CURATED PAST EXAM ITEMS
- Questions -

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 The inclusion in these curated past exam questions of material that is no longer current does not bring such material into scope for current assessments.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 QUESTIONS

ALL LEARNING OBJECTIVES

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Fall 2020 LFMC Exam

1. Fall 2020 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.

Learning Outcomes:

The Candidate will be able to:

c) Describe the purpose and application of economic capital

Sources:

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

1. (*9 points*)

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

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

ANSWER:

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

ANSWER:

LHR Life is reviewing its economic capital.

(b) **(LO 2c)** (*1 point*) Describe the advantages and disadvantages of LHR operating at an economic capital ratio of 150% compared to 400%.

ANSWER:

(c) **(LO 2c)** (*2 points*) 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

ANSWER:

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

ANSWER:

(d) **(LO 2c)** (*4 points*) LHR has three major business units, denoted X, Y, and Z. You are given the following information on the capital allocation to each unit:

Business unit	**Stand-alone risk capital**
X	390
Y	200
Z	325

Combination of business units	**Required risk capital**
X+Y	460
Y+Z	520
X+Z	600
X+Y+Z	700

The response for this part is to be provided in either the ANSWER box below or in the Excel document.

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.

ANSWER:

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

ANSWER:

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

ANSWER:

2. Fall 2020 LFMC Exam (LO 3b)

Learning Objectives:

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

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

Sources:

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

2. (*9 points*)

(a) **(LO 3b)** (*5 points*) AKL Life Insurance Company is a public company that was recently assigned a negative outlook by A.M. Best.

(i) (*3.5 points*) Describe the process followed by A.M. Best that results in the rating agency assigning a negative outlook to an insurance company.

ANSWER:

(ii) (*1.5 points*) List three potential impacts of the negative outlook on AKL's day-to-day operations.

ANSWER:

AKL has the following Best's Capital Adequacy Ratio (BCAR) components:

C1-Non Eq	15
C1-Eq	5
C2	5
C3-Int	15

C3-Mkt	5
C4	2
Available Capital	100

Net Required Capital =

$$\sqrt{(\text{C1-Non Eq} + \text{C3-Int})^2 + (\text{C1-Eq} + \text{C3-Mkt})^2 + (\text{C2})^2} + \text{C4}$$

(b) **(LO 3b)** (*1 point*) Calculate the BCAR for AKL. Show all work, including writing out relevant formulas used in any calculations.

The response for this part is to be provided in the Excel document.

(c) **(LO 3b)** (*3 points*) 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.

The response for this part is to be provided in the Excel document.

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

ANSWER:

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.

Learning Outcomes:

4 The Candidate will be able to:

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

Sources:

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

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

4. (*7 points*)

(a) **(LO 4d)** (*2 points*) Describe how the introduction of the new tax exemption rules in 2017 impacted the level of tax-exempt accumulation within a life insurance policy.

ANSWER:

(b) **(LO 4d)** (*5 points*) 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 $A_{x:\overline{n}|}$ is the present value of a life insurance policy which endows at attained age x+n:

$A_{x:\overline{n}|}$ = x/150 + n/1000, for when the annual interest rate is 3.5%

$A_{x:\overline{n}|}$ = 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.

The response for this part is to be provided in the Excel document.

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.

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

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

5. (*11 points*)

(a) **(LOs 1a, 1b)** (*2 points*) Describe four sources of profits or losses under the IFRS 17 General Measurement Approach.

ANSWER:

(b) **(LOs 1a, 1b)** (*6 points*) 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.*

ANSWER:

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.*

ANSWER:

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.*

ANSWER:

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

ANSWER:

(c) **(LOs 1a, 1b)** (*3 points*) 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

ANSWER:

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.

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

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

6. (*12 points*)

(a) **(LOs 1a, 1b)** (*7 points*) 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**	**At Current**	**At Initial Recognition**	**Current Service**	**Future Service**

	Period Start	Period End			
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.

The response for this part is to be provided in the Excel spreadsheet.

(b) **(LOs 1a, 1b)** (*5 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

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.

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

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)

7. (*7 points*)

(a) **(LOs 1a, 1b)** (*4 points*) Describe the four principles of a sound Reinsurance Risk Management Policy.

ANSWER:

(b) (*3 points*) Critique the following statements with respect to the valuation of gross policy liabilities and reinsurance recoverables under IFRS 4:

A. **(LOs 1a, 1b, 3a, 3b)** *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.*

ANSWER:

B. **(LOs 1a, 1b)** *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.*

ANSWER:

C. **(LOs 1a, 1b, 3a, 3b)** *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.*

ANSWER:

D. **(LOs 3a, 3b)** *Any provision for impairment of the reinsurance recoverables should be included in the gross liability*

ANSWER:

7. Continued

E. **(LOs 1a, 1b)** *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.*

ANSWER:

F. **(LOs 1a, 1b, 3a, 3b)** *It is expected that margins would be consistent between the gross liability and the net liability.*

ANSWER:

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.

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

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)

8. (*9 points*)

(a) **(LOs 3a, 3b)** (*2 points*) 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.

ANSWER:

(b) **(LOs 1a, 1b, 3a, 3b)** (*7 points*) You are valuing the following two blocks of Universal Life policies under CALM:

	UL A	**UL B**
Underwriting	Simplified underwriting, preferred and standard risk	Fully underwritten, preferred and standard risk
Surrender charges	5% surrender charges grading off at 5th policy anniversary; none thereafter	10% surrender charges grading off at 10th policy anniversary; none thereafter
Persistency bonus	None	10% of premiums paid during the first 10 years payable at the end of year 20
Cost of insurance options	YRT	Level
Investment options	• 1 domestic equity fund • 1 fund with portfolio rate tied to Government of Canada Long-term Bond Yields • No administration charge for investment switches • Full Market Value Adjustment (MVA) on investment switches	• 10 different foreign and domestic equity funds • 5 and 10-year GIC funds • 1 money market fund • Administration charge of 500 for investment switches • No Market Value Adjustment (MVA) on investment switches
Reinsurance	None	Quota share YRT

Explain how the valuation assumptions including margins differ between the two blocks of business for the following assumptions:

(i) Mortality

ANSWER:

(ii) Expenses

ANSWER:

(iii) Lapses

ANSWER:

(iv) Premium persistency

ANSWER:

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.

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

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)

9. (*9 points*)

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

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

ANSWER:

(ii) List five other desirable features.

ANSWER:

(b) **(LO 2a)** (*3 points*) With respect to hedging in the context of CALM valuations:

(i) (*1 point*) Describe the steps required for a first-principles application of CALM with a dynamic hedging program.

ANSWER:

(ii) (*2 points*) Describe the risks and costs of hedging to reflect in valuation.

ANSWER:

(c) **(LOs 2a, 3a, 3b)** (*4 points*) 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) (*1 point*) List the pros and cons of both approximation methods.

ANSWER:

(ii) (*3 points*) Recommend an approximation method. Justify your answer.

ANSWER:

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.

