off pattern of the excess mortality is highly dependent on the shape of the underlying mortality table.
- An unusual run-off pattern may be observed where there are discontinuities in the shape of the table. This means that it is important to ensure that the base mortality table is appropriately selected.

3. Fall 2024 LFMC Exam (LO 2a, 2b, 2c, 3c)

Learning Objectives:
2. The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.
3. The candidate will understand various approaches to manage and evaluate life insurance risks.

Learning Outcomes:
The Candidate will be able to:
(2a) Explain and calculate regulatory capital using various international frameworks
(2b) Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital
(2c) Describe the purpose and application of economic capital
(3c) Explain and understand the use and application of the Own Risk Solvency Assessment (ORSA) report

Sources:
A Multi-Stakeholder Approach to Capital Adequacy, Conning Research

OSFI Guideline A-4 Internal Target Capital Ratio for Insurance Companies, December 2017

ILA201-606-25: OSFI: Own Risk and Solvency Assessment (E-19)
IAIS—International Capital Standard, ComFrame, Holistic Framework for Systemic Risk in the Insurance Sector, Sullivan & Cromwell LLP, Dec 2019
Only pages 1-3, 8-28 (not on syllabus)

Economic Capital for life Insurance Companies, SOA Research paper, Oct 2016 (only sections 2 and 6)

Commentary on Question:
This question tested the candidates' understanding of regulatory capital and economic capital, the respective perspectives of stakeholders and the methods in capital management.

Solution:
(a) **(LO 2b)** Describe the objectives of capital adequacy for each of the following stakeholders with respect to a life insurance company:

(i) Policyholders
(ii) Regulator
(iii) Shareholders
(iv) Company Management

3. Continued

Commentary on Question:
Most candidates did well on this part of the question. Candidates generally understood the perspectives of regulators, shareholders, policyholders, and company management related to solvency requirements and return maximization. However, to receive full credit candidates had to demonstrate understanding that the cost of capital is not a concern for policyholders and regulators, and that the growth of business and capital risk management are also objectives of shareholders.

(i) Policyholders want capitalization levels to be set such that they are fully protected in the event of a loss. They are not concerned with cost of capital

(ii) The regulator's primary concern is the policyholder. Regulators want rates to be affordable and insurers to be able to pay claims fully.

There are not concerned with over-capitalization or the cost-of-capital. The more capital the better.

(iii) Shareholders have multiple objectives:

- maximize their return through lower capital; do not want inefficient use of capital
- maintaining enough capital to absorb shocks
- maintain enough capital to support growth

(iv) Company management given incentives to operate company in line with best interests of shareholders

Management has incentive to keep company open for gainful employment (return on capital) and would require higher levels of capital aligning with regulators, policyholders, shareholders)

(b) **(LO 2b. 2c, 3c)** Critique the following statements.

A. Economic capital measures a life insurance company's capital needs based on the future economic risks that the life insurance industry faces. Economic capital is the amount required to cover a risk neutral distribution of risks with a high degree of certainty over the life of the policyholders.

B. The Standard and Poor's Capital Adequacy Ratio is well known and understood industry measure that a life insurance company can use for its own economic capital models.

C. Failing an economic capital calculation could result in a stage 1 early warning intervention by OSFI.

3. Continued

D. Prior to approving a company's Own Risk and Solvency Assessment, OSFI will review it to understand its risk profile, methodology, assumptions, and quality of capital.

E. Under International Capital Standard's (ICS) standard method for determining ICS 2.0 capital requirements for life insurers, insurance and market risks are quantified using stress tests, while credit and operational risk are quantified using factor-based approaches.

Commentary on Question:
Candidates generally did well critiquing statements B, C, and D. For statement A most candidates did not discuss the length of projection. For statement E few candidates discussed the concentration risk and insurance risks for non-life.

