ILA LFMC Model Solutions
Spring 2020

1.   **Learning Objectives:**
2.   The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.

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

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

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

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

(5a)   Explain and apply methods in determining regulatory capital and economic capital.

Sources:
In Depth - Detailing the new accounting for long-duration contracts of insurers, PWC, Sep 2018

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

Tailoring Global Capital Standards, The Actuary, 2017

Commentary on Question:
This question tested the candidates' knowledge of new accounting standards, IFRS 17 and ASU 2018-12, and the Insurance Capital Standard (ICS).

Solution:
(a)   Compare the methodology and assumptions used to calculate ABC's liabilities under IFRS 17 and ASU 2018-12.

1.   Continued

Commentary on Question:
Candidates did well on this part of the question. Most candidates were able to identify the similarities and differences between IFRS 17 and ASU 2018-12. However, there were candidates who seem to have confused FAS 60 for ASU 2018-12 and did not understand how provisions for adverse deviations were treated under ASU 2018-12.

Calculation of Liability:
IFRS 17: Fulfillment Cash Flows + Contractual Service Margins, where Fulfillment of Cash Flows = Present Value of Future Cash Flows + Risk Adjustment.
ASU 2018-12: Present Value of Future Benefits and Expenses less (Net Premium Ratio x Present Value of Future Gross Premiums), where Net Premium Ratio = minimum (100%, Present Value of Benefits and Expenses / Present Value of Gross Premiums).

Discount Rates:
IFRS 17: Reflects the characteristic of the cash flows arising from the insurance contracts using either the Top-Down or Bottom-Up Approach, where:
Top-Down Approach: the insurer reflects the characteristics of the cash flows by starting with the expected current market return on assets and deducting from that expected current market return the premium that market participants require for bearing the risks, including credit risk, that are associated with those asset returns but are not present in the liability (or are excluded from the measurement of the liability);
Bottom-Up Approach: the insurer captures the characteristics of the cash flows by starting from a risk-free discount rate and adding to that rate an adjustment to reflect the extent of illiquidity present in the group of insurance contracts.
ASU 2018-12: Based on high-quality fixed-income instrument.

Disclosure Requirements: For both IFRS 17 and ASU 2018-12, similar enhanced disclosures are required.

Assumptions: Both IFRS 17 and ASU 2018-12 require current up-to-date assumptions that are reviewed and revised often.

Margins:
IFRS 17: Margins are provided in the risk adjustment and the contractual service margins. The risk adjustment are the adjustments to fulfillment cash flows for the uncertainty of such cash flows. The contractual service margins represent the profit that the company expects to earn as it provides insurance coverage and is recognized in profit or loss over the coverage period as the company provides insurance coverage.
ASU 2018-12: Implicit in the setting of assumptions due to their uncertainty.

1. Continued

Display of Premiums in Income Statements:
IFRS 17: Premiums are not considered to be income and are not reflected in income statements for all lines of business.
ASU 2018-12: Premiums are not considered to be income for some lines of business, like universal life insurance, and are not reflected in income statements, and are considered to be income for other lines of business, like non-participating whole life and accident insurance, and are reflected in income statements.

Treatment of Acquisition Expenses:
IFRS 17: Acquisition expenses are included in the measurement of fulfillment cash flows and implicitly amortized in the contractual service margin.
ASU 2018-12: Acquisition expenses are capitalized and amortized in the DAC (Deferred Acquisition Cost) asset.

(b) Calculate ABC's equity under both ASU 2018-12 and IFRS 17. Assume that the basis of Other Assets is the same under both regimes. Show all work.

Commentary on Question:
Candidates did well on this part of the question. Some candidates failed to show all of their work. Some candidates had difficulty with determining the liability under IFRS 17. A common error was including the present value of cash flows in assets rather than liabilities. Another common error was including both IBNR and the Liability for Incurred Claims in the calculation of liabilities for both IFRS 17 and ASU 2018-12.