Learning Outcomes:

2 The Candidate will be able to:

a) Explain and calculate regulatory capital using various international frameworks

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)

10. (*12 points*)

You are given the following for ABC Life:

Net Tier 1 Capital	22,000
Net Tier 2 Capital	8,000
Surplus Allowance	1,200
Eligible Deposits	700
Credit Risk Component	1,200
Market Risk Component	3,000
Gross Written Premium in Past 12 Months	5,000
Business Volume Required Capital Factor for Direct Written Premiums	2.50%
General Required Capital Factor for Credit, Insurance and Market Risk	5.75%
Total Net Amount at Risk	2,000,000
Total Face Amount	3,500,000
Next Year's Expected Claims	40,000
Standard Deviation of Next Year's Projected Net Death Claims	3,875
Present Value (PV) of Best Estimate Cash Flows (CFs)	20,000

Change in PV of CFs for Each 10% Increase in Mortality Assumptions	2,300
Change in PV of CFs for Each 10% Reduction in Future Mortality Improvement Assumptions in the First 25 Years	400
PV of Shocked CFs with 1 per 1000 Increase in Deaths in the Year Following the Reporting Date	22,500
PV of Shocked CFs with +/-30% Change in Lapses in the First Year Following the Reporting Date	20,500
PV of Shocked CFs with +/-60% Change in Lapses in the First Year Following the Reporting Date	21,300
PV of Shocked CFs with Absolute 20% Increase in Lapses in the First Year Following the Reporting Date	21,000

Correlation Coefficient	Mortality Risk	Lapse Risk
Mortality Risk	1	0.5
Lapse Risk	0.5	1

Assume:

- All business sold by ABC Life is non-par.
- There is no large increase in business volume.
- There is no reinsurance.
- The mortality risk component can be approximated by grossing up the shocked impact proportionally.

(a) **(LO 2a)** (*10 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

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

(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.

The response for this part is to be provided in the Excel spreadsheet.

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.

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

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)

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.

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

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)

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.

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

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)

6.

(*8 points*)

For an in-force block of whole life insurance policies with a critical illness rider you are given:

- All the polices are issued on the same day.
- All the policies are included in one IFRS 17 group.
- The locked-in discount rate at contract issue is 3%.
- Deaths are the only decrements and occur at year end.
- The whole life base policy has 8 remaining years of coverage.

- The Contractual Service Margin (CSM) opening balance for the whole life base policies is 500.
- The critical illness rider has 5 remaining years of coverage.
- The CSM opening balance for critical illness rider is 100.
- Assume coverage units are not discounted. Coverage and tPx for each year are provided in the following table:

Year	Whole life base coverage Maximum Coverage	Critical Illness Rider Maximum Coverage	tPx
1	100,000	10,000	1.0000
2	100,000	10,000	0.9500
3	100,000	10,000	0.9030
4	100,000	10,000	0.8570
5	100,000	10,000	0.8150
6	100,000	0	0.7740
7	100,000	0	0.7350
8	100,000	0	0.6980

(a) **(LOs 1a, 1b)** (*7 points*) Calculate the profit or loss recognized through the CSM every year using each of the following approaches:

(i) Simple sum of contractual coverages

The response for this part is to be provided in the Excel document.

(ii) Notional CSM

The response for this part is to be provided in the Excel document.

Show all work.

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

ANSWER:

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.

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

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

7.

(*9 points*)

(a) **(LOs 1a, 1b)** (*4 points*) A company has a liability of 1,000 payable on December 31, 2028 with no exit value.

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

ANSWER:

(ii) (*2 points*) Calculate the IFRS 17 discount rate on December 31, 2023 using a top-down approach. Explain your approach.

ANSWER:

(iii) (*1 point*) Calculate the IFRS 17 discount rate on December 31, 2023 using a bottom-up approach. Explain your approach.

ANSWER:

(b) **(LOs 1a, 1b)** (*5 point*) BMS Life issues a new universal life insurance product with an 80% confidence level that the premium less a profit charge will cover the benefit payments. Benefit payments are assumed to be normally distributed. At issue, you have the following:

PV Fulfilment Cash Flows	-125
Premium Margin	12%
Variance of benefit payments	3,000

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) (*2.5 points*) Calculate the best estimate benefit claim cost at issue. Show all work.

The response for this part is to be provided in the Excel spreadsheet.

(ii) (*2.5 points*) 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.

ANSWER:

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.

ANSWER:

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

ANSWER:

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

ANSWER:

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.

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

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)

8.

(*11 points*)

(a) **(LOs 3a, 3b)** (*1 point*) Explain the difference in the profit emergence for life insurance contracts under IFRS 4 and IFRS 17.

ANSWER:

(b) (*2 points*) 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~~

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

~~(c)~~ **(NO LONGER RELEVANT)** ~~(*8 points*) 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) (*2 points*) Calculate the contractual service margin or loss component at issue as appropriate. Show all work.

The response for this part is to be provided in the Excel spreadsheet.

(ii) (*4 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

(iii) (*2 points*) 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	-

The response for this part is to be provided in the Excel spreadsheet.

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.

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

Sources:

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

10.

(*9 points*)

~~(a)~~ **(NO LONGER RELEVANT)** ~~(*2 points*) Outline the ASU 2018-12 simplified DAC amortization model for insurance contracts classified as "long duration" under US GAAP.~~

ANSWER:

(b) **(LOs 1a, 1b – partial)** (*3 points*) 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.

ANSWER:

10. Continued

(c) **(NO LONGER RELEVANT)** *(4 points)* For a life insurance contract issued January 1, 2023, by a U.S. insurer, you are provided the following information:

- ASU 2018-12 applies to this contract.
- There are no expenses.
- The locked-in original contract issuance discount rate is 3%.
- At the end of year 2:
  - Actual benefits paid and premiums received did not match initial expectations. An experience study resulted in revised projected cash flows for the remainder of the contract.
  - The revised discount rate is 3.5%.

This table represents the present value of future cashflows using original projected cash flows under original assumptions, as determined on January 1, 2023:

	PV using discount rate of 3%		**PV using discount rate of 3.5%**	
Time	**Benefits**	**Gross Premiums**	**Benefits**	**Gross Premiums**
At Issue	432.44	661.57	428.13	655.55
Start of Year 2	343.92	488.59	341.38	485.20
Start of Year 3	242.60	320.57	241.42	319.05

This table represents the present value of future cashflows using the actual cashflows in the first two years followed by revised projected cash flows in other years, as determined at end of day, December 31, 2024.

	PV using discount rate of 3%		**PV using discount rate of 3.5%**	
Time	**Benefits**	**Gross Premiums**	**Benefits**	**Gross Premiums**
At Issue	493.11	638.20	488.13	632.43
Start of Year 2	396.27	469.59	393.31	466.36
Start of Year 3	281.30	306.07	279.90	304.64

Calculate the liability remeasurement loss which would be recorded in the year-end 2024 accounting entries. Show all work.

The response for this part is to be provided in the Excel spreadsheet.

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.

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

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)

11.

(*10 points*)

(a) **(LOs 1a, 1b)** (*4 points*) 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.

ANSWER:

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.

ANSWER:

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.

ANSWER:

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.

ANSWER:

(b) (*2 points*) Polar Bear Life Insurance (PBLI) would like to set up a YRT reinsurance treaty for all of its term life products. They have selected to reinsure with XYZ, a registered reinsurer in Canada. The reinsurance arrangement meets Sound Reinsurance Practice and Procedures. A 50% reinsurance treaty is being proposed. You are given:

Available Capital	530
Surplus Allowance	50
Eligible Deposit	0
Base Solvency Buffer (before reinsurance)	500
Base Solvency Buffer (after reinsurance)	450
Diversification Benefits	0

Reinsurance Assets and Receivables	0

(i) **(LO 2a)** (*1.5 points*) Calculate PBLI's LICAT Total Ratio before and after incorporating the reinsurance agreement with XYZ. Show all work.

ANSWER:

(ii) **(Losa 1a, 1b)** (*0.5 points*) Recommend whether PBLI should pursue reinsurance with XYZ from a capital perspective.