A. EC is based on the risks the company faces, not the industry. It is company specific risk, Real world distributions, not RN, length of projection is debatable. Some feel a one-year period is more appropriate
B. The "one-size-fits-all" standardization of these formulas makes them universal, but limits their ability to predict accurately the necessary amount of capital for a specific insurer

The risks that are modeled are calibrated based on industry data and not specific to the company being modeled

C. Stage 1 early warning intervention is for breaching LICAT supervisory targets

However, no consequences to failing. Results of model are internal only and provide information to the company, not monitored by OSFI

D. OSFI does not approve ORSA

Otherwise, rest is true

E. True for insurance - using stress tests,

Credit - Factor based and operational risks - Factor based
Note some insurance risks in the SN are factor based, but they are for non-life.
True for all market risks - using stress tests
except concentration risk, which is factor based

(c) **(LO 3c)** You are given the following information for a Canadian life insurance company:

Tier 1 Capital	500
Tier 2 Capital	200
Base Solvency Buffer	650
LICAT Total Ratio	123%
LICAT Core Ratio	88%
Internal Target Total Ratio	125%
Internal Target Core Ratio	70%

3. Continued

The life insurance company's Own Risk and Solvency Assessment determined its own capital needs to be 800.

Assess the life insurance company's ratios.

Commentary on Question:
Few candidates did well on this part of the question. Many candidates performed the comparison between LICAT Total/Core ratio and internal target ratios, but not many candidates compared the internal target Total/Core ratio with ORSA and supervisory target.

- The ORSA required capital / BSB = 800/650 =123%
- Thus, internal total target of 125% is reasonable, just above the ORSA to BSB ratio
- The total ratio of 123% is below internal target of 125%. That is permitted, but insurer should inform OSFI and provide plans on how it expects to get back to Internal Targets
- Core target of 70% is set at the supervisory target of 70%. Internal core targets should be greater than supervisory target.

4. Fall 2024 LFMC Exam (LO 2a)

Learning Objectives:
2. The candidate will understand international capital requirements, the approaches and tools of financial capital management
for international life insurance companies.

Learning Outcomes:
(2a) Explain and calculate regulatory capital using various international frameworks

Sources:
LFM-106-07: Insurance Industry Mergers and Acquisitions, Chapter 4 (Sections 4.1-4.6) (not on syllabus)

Regulatory Capital Adequacy for Life Insurance Companies: A Comparison of Four Jurisdictions, SOA Research Institute, Jul 2023
• Companion Excel Spreadsheet: Comparison of Jurisdictions Tool

Commentary on Question:
This question tested the candidates' knowledge of adjustable life products and financial condition testing.

Solution:
(a) **(NO LONGER RELEVANT)** ~~Critique each of the following principles as they apply to changes to adjustable policies:~~

~~(i) *Policy classifications should be established at issue and are not subject to change.*~~

~~(ii) *The changes to adjustable policies should be based on underlying experience and not on projected future experience.*~~

~~(iii) *It is never appropriate to cross-subsidize one policy cohort with another cohort.*~~

~~(iv) *Past losses cannot be recovered through future adjustments.*~~

~~**Commentary on Question**:~~
~~*This part of the question tested the candidates' knowledge of adjustable policies. Candidates had to clearly state whether the principle is true or false for full credit.*~~

4. Continued

(i) This statement is mostly true. Policy classification for adjustable policies should be established at issue. There should be no post-issue changes except when the re-classification can be justified or is required as a result of external circumstances beyond the control of the insurer arising post-issue. Some of these external circumstances include regulation amendment, merge and acquisition, etc.

(ii) This statement is false. The changes to adjustable policies should be based on associated underlying experience and projected future expectations.

(iii) This statement is false. There should be no material, planned, or systemic cross-subsidization of one cohort by another. However, small amounts of cross-subsidization may occur due to practical considerations such as volatility smoothing, etc.

(iv) This statement is false. Some adjustable policies may allow the recovery of past losses, which should be explicitly provided for in the adjustable policy contract or in marketing or sales disclosure material.