Assets:
IFRS 17: Assets = Other Assets = 2000
ASU 2018-12: Assets = Other Assets + GAAP-DAC = 2000 + 100 = 2100

Liabilities:
IFRS 17: Liabilities = Present Value of Cash Flows + Risk Adjustment + Contractual Service Margin + Liability for Incurred Claims
$$= 1000 + 250 + 100 + 475 = 1825$$
ASU 2018-12: Liabilities = Liabilities for Future Policyholder Benefits + IBNR
$$= 1280 + 500 = 1780$$

Equity: Equity for both IFRS 17 and ASU 2018-12 = Assets – Liabilities
IFRS 17: Equity = 2000 – 1825 = 175
ASU 2018-12: Equity = 2100 – 1780 = 320

1. Continued

(c) Critique the following statements regarding the Insurance Capital Standard (ICS) guided by International Association of Insurance Supervisors (IAIS).

A. The main objectives of the ICS are protection of shareholders and to contribute to financial growth.

B. The ICS reflects only insurance and investment risks to which an International Active Insurance Group (IAIG) is exposed.

C. The capital requirement in the ICS is intended to represent a three-year 95 percentile Conditional Tail Expectation (CTE) level of risk.

D. Currently, the only approach being considered to estimate margin over current estimates (MOCE) is the Cost of Capital MOCE approach, which is based on an assumed cost of holding ICS required capital.

Commentary on Question:
Candidates generally did not do well on this part of the question.

A. The correct statement should be: "The main objectives of the ICS are protection of policyholders, not shareholders, and to contribute to financial stability, not financial growth."

B. The correct statement should be: "The ICS reflects all material risks, such as insurance, investment/credit, marketing, and operational risks, to which an International Active Insurance Group (IAIG) is exposed."

C. The correct statement should be: "The capital requirement in the ICS is intended to represent a one-year 99.5% VaR, not a three-year 95% CTE level of risk."

D. The correct statement should be: "Currently, the two approaches being considered to estimate margin over current estimates (MOCE) is the Cost of Capital MOCE (CoC-MOCE) approach; which is based on an assumed cost of holding ICS required capital, and a Prudence MOCE (P-MOCE) approach, which determines a conservative buffer at the 75th percentile of an assumed loss distribution, assuming a normal distribution of losses between current estimate of liabilities (50th percentile) and capital requirements (99.5th percentile)."

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

Learning Outcomes:
(1a)   The Candidate will be able to:
- Compare and apply methods for life and annuity product reserves
- Evaluate, calculate, and interpret liabilities
- Recommend and justify appropriate valuation assumptions

Sources:
LFV-635-13 Participating Account Management and Disclosure to Participating Policyholders and Adjustable Policyholders

CIA Educational Note: Dividend Determination for Participating Policies, Jan 2014

Commentary on Question:
This question tested the candidates' knowledge of the contribution principle and their knowledge of capital, reserving and legislative requirements related to Par products.

Solution:
(a)   DEF is planning the following dividend determination process for First Par:

- *First Par dividends will be updated every three years in order to smooth experience over time.*
- *A single interest rate will be used for all First Par policyholders, regardless of issue date or other policyholder characteristics.*
- *Claims experience gains and losses from all products will be considered.*

Comment on how well the above dividend determination process reflects the contribution principle.

Commentary on Question:
Candidates generally did not make the correct assessments with the first and second statements. Candidates generally did well in assessing the third statement. For statement 1 candidates failed to understand that updating dividends less often than annual does not contradict the Contribution Principle. For statement 2 candidates failed to acknowledge that for a new Par product, using one single interest rate for dividend determination can be appropriate.

2. Continued

- Dividend determination is a process subject to practical constraints, e.g. cost associated with changing the dividend scale, the number of Par policies etc. It is reasonable to examine the dividends less often than annual to gather credible experience data, hence an application of Contribution Principle.
- The interest rate is a policy factor, i.e. pricing interest rate. Using a single interest rate is ok when the same pricing interest rate is used for the First Par product, which is often practical given that this is the first participating product of the company. Hence, it can be considered as an application of the Contribution Principle.
- Claims factor is an experience factor and the company should calculate the claims factors separately for different dividend classes of Par block. The claim experience gains and losses from Non-Par products (such as UL) should not be considered for dividend determination. Hence, using the experience gains/losses from all products would not reflect the Contribution Principle.