ANSWER:

(c) **(LO 2a)** (*4 points*) 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

ANSWER:

(ii) Surplus Allowance

ANSWER:

(iii) Eligible Deposit

ANSWER:

(iv) Base Solvency Buffer

ANSWER:

****END OF EXAMINATION****

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.

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

Sources:

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

1.

(*13 points*)

(a) **(LO 3b)** (*1.5 points*) Describe the three A.M. Best Opinion Outlooks.

ANSWER:

~~(b)~~ **(NO LONGER RELEVANT)** ~~(*2.5 points*) 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.*~~

~~ANSWER:~~

~~*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.*~~

~~ANSWER:~~

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

~~ANSWER:~~

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

~~ANSWER:~~

~~*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.*~~

~~ANSWER:~~

~~(c)~~ **(NO LONGER RELEVANT)** (~~*3 points*~~) ~~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~~

~~ANSWER:~~

~~(ii) AM Best's Financial Strength Rating~~

~~ANSWER:~~

1. Continued

ABC Bank and DEF Life have independently prepared actuarial appraisals as part of a competitive bidding process to acquire XYZ Life. DEF's appraisal resulted in a higher value than ABC's. ABC Bank currently does not have any insurance operations while DEF Life is one of the largest global life insurers. XYZ Life is a small life insurer offering products similar to those of DEF Life.

(d) (*3 points*) Identify four differences between the inputs to an actuarial appraisal and the inputs to an AM Best Issuer Credit Rating.

ANSWER:

(e) (*3 points*) Describe possible reasons why DEF's appraisal value is higher than ABC's, considering each of the three main components of an actuarial appraisal.

ANSWER:

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.

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

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)

2.

(*9 points*) PCLC Life Insurance Company is currently an A-rated company by S&P. The company has recently implemented economic capital models in order to explore the implications of various capital levels on multiple key business objectives.

The following information is provided:

- Risk threshold by financial variables

Financial Variable	**Risk Threshold-Name**	**Risk Threshold-Quantity**	**Company Rating**
RBC Ratio	Default	100% of authorized level	D or Below
S&P Capital Adequacy Ratio (CAR)	One-Notch Downgrade	150%	BB or Below

- Simulated capital information

	RBC Default	S&P CAR
Probability of One-Notch downgrade or default over 1 year	0.05%	2%
Value at Risk (VaR) of RBC or S&P CAR	160%	190%
Mean of risk capital	650,000	740,000
Annual Discount Rate	3%	4%

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

The response for this part is to be provided in the Excel document.

(b) **(LO 2b)** (*2 points*) 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.

The response for this part is to be provided in the Excel document.

(c) **(LOs 2b, 2c)** (*5 points*) Critique the following statements:

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

ANSWER:

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.

ANSWER:

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.*

ANSWER:

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

ANSWER:

5. Fall 2021 LFMC Exam (LO 4d)

Learning Objectives:

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

Learning Outcomes:

The Candidate will be able to:

(a) 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

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

- Ch. 9: Investment Income Tax

5.

(*7 points*) You are given the following information for a Canadian life insurance company for 2019 (in millions):

Income Item	**Total**
Direct Written Premium	400
Premium Ceded	50
Premium Assumed	40
Foreign Insurance Premium	150
Refunded Premiums	15
Cash Value of Policy Dividends – Cash	30
Cash Value of Policy Dividends – Paid-up Additions	45
Loan Repayment	20
Loan Interest Repayment	5

Balance Sheet Item	Tax Basis	Statutory Basis
Beginning of Year Reserves – Direct Written	140	100
End of Year Reserves – Direct Written	180	130

Maximum Taxable Actuarial Reserve (MTAR)	
Mean MTAR - Reinsurance Assumed	10
Mean MTAR - Reinsurance Ceded	30

Taxable income attributable to policyholders	2
Premium Tax Rate	4%
Yield on Investments	3%
IIT rate	2.5%
Corporate tax rate	20%

(LO 4d) Calculate the following:

(i) (*1 point*) Premium tax payable.

The response for this part is to be provided in the Excel document.

(ii) (*2* points) Investment income tax (IIT) payable.

The response for this part is to be provided in the Excel document.

(iii) (*4* points) Net after-tax statutory income.

The response for this part is to be provided in the Excel document.

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.

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

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)

6.

(*11 points*)

(a) **(LOs 1a, 1b)** (*2 points*) Contrast the calculations between initial recognition and subsequent measurement for the Contractual Service Margin (CSM) under IFRS17 general measurement model.

ANSWER:

(b) **(LOs 1a, 1b)** (*5 points*) 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.

ANSWER:

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.*

ANSWER:

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.*

ANSWER:

(c) **(LOs 1a, 1b)** (*4 points*) A company has a closed block of incurred disability claims, a closed block of payout annuities and an open block of universal life insurance. The payout annuities are onerous. You are given the following total company CSM roll forward forecast for 2024.

Opening balance on January 1	3,000
New Contracts Issued	50
Interest Accretion	41
Changes in fulfilment cash flows relating to future services	-80
Ending balance on December 31	3,011

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.

ANSWER:

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.

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

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

8.

(*8 points*)

(a) **(LOs 1a, 1b)** (*1 point*) State the characteristics of the discount rate under IFRS17.

ANSWER:

(b) **(LOs 1a, 1b)** (*2 points*) Company MBX is evaluating a market to establish the observable period for risk free assets for its life insurance product. You are given the following markets:

Market	**A**	**B**	**C**
Trading Volume (Millions)	400	500	20
Bid-Ask Spread	2.0-4.0 bps	10.0-20.0 bps	10.0-20.0 bps
Bond Maturity Duration	**% of Daily Transactions**		
3	35%	50%	35%
5	25%	30%	25%
10	17%	20%	17%
20	12%	0%	12%
30	10%	0%	10%
60	1%	0%	1%

(i) Evaluate the appropriateness of each market to be used as a reference portfolio.

ANSWER:

(ii) Recommend the end of the observable period based on your evaluation in (i)

ANSWER:

(c) **(LOs 1a, 1b)** (*3 points*) Company MBX currently sells a Yearly Renewable Term product. Evaluate what the following product changes would do to the liquidity characteristics of the product

(i) Replacing the YRT premium structure with a Fully Guaranteed Level Premium rate

ANSWER:

(ii) Including a conversion option to a permanent life product with no underwriting

ANSWER:

(iii) Including a Waiver of Premium benefit upon Job Loss & Disability

ANSWER:

(iv) Offering a cash surrender value after five years

ANSWER:

(d) **(LOs 1a, 1b)** (*1 point*) 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

ANSWER:

(ii) Bottom-up approach

ANSWER:

(e) **(LOs 1a, 1b)** (*1 point*) 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.

ANSWER:

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.

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

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

9.

(*10 points*)

(a) **(LOs 1a, 1b)** (*7 points*) 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.

ANSWER:

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.

ANSWER:

C. The risk adjustment confidence level will be calculated and disclosed at the contract level.

ANSWER:

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.

ANSWER:

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.

ANSWER:

F. The same discount curve will be used to discount the future cash flows and the risk adjustment.

ANSWER:

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.

ANSWER:

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.

ANSWER:

(b) **(LOs 1a, 1b)** (*3 points*) 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.

ANSWER:

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.

Learning Outcomes:

The Candidate will be able to:

a) Explain and calculate regulatory capital using various international frameworks

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)

10.

(*10 points*) LHW Insurance is a Canadian-based company subject to the LICAT framework. The Company writes Universal Life (UL) business. You are an actuarial student being asked to help prepare the LICAT return.