(b) **(NO LONGER RELEVANT)** Explain the analysis that the Appointed Actuary is required to prepare for Financial Condition Testing (FCT)

Commentary on Question:
This part of the question tested the candidates' understanding of FCT as a risk management tool. A common error was just describing the detailed scenarios that should be considered for the FCT test.

FCT is an annual exercise where the appointed actuary should design and perform stress testing to investigate the insurer's recent and current financial position and financial condition. The appointed actuary is expected to provide a written report on the finding of the stress testing, and document management actions for mitigation of the identified threats. The assumptions and scenarios tested should be current and forward looking.

4. Continued

(c) **(LO 2a)**The table below summarizes the FCT results at the end of the projection period.

Scenario	Type	Statement value of assets	Statement value of liabilities	LICAT Total ratio
Base	Base	150	80	140%
Pandemic	Solvency	110	100	75%
Increased mortality	Going concern	120	110	95%
Business Growth	Going Concern	200	130	200%

- The Company's target LICAT total ratio is 150%

For each scenario:

(i) Explain whether the results are satisfactory.

(ii) Identify actions the Company might take to address unsatisfactory results.

Commentary on Question:
This part of the question tested the candidates' understanding of OSFI's requirements and possible management actions to improve FCT results. For part (ii) simply stating that the LICAT ratio can be improved by increasing available capital or reducing required capital was not sufficient to receive credit.

(i) Base scenario – LICAT ratio at the end of the period is lower than the insurer's internal target. Therefore, this is not satisfactory.

Solvency scenario (Pandemic) – The assets are greater than the liabilities at the end of the projection. Therefore, this is satisfactory. However, the LICAT ratio is less than OSFI's supervisory minimum. Management actions should be identified in the FCT report to increase the LICAT ratio to supervisory minimum.

Going-concern scenario (Increased mortality) – The LICAT ratio is higher than OSFI's regulatory target at the end of the projection period. Therefore, this is satisfactory. However, the LICAT ratio is lower than OSFI's supervisory target and the insurer should identify management actions in the FCT report.

Going-concern scenario (Business Growth) – Satisfactory. However, FCT is a defensive investigation, and this is a favorable scenario which is not a scenario that should be tested in FCT.

4. Continued

(ii) To address the unsatisfactory results, the insurer should consider raise additional available capital or reduce its required capital. Some actions can be considered include:

- Issue more common share
- Require parent capital injection
- Use of registered reinsurance to reduce insurance required capital
- Reprice certain high risk products
- Reduce dividend scale for participating products
- Reduce adjustable elements for adjustable products
- Strengthen risk management practices such as implementing hedging, better ALM, etc.

(d) **(NO LONGER RELEVANT)**

~~(i) Critique each statement from the Financial Condition Testing (FCT) report from the perspective of a peer reviewer:~~

~~*A. The Company sustained material mortality losses and assumed all claims in excess of the expected mortality level are due to COVID. Therefore, no changes were made to the base mortality assumption.*~~

~~*B. Significant changes to the Income Tax Act are expected to materially impact the Company's income. This was not considered in the scenarios as the new rules will only be effective n*mortality post COVID. Actuary should test the potential impact of increased mortality in their FCT.~~

~~*C. The Company only tested the impact of the most severe risks.*~~

~~(ii) Explain OSFI's objectives in requiring a peer reviewer for the work of the Appointed Actuary~~

~~**Commentary on Question**:~~

~~*Candidates generally did well on part (i). A common error for part (ii) was that instead of OSFI's objective in requiring a peer reviewer, many candidates provided a description of OSFI's qualification requirement for a peer reviewer.*~~

4. Continued

(i)

A. This is not acceptable. Actuary needs to consider the potential changes to mortality due to COVID. Actuary should test the impact of increased mortality under the company's FCT.

B. This is not acceptable. Actuary is expected to consider impact of material events such as tax changes in the FCT projection if the events are expected to occur over the projection period.

C. This is not acceptable. The company should consider severe but plausible scenario for solvency testing. The company should also consider scenarios that are less severe but more plausible to test the company's financial adequacy for going-concern.