(b) You are given the following statements:

A. *Initial sales projections do not justify creating a separate participating account. Hence, there is no need for DEF to create a Par Account Management Policy.*

B. *First Par will have several advantages over the existing UL products:*

- *DEF may claim qualifying par status, reducing LICAT required capital.*
- *DEF can hold lower PfADs on First Par compared to UL products.*
- *DEF will be able to realize a profit margin at 12% regardless of experience, as the full amount of any losses can be offset by reducing dividends.*

C. *DEF will create a Dividend Policy, but it will not be disclosed publicly to reduce the risk of a lawsuit.*

D. *The Appointed Actuary does not need to sign any additional opinions related to the dividends and the company's dividend policy, since there is no Par Account Management Policy.*

Evaluate the above statements

Commentary on Question:
Candidates generally did well on evaluating statements A, C and D. For statement B, candidates generally failed to mention that shareholder transfer of more than 10% is not allowed.

2. Continued

A. Not appropriate. The company must create a separate participating account, as per the Insurance Companies Act (ICA) / Guideline E16. It is not appropriate to comingle assets with UL product. A Par Account Management policy must be created.

B.
- In order to claim qualifying Par status, the company must have a Dividend Policy and it should be publicly disclosed. LICAT capital requirements could be lower due to Par credit.
- ABC may hold lower margins on the Par product, as long as they can demonstrate sufficient adjustability (or dividend room) to absorb the full margins that would be required on a non-participating (or non-adjustable) product.
- The allowable shareholder transfer is defined, and varies from 2.5% to 10%, and is applied to the profit of the participating account. It is therefore not possible to realize a profit margin of 12%.

C. It is true that ABC needs to create the Dividend Policy, but it will need to be publicly disclosed so that it can declare the qualifying Par status.

D. The company must create a separate participating account, and a Par Account Management policy. The Appointed Actuary is required to provide opinion whether the dividend policy and actions are fair and continue to be fair.

3. **Learning Objectives:**

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

Learning Outcomes:

(5a)   The Candidate will be able to:
  - Explain and apply methods in determining regulatory capital and economic capital
  - Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital
  - Explain Canadian regulatory capital framework and principles
  - Explain and apply methods in capital management

Sources:

LFV-645-19: OSFI LICAT Guideline – Oct 2018

CIA Educational note, Currency Risk in the Valuation of Policy Liabilities for Life and Health Insurers, December 2009

Commentary on Question:

This question tested the candidates' knowledge of LICAT.

Solution:

(a)   Calculate the par and non-par allocations of the company's currency risk capital requirement.   Show all work.

Commentary on Question:

A common error was not calculating the potential offset for gold.

Currency	(A): Value of Assets Denominated in Foreign Currency (CAD)	(B) Value of Liabilities Denominated in Foreign Currency (CAD)	(C) Par Liability	(D) Non-Par Liability	(E)Solvency Buffer	(F) Net Position = (A)-(B)
USD	800	990	450	540	40	-190
EUR	270	220	105	115	10	50
GBP	400	300	170	130	12.5	100
CNY	850	800	100	700	55	50
CHF	80	100	40	60	5	-20
GOLD	50	30	20	10	12	20
Total	2450	2440	885	1555	134.5	-10

The offset is defined as a short position of up to 120% of the solvency buffer in each currency.
  - In this example, the USD exposure is negative (short position), so no offset is calculated.

3.   Continued

- The EUR solvency buffer is 10, so the maximum permitted offset is 120% x 10 = 12 for the EUR exposure.
- The GBP solvency buffer is 12.5, so the maximum permitted offset is 120% x 12.50 = 15 for the GBP exposure.
- A 50 offset for the CNY position is used (100% of $50) to reduce the net CNY exposure to zero.
- the CHF exposure is negative (short position), so no offset is calculated.