(a) **(LO 2a)** (*1 point*) Describe the margins which are to be included in the Surplus Allowance.

ANSWER:

(b) **(LO 2a)** (*3 points*) 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.

ANSWER:

(ii) Calculate the required mortality risk capital for the total UL block using the information in the table above.

The response for this part is to be provided in the Excel spreadsheet.

(c) **(LO 2a)** (*1 point*) 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.

ANSWER:

(d) **(LO 2a)** (*2 points*) Describe the characteristics of the index-linked products which are subject to the correlation factor calculation.

ANSWER:

(e) **(LO 2a)** (*3 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

****END OF EXAMINATION****

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.

Learning Outcomes:

The Candidate will be able to:

(c) Describe the purpose and application of economic capital

Sources:

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

1.

(*10 points*) ABC Life Insurance is building an Economic Capital (EC) framework. Management is having a discussion regarding whether to use the finite risk horizon approach or the liability run off approach.

(a) **(LO 2c)** (*6 points*) 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.

ANSWER:

(ii) We want to know how many assets are required to cover liabilities with some degree of security.

ANSWER:

(iii) We closely monitor changes in market conditions and respond accordingly. We want to reflect these actions in the Economic Capital framework.

ANSWER:

(iv) We believe that yield curves eventually go back to normal after extreme market events.

ANSWER:

(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.

ANSWER:

(vi) We hope to easily calibrate EC to a target security level.

ANSWER:

ABC has a liability cash flow projection model for reserve calculation. The model uses a population mortality table plus a PAD as base mortality table; it uses average historical mortality improvement derived from data from the past century. The discount rate is prescribed by regulation.

ABC observes mortality volatilities from various sources and decides to modify this model to do a stochastic projection for economic capital.

(b) **(LO 2c)** (*4 points*) Recommend changes to the current liability projection model in order to accomplish ABC's intended objective.

ANSWER:

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.

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

Sources:

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

4.

(*11 points*)

~~(a)~~ **(NO LONGER RELEVANT)** ~~(*2 points*) Outline the requirements under the CIA Standards of Practice for the following when calculating IFRS 4 reserves for life insurance products:~~

~~(i) Reinsurance recoverables~~

~~ANSWER:~~

~~(ii) Amount of assets required to support contract liabilities~~

~~ANSWER:~~

~~(iii) Renewal benefits~~

~~ANSWER:~~

~~(iv) Forecasting cashflows~~

~~ANSWER:~~

~~(v) Adopting a scenario~~

~~ANSWER:~~

(b) (*5 points*) 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.*

ANSWER:

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.*

ANSWER:

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.*

ANSWER:

~~*D.*~~ **(NO LONGER ELEVANT)** ~~*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.*~~

~~ANSWER:~~

~~*E.*~~ **(NO LONGER ELEVANT)** ~~*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.*~~

~~ANSWER:~~

(c) **(LOs 1a, 1b – partial)** (*4 points*) 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) (*1 point*) Provide a rationale for setting the initial MfAD at 6.5%.

ANSWER:

(ii) (*2 points*) Recommend an updated MfAD.

ANSWER:

(iii) (*1 point*) Calculate the impact on the annuity block's PfAD from the recommended MfAD.

ANSWER:

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.

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

Sources:

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

6.

(*10 points*) 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)** (*2 points*)

(i) Explain the purpose of the Risk Adjustment (RA) within the GMM.

ANSWER:

(ii) List three risks to be included in the RA

ANSWER:

(iii) List three risks to be excluded in the RA

ANSWER:

(b) **(LOs 1a, 1b)** (*2 points*) Identify the considerations to use the current IFRS 4 MfADs as a starting point for calculating the IFRS 17 RA.

ANSWER:

(c) **(LOs 1a, 1b)** (*2 points*) Describe two techniques which can be used to set the RA under an aggregate approach.

ANSWER:

(d) **(LOs 1a, 1b)** (*4 points*) 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) (*1 point*) Describe an approach for using LICAT results to quantify an equivalent confidence level for IFRS 17 reporting.

ANSWER:

(ii) (*3 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

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.

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

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

7.

(*6 points*) Company DEF sells a mix of 10-year term (T10) and whole life (WL) products. The T10 products can be renewed at guaranteed premium rates at the option of the policyholder. You are the actuary in charge of converting the modeling of reserves under CALM to IFRS 17. All policies were issued on the same date, at the start of Year 1. After inputting the assumptions into the modeling system, the following output is produced by the valuation system.

	T10	**Whole Life**
PV of premiums	13,000,000	14,000,000
PV of benefits	11,000,000	8,000,000
PV of directly attributable maintenance expenses	700,000	1,200,000
Directly attributable acquisition expenses	1,200,000	1,700,000

Risk Adjustment	1,000,000	1,600,000

Year	**T10 Coverage Units**	**Whole Life Coverage Units**
1	20,000,000	5,000,000
2	19,000,000	4,800,000
3	18,000,000	4,600,000
4	17,000,000	4,500,000
5	16,000,000	4,400,000
Total over Coverage Period	250,000,000	100,000,000

(a) **(LOs 1a, 1b)** (*2 points*) Explain how the following IFRS 4 items would change under IFRS 17 for the T10 product

(i) Classification of contracts

ANSWER:

(ii) Term of the Liability

ANSWER:

(iii) Determination of contract cashflows, including items included or excluded

ANSWER:

(b) **(LOs 1a, 1b)** (*4 points*)

(i) (*2 points*) Calculate the total opening CSM for the portfolio containing both the T10 and whole life products.

The response for this part is to be provided in the Excel spreadsheet.

(ii) (*2 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

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.

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

Sources:

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

8.

(*9 points*)

(a) **(LOs 1a, 1b)** (*6 points*) 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).

ANSWER:

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.

ANSWER:

C. In Canada, it's reasonable to set the last observable point for Government of Canada bonds at 30 years.

ANSWER:

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.

ANSWER:

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.

ANSWER:

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.

ANSWER:

(b) **(LOs 1a, 1b)** (*3 points*) 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

ANSWER:

(ii) Outline two advantages of the approach

ANSWER:

(iii) Outline two disadvantages of the approach

ANSWER:

9. Spring 2022 LFMC Exam (LO 4d)

Learning Objectives:

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

Learning Outcomes:

The Candidate will be able to:

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

Sources:

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

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

9.

(*10 points*) Maple Leaf Life is a Canadian life insurer that primarily sells participating life insurance.

For the participating insurance product, the following two events occurred during the year:

1. Cash dividends are paid out to the policyholders.
2. Some policyholders have taken out policy loans.

(a) **(LO 4d)** (*2 points*)

(i) Describe the impact of paying cash dividends with respect to Maple Leaf Life's income tax payable.

ANSWER:

(ii) Describe the impact of taking out policy loans with respect to the policyholders' income tax payable.

ANSWER:

(b) **(LO 4d)** (*8 points*) 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) (*1 point*) Describe the difference in tax treatment of an exempt policy verses a non-exempt policy.

ANSWER:

(ii) (*4 points*) Demonstrate that the policy is projected to pass tax exempt testing in year 15, but not in year 19.

The response for this part is to be provided in the Excel spreadsheet.

(iii) (*2 points*) Determine a new Pol CV pattern to ensure the policy passes tax exempt testing in year 19.

The response for this part is to be provided in the Excel spreadsheet.

(iv) (*1 point*) Critique the product design of indexing the death benefit to the company's stock price, and the potential impact on the tax-exempt test.