(ii) OSFI requires a peer reviewer for the work of the appointed actuary to help provide an assessment of the insurer's financial condition safety and soundness. The peer reviewer can also provide independent advice to the appointed actuary and act as an additional source of professional education to the appointed actuary. Peer reviewer can help maintain confidence in the work of the AA by public, management and supervisory authorities.

5. Fall 2024 LFMC Exam (LO 2a)

Learning Objectives:
2. The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

Learning Outcomes:
(2a) Explain and calculate regulatory capital using various international frameworks

Sources:
LFM-106-07: Insurance Industry Mergers and Acquisitions, Chapter 4 (Sections 4.1-4.6) (not on syllabus)

Regulatory Capital Adequacy for Life Insurance Companies: A Comparison of Four Jurisdictions, SOA Research Institute, Jul 2023
• Companion Excel Spreadsheet: Comparison of Jurisdictions Tool

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) **(LO 2a)** A US-domiciled insurance company is redomiciling to Bermuda. On the effective date, the assets have a book value lower than the market value. The conservatism in the US liability reserves has been reconciled to a risk margin using the cost of capital approach with a 10% cost of capital rate.

(i) Explain the impact on the assets on the statutory accounting balance sheet.

(ii) Explain the impact on the liabilities on the statutory accounting balance sheet.

(iii) Describe the implications for the surplus on the statutory accounting balance sheet.

Commentary on Question:
This question tested the candidates' understanding of the impacts of changing the accounting basis. Most candidates correctly identified that the company is transitioning from a book value basis to a market value basis for reporting. However, some candidates overlooked that this change would result in an increase in reported assets.

5. Continued

(i) US statutory accounting for assets and liabilities is on a book value basis, Bermuda statutory accounting for assets is based on market values and liabilities are based on a fair value approach, which is the sum of the "Best Estimate Liability" and a "Risk Margin" (i.e., Reserves equal Best Estimate Liability plus Risk Margin). Once the company is redomiciled to Bermuda, it can take a gain from marking to market the assets which increases the available capital.

(ii) The US liabilities are held on a conservative basis using a discount rate set at issue of the policy. EBS liabilities are based on a fair value approach, which is the sum of the "Best Estimate Liability" and a "Risk Margin" (i.e., Reserves equal Best Estimate Liability plus Risk Margin). Bermuda Risk margin is based on a cost of capital approach with a 6% prescribed CoC rate. The company would be able to release reserves from the less conservative risk margin.

(iii) The increase in assets and decrease in liabilities will increase the surplus.

(b) **(LO 2a)** You are given the following information for a block of business in Bermuda:

Year	0	1	2	3	4	5
Best Estimate Liability (BEL)	900	800	720	560	340	0
Market risk free rate		4.5%	4.5%	4.5%	4.5%	4.5%

BSCR capital	Time 0
C_{Market}	40
$C_{P\&C}$	0
C_{LT}	10
C_{Credit}	0
Operational risk charge (%)	2%
Loss absorbing capacity adjustment	0

Correlation Matrix	C_{Market}	$C_{P\&C}$	C_{LT}	C_{Credit}
C_{Market}	1	0.25	0.125	0.125
$C_{P\&C}$	0.25	1	0.5	0.25
C_{LT}	0.125	0.5	1	0
C_{Credit}	0.125	0.25	0	1

Bermuda Solvency Capital Requirement (BSCR)	175%

Assume the following:

- The required capital is a constant ratio of BEL throughout the projection period.

5. Continued

- The risk margin is based on non-market risk.

(i) Calculate the required capital at time 0. Show all work.

(ii) Calculate the technical provision at time 0. Show all work.

Commentary on Question:
This part of the question tested the candidates' understanding of how to calculate Bermuda's capital requirements using a specified correlation matrix. Candidates either understood the requirements and earned nearly full credit or struggled significantly and earned little credit.