ANSWER:

10. Spring 2022 LFMC Exam (LO 4e)

Learning Objectives:

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

Learning Outcomes:

The Candidate will be able to:

e) Describe and apply the methods and principles of embedded value for an insurance enterprise

Sources:

4(e) Embedded Value: Practice and Theory, Actuarial Practice Forum, Mar 2009

10.

(*10 points*) A consultant is developing a proposal to use embedded value analysis for explaining the value of the company's business. The following statements from the consultant have been highlighted for your review before they will be included in the report to the company's CFO.

Critique each statement. Justify your answer.

(LO 4e)

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.*

ANSWER:

B. *Embedded Value is a more effective accounting basis that addresses the criticisms of current accounting methods.*

ANSWER:

C. *Embedded Value is the same as the actuarial appraisal value of a company when used for mergers and acquisitions.*

ANSWER:

D. *When calculating the Adjusted Net Worth, both the Required Capital and Free Surplus are assumed to earn market rates of return.*

ANSWER:

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.*

ANSWER:

F. *It is essential to have a clearly defined process for the selection of assumptions in the calculation of the Embedded Value.*

ANSWER:

G. *All non-economic assumptions used in the Embedded Value calculation should be based on industry data plus a provision for adverse deviations.*

ANSWER:

H. *When calculating the Time Value of Financial Options and Guarantees (TVFOG) using stochastic scenarios, it is recommended to use "real-world" scenarios.*

ANSWER:

I. *The accurate calculation of the final Embedded Value is more important to investors than adequate disclosure of the movement.*

ANSWER:

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.*

ANSWER:

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.

Learning Outcomes:

The Candidate will be able to:

a) Explain and calculate regulatory capital using various international frameworks

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)

11.

(*8 points*) Company AWH sells annuities which have a guaranteed payout for the life of the policyholder. The investment portfolio is comprised of corporate bonds.

(a) **(LO 2a)** (*3 points*) 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.

ANSWER:

(b) **(LO 2a)** (*2 points*) Describe the calculation of the capital requirements for company AWH under the International Capital Standard (ICS).

ANSWER:

(c) **(LO 2a)** (*3 points*) 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

ANSWER:

(ii) Interest rate risk component

ANSWER:

(iii) Credit risk component

ANSWER:

****END OF EXAMINATION****

Fall 2022 LFMC Exam

7. Fall 2022 LFMC Exam (LO 1a, 1b)

Relevant 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

(*8 points*) Company BCS sells a Universal Life (UL) product:

- The death benefit is 50,000 plus the account value balance.
- At the end of 5 years, the policy terminates and the benefit paid is the account value balance.

The reserves for the policy are calculated under IFRS 17.

You are given:

	Descriptions
Expected Mortality	0% for the first 4 years, 10% at the end of year 5
Expected Lapse	0%
Premium	3,000 at the beginning of the year for 5 years
Cost of Insurance deducted at the beginning of each year	4% of Net Amount at Risk
Annual Management Fee deducted at the end of the year	1% of account value at the end of the year
Credited interest on Account Value	7%
Discount Rate	5%

(a) **(LO 1a, 1b)** (*1 point*) Identify the cash flows included for the UL product under the:

(i) Whole Contract view

ANSWER:

(ii) Core Cash Flows view

ANSWER:

(a) **(LO 1b)** (*5 points*) Calculate the Best Estimate Liability at issue using:

(i) The Whole Contract view

The response for this part is to be provided in the Excel spreadsheet.

(ii) The Core Cash Flows view

The response for this part is to be provided in the Excel spreadsheet.

(b) **(LO 1a)** (*2 points*) 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

ANSWER:

(ii) Bottom up approach

ANSWER:

8. Fall 2022 LFMC Exam (LO 1a, 1b)

Relevant Sources:

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

(*10 points*) Company TPL sells a 10 year level term product which can be renewed at guaranteed premiums rates at the option of the policyholder. You are the actuary in charge of converting the modeling of reserves from CALM to IFRS 17. You are given the following output from the valuation system in Year 1 following transition:

	Group A – Inforce at Transition (values at the beginning of year 1)	**Group B – New Business Issued in Year 1 following transition (values at initial recognition)**
PV of premiums	13,000,000	1,300,000
PV of benefits	11,000,000	1,100,000
PV of directly attributable maintenance expenses	700,000	70,000
Directly attributable acquisition expenses	1,200,000	120,000
Risk Adjustment	1,000,000	100,000
Contractual Service Margin (CSM) at Transition	500,000	Not Applicable

Year	**T10 Coverage Units – Group A (thousands)**	**T10 Coverage Units – Group B (thousands)**
1	20,000,000	2,000,000
2	19,000,000	1,900,000
3	18,000,000	1,800,000
4	17,000,000	1,700,000
5	16,000,000	1,600,000
Total	250,000,000	25,000,000

Assume:

- No changes in non-financial or financial assumptions
- No experience variances
- Coverage Units are the policy face amount
- The Contractual Service Margin for Group A at the end of Year 1 is 241,500

8. Continued

(a) **(LO 1a,1b)** (*2 points*) Determine each of the following for Group B at initial recognition:

(i) The profitability classification of the group (with respect to Level of Aggregation).

ANSWER:

(ii) The impact to the Insurance Service Result.

ANSWER:

(b) **(LO 1a, 1b)** (*1 point*) Explain possible reasons why the CSM at initial recognition for Group B is not proportional to the CSM at Transition for Group A.

ANSWER:

(c) **(LO 1a, 1b)** (*5 points*) 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.

ANSWER:

(ii) Actual attributable maintenance expenses are increased by 100,000 in Group A.

ANSWER:

(iii) Additional premium-related expenses of 100,000 in Group A.

ANSWER:

(iv) A favourable change in non-financial assumptions of 1,000,000 in Group A.

ANSWER:

(v) A favourable change in non-financial assumptions of 150,000 in Group B.

ANSWER:

(d) **(LO 1a, 1b)** (*1 point*) 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.

ANSWER:

(e) **(LO 1a, 1b)** (*1 point*) Explain why the Risk Adjustment for Group A at transition may be different from the current Margins for Adverse Deviation (MfAD) under IFRS 4.

ANSWER:

10. Fall 2022 LFMC Exam (LO 4d)

Relevant 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

(*8 points*)

(a) **(LO 4d)** (*2 points*)

(i) Discuss the circumstances under which a Canadian Life Insurance company is subject to premium taxes.

ANSWER:

(ii) Explain the impact of paying premium taxes on the company's net income for tax purposes.

ANSWER:

(b) **(LO 4d)** (*6 points*) 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.

ANSWER:

B. A Canadian group insurance policyholder uses their experience rating refunds to reduce upcoming premium payments.

ANSWER:

C. *The cost to Oakville Life of mandatory underwriting for Canadian life annuities increases.*

ANSWER:

D. *Universal Life sales increase for Oakville Life's United States-based insurance business.*

ANSWER:

E. *Oakville Life reduces premium rates on their Canadian Term Life products in the hopes of selling more policies.*

ANSWER:

F. *Oakville Life increases interest rates charged on policy loans for their Canadian policies.*

ANSWER:

11. Fall 2022 LFMC Exam (LO 2a)

Relevant Sources:

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

(*13 points*)

(a) **(LO 2a)** (*9 points*)

MNG, a Canadian Life Insurance Company, has two blocks of individual life insurance policies, Business A and Business B.