(i)

$$BSCR\ before\ operational\ risk = \sqrt{CMarket^2 + CLT^2 + 2 * CMarket * CLT * Corr(CMarket, CLT)}$$
$$= \sqrt{40^2 + 10^2 + 2 * 40 * 10 * 0.125} = 42.43$$

$$Operational\ risk = BSCR\ before\ operational\ risk * Operational\ risk\ charge\ (\%)$$
$$= 42.43 * 2\% = 0.85$$

$$BSCR = BSCR\ before\ operational\ risk + Operational\ risk = 42.43 + 0.85 = 43.27$$

$$BSCR\ at\ 175\% = BSCR * 175\% = 43.27 * 175\% = 75.73$$

(ii) $$Required\ capital\ (exc. Market)\ as\ \%\ of\ BEL = \frac{CLT*(1+Operational\ risk\ charge\ (\%))}{BEL\ at\ time\ 0} = \frac{10*(1+2\%)}{900} = 1.13\%$$

$$Required\ capital\ (exc. Market) = Required\ capital\ as\ \%\ of\ BEL * BEL$$
$$Required\ capital\ (exc. Market)\ at\ time\ 0 = 1.13\% * 900 = 10.2$$
$$Required\ capital\ (exc. Market)\ at\ YEAR\ 1 = 9.07$$
$$Required\ capital\ (exc. Market)\ at\ YEAR\ 2 = 8.16$$
$$Required\ capital\ (exc. Market)\ at\ YEAR\ 3 = 6.35$$
$$Required\ capital\ (exc. Market)\ at\ YEAR\ 4 = 3.85$$

5. Continued

$$CoC\ Rate = 6\%\ (prescribed)$$

$$RM = CoC \times \sum_t \frac{SCR(t)}{(1 + r(t+1))^{t+1}}$$

Where:

- CoC denotes the Cost-of-Capital rate;
- SCR(t) denotes the Solvency Capital Requirement after t years;
- r(t + 1) denotes the basic risk-free interest rate for the maturity of t + 1 years.

The basic risk-free interest rate (r(t + 1)) shall be chosen in accordance with the currency used for the financial statements of the insurance and reinsurance undertaking.

$$RM\ at\ time\ 0 = 10.2 + \frac{9.07}{1+4.5\%} + \frac{8.16}{(1+4.5\%)^2} + \frac{6.35}{(1+4.5\%)^3} + \frac{3.85}{(1+4.5\%)^4}$$
$$= 2.02$$

$$Technical\ Provision\ at\ time\ 0 = RM\ at\ time\ 0 + BEL\ at\ time\ 0 = 2.02 + 900$$
$$= 902.02$$

6. Fall 2024 LFMC Exam (LO 1a, 1b)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

Learning Outcomes:
(1a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products

Sources:
CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts

CIA Draft Educational Note: IFRS 17 – Fair Value of Insurance Contracts

CIA Educational Note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts, Jul 2

CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts

JKL Life is setting IFRS17 discount rates for a newly acquired block of universal life (UL) policies.(not on syllabus)

Commentary on Question:
The question tested the candidates' understanding of IFRS17.

Solution:
(a) **(LO 1a)** Describe the impact on the illiquidity premium for each of the following UL product features:

(i) No surrender charges

(ii) Market value adjustments

(iii) Level cost of insurance (LCOI)

(iv) Option to add term rider

(v) Variable interest option with guaranteed minimum interest rate

6. Continued

Commentary on Question:
This part of the question tested the candidates' knowledge of how the illiquidity premium is influenced by product features. Candidates generally performed well. To receive full credit candidates had to explain the impact on exit value/inherent value and the direction of impact on the illiquidity premium (ILP) (that is, explain why the product feature increased or decreased the ILP rather than just stating the impact). Common mistakes include failing to state the impact on ILP or only explaining the impact on the product's liquidity but not to the illiquidity premium. Few candidates were able to describe the impacts in part (iv).