You are given the following information:

Abbreviations:
PV: Present Value; BE: Best Estimate; BEL: Best Estimate Liability; CF: Cashflows

Designation of risk	**Business A**	**Business B**
Mortality risk	Death-supported	Life-supported
Lapse risk	Lapse-supported	Lapse-sensitive

PVs at 5.3% discount rate	**Business A**	**Business B**
BE CF	1,070	-210
Padded CF	1,075	-205

	BEL	
Shock to BE mortality assumption in all policy years	**Business A**	**Business B**
+25%	980	-160
+19.6%	1,000	-175
+14.8%	1,030	-184
-25%	1,100	-200
-15%	1,115	-220
-8.7%	1,130	-240
0% + 1 additional death per thousand	1,069	-200

BEL

Shock to BE mortality improvement assumption	Business A	Business B
- 75% for 25 years, followed by -100% (i.e. no mortality improvement) thereafter.	1,050	-196
+75% at all policy years	1095	-220

	BEL	
Shock to BE lapse assumption	**Business A**	**Business B**
±30% in all policy years	1,085	15
±60% in the first year	1,072	-160
±30% in the first year	1,071	-180
-40% in the first year	1,080	-245
+20% in the first year followed by a permanent +10% in all subsequent policy years	1,075	-200
An absolute addition of 20% to the lapse rate in the first policy year	1,055	-185

Other Values	Business A	Business B
Standard deviation of the upcoming year's projected net death claims	1.5	1.2
The following year's net expected claims	13	17
Total net actuarial liability for all policies	1,500	-90
Total net face amount for all policies	1,100	10,600

(i) (*4 points*) Calculate the mortality risk solvency buffer for the company, without diversification credit between life-supported and death-supported business.

The response for this part is to be provided in the Excel spreadsheet.

(ii) (*2 points*) Calculate the diversification credit between life-supported and death-supported business

The response for this part is to be provided in the Excel spreadsheet.

(iii) (*3 points*) For the company:

- Calculate the lapse risk solvency buffer

The response for this part is to be provided in the Excel spreadsheet.

- Calculate the expense risk solvency buffer

The response for this part is to be provided in the Excel spreadsheet.

11. Continued

(b) **(LO 2a)** (*4 points*) 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.

Describe the impact on the following for each independent event:

(i) Total LICAT ratio

ANSWER:

(ii) Tier 1 capital ratio

ANSWER:

Spring 2023 LFMC Exam

1. Spring 2023 LFMC Exam (LO, 2b, 2c, 3c)

Relevant 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)

(*8 points*)

(a) **(LO 3c)** (*1 point*) List the key elements of Own Risk and Solvency Assessment (ORSA).

ANSWER:

(b) **(LO 2b, 2c)** (*5 points*) 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.*

ANSWER:

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.*

ANSWER:

C. *Both rating agencies and shareholders consider the more capital an insurer has, the better.*

ANSWER:

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.*

ANSWER:

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.*

ANSWER:

(c) **(LO 2c)** (*2 points*) Describe how Economic Capital can be used as a risk management tool in the following areas below.

(i) Capital adequacy

ANSWER:

(ii) Risk appetite

ANSWER:

2. Spring 2023 LFMC Exam (LO, 1a,1b)

Relevant Sources:
ILA201-601-25: The IFRS 17 Contractual Service Margin: A Life Insurance Perspective (Sections 2-4.8)

(*13 points*) Your company is adopting IFRS 17.

(a) **(LO 1a, 1b)** (*4 points*) 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.

ANSWER:

(ii) Explain how the recognition of profit or loss will change if you cede mortality risk through a reinsurance contract held.

ANSWER:

(b) **(LO 1a, 1b)** (*5 points*)

(i) Describe the necessary steps and requirements in determining the level of aggregation.

ANSWER:

(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.

ANSWER:

(c) **(LO 1b)** (*4 points*) 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

The response for the entire part (c) is to be provided in the Excel spreadsheet.

5. Spring 2023 LFMC Exam (LO 2a)

Relevant 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)

(*8 points*)

(a) **(LO 2a)** (*3 points*) 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.

ANSWER:

(ii) Describe the impact of having capital levels fall below the target.

ANSWER:

(b) **(LO 2a)** (*5 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

(ii) Calculate the Core Ratio.

The response for this part is to be provided in the Excel spreadsheet.

(iii) Outline the implications of the company's current capital ratios.

ANSWER:

(iv) Recommend two actions that could be taken to improve current capital ratios

ANSWER:

Show all work.

6. Spring 2023 LFMC Exam (LO, 1a,1b)

Relevant 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)

(*5 points*)

(a) **(NO LONGER RELEVANT)** (*2 points*)

~~(i) Identify and briefly describe the components of an actuarial appraisal value (AAV).~~

~~ANSWER:~~

~~(ii) List the information typically included in an actuarial appraisal report.~~

~~ANSWER:~~

(b) **(LO 1a,1b)** (*3 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

7. Spring 2023 LFMC Exam (LO, 4d)

Relevant Sources:
Canadian Insurance Taxation, 4th Ed, 2015, Chapter 4,5,&9

(*8 points*) With respect to the taxation of individual life insurance policies under the Income Tax Act of Canada:

(a) **(LO 4d)** (*1 point*) Explain how an exempt test policy (ETP) would be constructed.

ANSWER:

(b) **(LO 4d)** (*3 points*) 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.*

ANSWER:

B. *Death benefits received on a non-exempt policy are fully taxable.*

ANSWER:

C. *Additional ETPs are deemed to be issued if the death benefit increases by any amount from the previous year.*

ANSWER:

(c) **(LO 4d)** (*4 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

9. Spring 2023 LFMC Exam (LO, 1a,1b)

Relevant 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

(*10 points*) You have been asked to help determine the opening value of the CSM for your company as of January 1, 2022, for the transition to IFRS 17, using the fair value methodology.

(a) **(LO 1a, 1b)**

(b) (*3 points*)

(i) Describe the two commonly used approaches for determining the fair value of a block of contracts.

ANSWER:

(ii) Explain how each of the two approaches can be used to determine the CSM at transition.

ANSWER:

(b) **(LO 1a, 1b)**
(*3 points*) 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.

ANSWER:

9. Continued

(c) **(LO 1b)**

(*4 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

Fall 2023 LFMC Exam

3. Fall 2023 LFMC Exam (LO 4d)

Relevant Sources:
Canadian Insurance Taxation, 4th Ed, 2015, Chapter 4,5 and 9

(*7 points*) With respect to the Income Tax Act of Canada:

~~(a)~~ **(NO LONGER RELEVANT)** ~~(*2 points*)~~

~~(i) List the requirements for an annuity to be recognized as a prescribed annuity.~~

~~ANSWER:~~

~~(ii) Describe the differences in the tax treatment between prescribed and non-prescribed annuities.~~

~~ANSWER:~~

(b) **(NO LONGER RELEVANT)** ~~(*1 point*) 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:~~

~~*The response for this part is to be provided in the Excel spreadsheet.*~~

(c) **(NO LONGER RELEVANT)** ~~(*1 point*) 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.~~

~~*The response for this part is to be provided in the Excel spreadsheet.*~~

3. Continued

(d) **(LO 4d)** (*3 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

4. Fall 2023 LFMC Exam (LO 1a, 1b)

Relevant 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

(*11 points*) XYZ Insurance sells and underwrites the product Easy-Term with the following features:

- Coverage is provided for 3 years, with a one-time option to renew the contract for an additional 3 years.
- Premium payment is in the form of a single premium purchasing the insurance coverage for 3 years.
- The contract is fully underwritten at the time it is issued.
- Contract holders wishing to renew are required to fill out a medical questionnaire. XYZ is obliged to accept the renewal but there is no contractual limit on the premium that will be charged on renewal.