(i) The absence of surrender charge reduces the exit cost from the policyholder's persepective, hence causes illiquidity premiums to decrease

(ii) The presence of market value adjustment increases the exit cost from the policyholder's persepective, hence causes illiquidity premiums to increase

(iii) The level cost of insurance builds up the contract's inherent value, hence causes illiquidity premiums to increase

(iv) This option has no effect on the illiquidity premium because increasing coverage does not change the liquidity characteristics already present in the base policy.

(v) The interest guarantee increases up the contract's inherent value, hence causes illiquidity premiums to increase

(b) **(LO 1a, 1b)** Critique the following statements related to applying the Fair Value method under IFRS 17 for the acquired block of UL policies:

A. *If this product generates a loss component at initial recognition, JKL should not expect a positive fair value CSM at acquisition since another potential buyer would experience similar losses.*

B. *OSFI's Supervisory Target Capital Ratios should be used as the capital basis for determining fair value. OSFI's Minimum Capital Ratios would not be appropriate since they do not include any margin for risks not included in the LICAT guideline.*

C. *The fair value for the reinsurance contracts held on this UL block of business may need to be determined using different assumptions since reinsurers are a different group of market participants than the direct writers.*

6. Continued

D. JKL can use their own assumptions for the risk adjustment in determining the fair value since they use a margin approach and their margins for this product are consistent with other insurers.

Commentary on Question:
This part of the question tested the candidates' knowledge of a fair value measurement. Candidates generally did not do well on this part of the question and did not provide relevant justification to support their critiques. To receive full credit candidates had to explain why the statements were incorrect and specifically mention considerations related to fair value methodology.

A. When calculating a fair value, as per IFRS 13, the transaction is assumed to take place in the principal market or in the most advantageous market. This means that the transaction is expected to be priced such that profits will be enough to cover the cost of capital, or when PV IF = 0. The loss component at initial recognition from ABC is irrelevant. The profits needed to cover the cover the cost of capital will be profitable, leading to a positive transition CSM.

B. It's true that neither of OSFI's capital ratios would be appropriate. The appropriate target would be a market participant's internal target capital ratio and insurers are expected to operate at capital levels above their internal targets. This internal target represents a lower bound for fair value measurement.

C. Market participants for reinsurance contracts held would be the same as those for the underlying contracts. In most M&A transactions, the potential buyer of a block of business would acquire both the direct contracts and reinsurance contracts held. In other words, the fair value for a group of reinsurance contracts held could be seen as the amount that would bring the fair value of the direct contracts without reinsurance to the net fair value of the underlying contracts including reinsurance. Therefore, the assumptions would be consistent between the direct and reinsurance contracts.

D. JKL can use their own assumptions for the RA but will also need to consider diversification with other portfolios (e.g., annuities) to determine the level of risk premium to reflect the compensation required to bear the non-diversifiable risk from their point of view. Further adjustments, such as operational risk, will be needed to reflect differences in size between JKL and other market participants.

6. Continued

(c) **(LO 1a, 1b)** Calculate the fair value CSM at acquisition under the Adjusted Fulfillment Cash Flow approach for the UL block using the information in the excel spreadsheet. Show all work.

Commentary on Question:
This part of the question tested the candidates' ability to calculate the fair value CSM. Candidates generally were able to correctly calculate the weighted average cost of capital (WACC) and PV fulfilment cashflows (FCF) but struggled to calculate the adjusted FCF, cost of capital, and release of risk provision, which are all components used to calculate the fair value.

The transition CSM under the adjusted fulfilment cashflow approach = fair value (FV) - PV fulfilment cashflows (FCF)

PV FCF is the PV of the 10 years of 1000 BEL cashflows + $20 RA (2% of BEL) discounted at the IFRS 17 discount rate of 5% = 7876.17

To calculate the FV, the adjusted FCF, cost of capital, and release of risk provision are required.