You have decided to measure Easy-Term using the General Measurement model.

You are given the following at initial recognition for two groups of Easy-Term contracts:

	Group A	Group B
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-directly attributable acquisition expenses	35	35
Risk Adjustment	400	400

(a) **(LO 1a, 1b)** (*2 points*) Explain in general how profit is recognized over the duration of the contract for policies that are directly issued and profitable at issue.

ANSWER:

(b) **(LO 1a, 1b)** (*1 point*) Recommend a contract boundary for Easy-Term. Justify your response.

ANSWER:

(c) **(LO 1b)** (*2 points*) Determine the impact to profit or loss at initial recognition for each group. Show all work.

The response for this part is to be provided in the Excel spreadsheet.

(d) **(LO 1b)** (*3 points*) 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.
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.

ANSWER:

(ii) Calculate the impact of the reinsurance contract to the company.

The response for this part is to be provided in the Excel spreadsheet.

(iii) Determine the impact to profitability to the group of contracts of the reinsurance contract held. Show all work.

The response for this part is to be provided in the Excel spreadsheet.

(e) **(LO 1a, 1b)** (*3 points*) 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.

ANSWER:

B. *Reinsurers are chosen based on the reinsurer's published capital ratio and external ratings.*

ANSWER:

C. *All reinsurance contracts are required to be fully executed by all parties prior to the effective date of the contract.*

ANSWER:

6. Fall 2023 LFMC Exam (LO 1a, 1b)

Relevant 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)

a) **(LO 1a, 1b)** (*3 points*) 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.*

ANSWER:

B. *Identifying onerous contracts will require individual testing of each contract.*

ANSWER:

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.*

ANSWER:

(b) **(LO 1a, 1b)** (*4 points*) 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.

ANSWER:

(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.

ANSWER:

(iii) Costs from a risk and control peer review of ALM processes.

ANSWER:

(iv) An advertising campaign aimed at increasing brand awareness.

ANSWER:

(c) **(Not relevant)** (*5 points*) 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

The response for this part is to be provided in the Excel spreadsheet.

8. Fall 2023 LFMC Exam (LO 2a, 3c)

Relevant 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)

(*10 points*) You are an actuary supporting risk and capital management for ABC Life, which is a federally regulated Canadian life insurance company.

(a) **(LO 2a)** (*4 points*) 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

ANSWER:

B. Set the target to the average of its three biggest competitors' ratios

ANSWER:

C. Set the target considering expected new business

ANSWER:

D. Set the target to 140% of the LICAT total ratio.

ANSWER:

a) **(LO 2a)** (*3 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

b) **(LO 2a, 3c)** (*3 points*) 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.

ANSWER:

(ii) Identify the available options to limit any adverse capital impacts from using unregistered reinsurance.

ANSWER:

Spring 2024 LFMC Exam

2. Spring 2024 LFMC Exam (LO 1a, 1b)

Relevan tSources:

CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts, Jun 2022

(*10 points*) With respect to IFRS 17 discount rates:

(a) **(LO 1a, 1b)** (*3 points*) 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

ANSWER:

(ii) Add a term conversion option

ANSWER:

(iii) Add a waiver of premium benefit

ANSWER:

(iv) Add a return of premium rider that refunds 100% of the last three years of premiums upon termination

ANSWER:

(b) **(LO 1a, 1b)** (*4 points*) 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

The response for this part is to be provided in the Excel spreadsheet.

(ii) Hybrid approach

The response for this part is to be provided in the Excel spreadsheet.

(c) **(LO 1a, 1b)** (*3 point*s)

(i) Explain why an ultimate risk-free rate is needed.

ANSWER:

(ii) Describe the key principles and desirable characteristics when setting the ultimate risk-free rate.

ANSWER:

3. Spring 2024 LFMC Exam (LO 1a, 1b)

Relevant 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

(*10 points*)

(a) **(LO 1a, 1b)** (*5 points*) 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.*

ANSWER:

B. *The risk adjustment reflects impacts of aggregation and therefore may reduce liability cash flows after accounting for diversification benefits.*

ANSWER:

C. *Insurance profits under IFRS 17 are calculated and earned at initial recognition.*

ANSWER:

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.*

ANSWER:

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.*

ANSWER:

3. Continued

(b) **(LO 1a, 1b)** (*5 points*) 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) (*3 points*) Calculate the risk adjustment for DJS.

The response for this part is to be provided in the Excel spreadsheet.

(ii) (*1 point*) Describe the disadvantages of using the cost-of-capital approach for determining the risk adjustment.

ANSWER:

(iii) (*1 point*) Explain why the target return on capital may be different for life insurance and annuity contracts.

ANSWER:

4. Spring 2024 LFMC Exam (LO 4d)

Relevant Sources:

Canadian Insurance Taxation, Swales, et. al., 4th Edition, 2015
• Ch. 4: Income for Tax Purposes – General Rules
• Ch. 5: Investment Income

(*7 points*)
(a) **(LO 4d)** (*1 point*) 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.*

ANSWER:

B. *A Canadian resident insurance company is subject to income tax on all worldwide income.*

ANSWER:

(b) **(LO 4d)** (*2 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

(c) **(LO 4d)** (*4 points*) 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.

ANSWER:

(ii) A corporate bond with fixed semi-annual coupons held at fair value.

ANSWER:

4. Continued

(iii) A share of a corporation where the insurer holds an immaterial interest.

ANSWER:

(iv) Property acquired with the intent of generating rental income.

ANSWER:

5. Spring 2024 LFMC Exam (LO 2a)

Relevant 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) (LO 2a)

(*10 points*) ABC is a Canadian life insurance company that currently invests entirely in provincial bonds with a high degree of duration matching between assets and liabilities.

Upon the adoption of IFRS 17, ABC is considering changes to its investment strategy with the objective of increasing investment returns without increasing net income volatility.

(a) **(LO 2a)** (*7 points*) 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.*

ANSWER:

B. *Acquiring private debt would decrease the IFRS 17 discount rates to reflect the illiquid nature of these assets, which would increase liabilities.*

ANSWER:

C. *High yield bonds are highly correlated with other fixed income assets and would introduce additional interest rate sensitivity.*

ANSWER:

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.*

ANSWER:

5. Continued

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.

ANSWER:

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.

ANSWER:

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.

ANSWER:

~~(b)~~ **(NO LONGER RELEVANT)** ~~(*3 points*) 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.~~

~~*The response for this part is to be provided in the Excel spreadsheet.*~~

6. Spring 2024 LFMC Exam (LO 4e)

Relevant 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)

(*9 points*) Your company is buying a block of insurance business.

(a) **(LO 4e)** (*4 points*) 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			

The response for this part is to be provided in the Excel spreadsheet.

(b) **(LO 4e)** (*4 points*) Using the financial information for the block of business given in the Excel spreadsheet:

(i) Calculate the actuarial appraisal value. Show all work.

The response for this part is to be provided in the Excel spreadsheet.

(ii) Calculate embedded value. Show all work.

The response for this part is to be provided in the Excel spreadsheet.

(c) **(NO LONGER RELEVANT)** ~~(*1 point*) Critique the decision to set the bid price for this block of business at the actuarial appraisal value.~~

~~ANSWER:~~

7. Spring 2024 LFMC Exam (LO 1a, 1b)

Relevant 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

(*8 points*)

(a) **(LO 1a, 1b)** (*4 points*) 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.*

ANSWER:

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.*

ANSWER:

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.*

ANSWER:

D. *The ceded risk adjustment will always be proportional to the direct risk adjustment.*

ANSWER:

7. Continued

(b) **(LO 1a, 1b)** (*4 points*) 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) (*3 points*) 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			

The response for this part is to be provided in the Excel spreadsheet.