The adjusted FCF is the PV of the 10 years of $1000 BEL cashflows + 20 RA + 10 non-directly attributable expenses (1% of BEL) discounted at the fair value rate of 5.1% = 5% IFRS 17 discount rate + 0.10% own credit risk.
Adjusted FCF = 7914.90

To calculate the cost of capital, the target available capital at each year is required. The available capital each year is the base solvency buffer * target capital ratio * (1-diversification credit) - RA balance, where the BSB is the BEL balance * capital requirement %. For example, at year 0 the available capital = $1578.32 = PV BEL $7721.73 * 22% * 120% * (1-15%) - RA 154.43.

The cost of capital is the available capital at beginning of year * WACC, where WACC = 40%*12% + 60%*6% = 8.4%. For example, the cost of capital at end of first year = $1578.32 * 8.4% = $132.58. The PV of the 10 years of CoC discounted at the hurdle rate of 12% = $508.10.

The risk provision is the PV of the 10 years of $20 RA cashflows discounted at the hurdle rate of 12% = $113.00

Putting it all together, fair value = 7914.90 + 508.10 - 113.00 = 8310.00.

Finally, fair value CSM = 8310 – 7876.17 = 433.83.

7. Fall 2024 LFMC Exam (LO 1a, 1b, 2a)

Learning Objectives:
1. The candidate will understand and apply valuation principles to individual life insurance and annuity products issued by international life insurance companies.

2. The candidate will understand international capital requirements, the approaches and tools of financial capital management for international life insurance companies.

Learning Outcomes:
(1a) Describe the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(1b) Evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
(2a) Explain and calculate regulatory capital using various international frameworks

Sources:
CIA Educational Note: IFRS 17 Market Consistent Valuation of Financial Guarantees for Life and Health Insurance Contracts, Jun 2022 (1a, 1b)

ILA201-604-25: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), November 2024, Ch. 1-6 (excluding Sections 4.2-4.4) (2a)

ILA201-601-25: The IFRS 17 Contractual Service Margin: A Life Insurance Perspective (Sections 2-4.8) (1a, 1b)

Commentary on Question:
This question tested the candidates' understanding of LICAT requirements for segregated funds.

Solution:
(a) **(LO 2a)** You are given:

- OSFI has not approved QRS' hedging program for LICAT purposes.
- LICAT Total Gross Calculated Requirement (TGCR) = 26

Calculate the segregated fund Net Required Component at the supervisory level under the Base scenario. Show all work.

Commentary on Question:
A common error was excluding the 125% factor. Most candidates included CSM in the liability calculation.

Net Requirement = TCGR – Net Actuarial Liability

= Max [0, 26-(4+1+20)] = 1 million
Apply 125% factor to the net requirement to get the net required component
= 1 million * 125% = 1.25

CSM should be included in the calculation of the Net Actuarial Liability

(b) **(LO 1a, 1b)** Before a price shock, the value of the hedging derivatives is 0. The fulfilment cash flows (FCF) and derivative values after equity price shock are given by:

- FCF = -410p/35 + 5
- Derivatives value = -12p

Where p = price shock

Calculate the contractual service margin after a -35% price shock (p = - 0.35)

(i) without the use of the risk mitigation exception

(ii) with the use of the risk mitigation exception, with hedge ineffectiveness reflected in CSM

(iii) with the use of the risk mitigation exception, with hedge ineffectiveness reflected in Profit/Loss

Commentary on Question:
Candidates generally did well on part (i). Many candidates mistakenly applied the 95% hedge effectiveness in part (ii).

Current CSM = 20
Current BEL + RA = 5

BEL+ RA after a -35% shock = -410/(-35%)/35 + 5 = 9.1

(i) CSM after a -35% shock = 20-(9.1-5) = 15.9

(ii) Derivates value after a -35% shock = -12(-35%) = 4.2
CSM after a -35% shock = 20 – (9.1-5-4.2) = 20.1

(iii) Derivates value after a -35% shock = -12(-35%) = 4.2
Hedge effectiveness = 95%
CSM after a -35% shock = 20-(9.1-5-95%*4.2) = 19.89