(ii) (*1 point*) Recommend whether to proceed with the 50% coinsurance arrangement. Justify your response.

ANSWER:

8. Spring 2024 LFMC Exam (LO 1a, 1b)

Relevant 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)

(*10 points*) MLL is a Canadian life insurance company.

~~(a)~~ **(NO LONGER RELEVANT)** ~~(*6 points*) 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.~~

~~ANSWER:~~

~~(ii) Recommend an approach for applying each of the three key elements of the Holistic Framework to manage systemic risk.~~

~~ANSWER:~~

8. Continued

(b) **(LO 1a, 1b)** (*4 points*) 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.

ANSWER:

9. Spring 2024 LFMC Exam (LO 2c)

Relevant Sources:

Economic Capital for life Insurance Companies, SOA Research paper, Oct 2016 (only sections 2 and 6)

(*8 points*) XYZ Life previously sold only lapse supported whole life insurance and acquired a block of lapse sensitive term life insurance in 2024.

(a) **(LO 2c)** (*2 points*)

(i) Describe the components of an economic capital calculation

ANSWER:

(ii) Describe the economic capital considerations pertaining to the term life acquisition.

ANSWER:

(b) **(LO 2c)** (*3 points*) 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.

ANSWER:

B. For the purpose of determining the lapse designation, XYZ will test whole life and term life on a combined basis.

ANSWER:

C. XYZ is not allowed by regulation to acquire the term block if it would cause capital to decrease below the Internal Capital Target.

ANSWER:

9. Continued

(c) **(LO 2c)** (*3 points*) 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.

The response for this part is to be provided in the Excel spreadsheet.

Fall 2024 LFMC Exam

2. Fall 2024 LFMC Exam (ILA 101 LO 1a-1d, 201I 1a-1b, 2a)

Relevant 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)

(*8 points)*

(a) **(ILA 101 LO 1a-1d)** (*2 points*) Compare and contrast Dukes-Macdonald (DM) and VTP2.

ANSWER:

(b) **(LO1a-1b, 2a)** (*6 points*) 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.

ANSWER:

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.

ANSWER:

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.

ANSWER:

D. Deaths during the grace period can be ignored when calculating mortality deterioration.

ANSWER:

E. The underlying base mortality table used to calculate mortality deterioration should be based on experience data from the term products.

ANSWER:

F. The shape of the underlying base mortality table does not affect how quickly the excess mortality wears off.

ANSWER:

3. Fall 2024 LFMC Exam (LO 2a, 2b, 2c, 3c)

Relevant 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)

(*9 points*)

(a) **(LO 2b)** (*3 points*) Describe the objectives of capital adequacy for each of the following stakeholders with respect to a life insurance company:

(i) Policyholders

ANSWER:

(ii) Regulator

ANSWER:

(iii)Shareholders

ANSWER:

(iv)Company Management

ANSWER:

(b) **(LO 2b. 2c, 3c)** (*4 points*) 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.

ANSWER:

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.

ANSWER:

C. Failing an economic capital calculation could result in a stage 1 early warning intervention by OSFI.

ANSWER:

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.

ANSWER:

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.

ANSWER:

(c) **(LO 3c)** (*2 points*) 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%

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.

ANSWER:

4. Fall 2024 LFMC Exam (LO 2a)

Relevant 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

(*11 points*)

~~(a)~~ **(NO LONGER RELEVANT)** ~~(*3 points*) 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.*~~

~~ANSWER:~~

~~(ii) *The changes to adjustable policies should be based on underlying experience and not on projected future experience.*~~

~~ANSWER:~~

~~(iii) *It is never appropriate to cross-subsidize one policy cohort with another cohort.*~~

~~ANSWER:~~

~~(iv) *Past losses cannot be recovered through future adjustments.*~~

~~ANSWER:~~

4. Continued

~~(b)~~ **(NO LONGER RELEVANT)** ~~(*1 point*) Explain the analysis that the Appointed Actuary is required to prepare for Financial Condition Testing (FCT)~~

~~ANSWER:~~

(c) **(LO 2a)** (*3 points*) 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.

ANSWER:

(ii) Identify actions the Company might take to address unsatisfactory results.

ANSWER:

~~(d)~~ **(NO LONGER RELEVANT)** ~~(*4 points*)~~

~~(i) (*3 points*) 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.*~~

~~ANSWER:~~

~~*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 next year.*~~

~~ANSWER:~~

~~*C. The Company only tested the impact of the most severe risks.*~~

~~ANSWER:~~

~~(ii) (*1 point*) Explain OSFI's objectives in requiring a peer reviewer for the work of the Appointed Actuary~~

~~ANSWER:~~

5. Fall 2024 LFMC Exam (LO 2a)

Relevant 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

(*7 points*)

(a) **(LO 2a)** (*3 points*) 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.

ANSWER:

(ii) Explain the impact on the liabilities on the statutory accounting balance sheet.

ANSWER:

(iii) Describe the implications for the surplus on the statutory accounting balance sheet.

ANSWER:

(b) **(LO 2a)** (*4 points*) 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.
- The risk margin is based on non-market risk.

(i) (*2 points*) Calculate the required capital at time 0. Show all work.

The response for this part is to be provided in the Excel spreadsheet.

(ii) (*2 points*) Calculate the technical provision at time 0. Show all work.

The response for this part is to be provided in the Excel spreadsheet.

6. Fall 2024 LFMC Exam (LO 1a, 1b)

Relevant 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)

(*10 points*) JKL Life is setting IFRS17 discount rates for a newly acquired block of universal life (UL) policies.

(a) **(LO 1a)** (*2 points*) Describe the impact on the illiquidity premium for each of the following UL product features:

(i) No surrender charges

ANSWER:

(ii) Market value adjustments

ANSWER:

(iii) Level cost of insurance (LCOI)

ANSWER:

(iv) Option to add term rider

ANSWER:

(v) Variable interest option with guaranteed minimum interest rate

ANSWER:

5. Continued

(b) **(LO 1a, 1b)** (*4 points*) 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.

ANSWER:

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.

ANSWER:

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.

ANSWER:

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.

ANSWER:

(c) **(LO 1a, 1b)** (*4 points*)

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.

The response for this part is to be provided in the Excel spreadsheet.

7. Fall 2024 LFMC Exam (LO 1a, 1b, 2a)

Relevant 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)

(*8 points*) QRS Life has a portfolio of segregated fund contracts.

QRS employs a static hedging strategy to reduce its exposure to unfavourable movement in the market. The hedging effectiveness is 95%.

Under IFRS17, these segregated fund contracts meet the definition of an insurance contract with direct participation features.

You are given:

- BEL: 4
- RA: 1
- CSM: 20

(a) **(LO 2a)** (*1 point*)

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.

The response for this part is to be provided in the Excel spreadsheet.

(b) **(LO 1a, 1b)** (*7 points*) 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

The response for this part is to be provided in the Excel spreadsheet.

(ii) with the use of the risk mitigation exception, with hedge ineffectiveness reflected in CSM

The response for this part is to be provided in the Excel spreadsheet.

(iii) with the use of the risk mitigation exception, with hedge ineffectiveness reflected in Profit/Loss

The response for this part is to be provided in the Excel spreadsheet.