Currency	(G) Potential Offset =MIN(MAX(A-B,0),120%*E)	(H) Currency position = Net Position – Potential offset
USD	0	-190
EUR	12	38
GBP	15	85
CNY	50	0
CHF	0	-20
GOLD	14.4	5.6
Total	91.4	

Net Position:
Long (CNY, EUR, GBP), : 0 + 38 + 85 = 123
Short (CHF, USD): -20 + -190 = -210
Gold: 5.6

Aggregated Amount = 30%* (MAX(ABS(Long), ABS(Short))+Gold)
= 30% *(Max(123, 210)+5.6) = 64.68

After the total currency risk solvency buffer has been calculated in aggregate, it is allocated by geography in proportion to the contribution of the geography's net long currency position or net short currency positions (depends on which one is used to determine the capital requirement. In this case, it is the net long position) to the aggregate currency risk solvency buffer.

Within a geography, the buffer is allocated between par and non-par blocks in proportion to the share of the liabilities in the geography.

Based on previous step, the total capital requirement of $64.48 is allocated to CHF, and US, because the contribution is calculated using the net short position

Swiss: 64.48* 20/210 = 6.14   (I)
USD: 64.48*190/210 = 58.34 (J)

3. **Continued**

Since the aggregate requirement is determined from the short positions rather than the long positions, none of the requirement is allocated to the China, Europe and UK.

To allocate the solvency buffer to par and non-par within each geography

Geography	Block	Liability	Solvency buffer allocated
Swiss	Par	40	2.46
	Non-par	60	3.68
US	Par	450	26.52
	Non-par	540	31.82

Where for Swiss
Par: 6.14* 40/(40+60)
Non-Par: 6.14 *60/(40+60)
For US
Par: 58.34*450/(450+540)
Non-Par: 58.34*540/(450+540)

(b)   Describe how the following actions reduce required capital for currency risks under LICAT:

(i)   Divest or reduce operations in foreign currency

(ii)   Purchase Options

(iii)   Purchase Forwards

Commentary on Question:
A common error was describing how to apply the actions instead of describing how the actions reduce required capital. Candidates that described how these actions could reduce required capital under LICAT with reasonable explanation generally did well on this part of the question.

- Divest or reduce operations in foreign currency

An insurer doing negligible business in foreign currency, and that does not take foreign exchange positions within its own investment portfolio, may be exempted from the requirement for currency risk provided that:
1) Its foreign currency business, defined as the greater of the sum of its gross long positions, and the sum of its gross short positions in all foreign currencies, does not exceed 100% of total Available Capital; and

3. **Continued**

2) Its overall net open foreign exchange position does not exceed 2% of total Available Capital.
Immaterial operations:
Use internal limits as proxy for positions
Need to monitor actual position
Limits are added, regardless of sign
Can exclude position in question if it is deducted from Available Capital
- E.g. Assets backing surplus e.g. goodwill
- E.g. Asset and liabilities corresponding to foreign operations

- Options

Include any profit/loss in currency exposure
Need to scenario test in identical manner to options for equities in section 5.2.3.3 for the net open position of the currency and the option combined
Range of values to use is +/-30%
Use 3.33 times the largest decline
If largest decline in entire scenario table is greater than decline in middle row, then excess is an additional risk capital requirement

- Forwards

Include net forward position in net open position
Valued using current spot exchange rates and current spot interest rates, not forward
For financial statements, valuation requires use of forward rate, either published or calculated using uncovered interest parity

(c) Define three market risks in LICAT other than currency risk.

Commentary on Question:
Candidates were generally able to identify three risks, but few candidates sufficiently defined the risks.

Market risk arises from potential changes in rates or prices in various markets such as those for bonds, foreign currency, equities and commodities. Exposure to this risk stems from investment and other business activities that create on- and off-balance sheet positions.

Interest rate risk
The risk of economic loss resulting from market changes in interest rates. The most significant aspect of this risk is the net effect of potential changes in interest rates on the values of interest-sensitive assets and liabilities whose cash flows may be mismatched.

3. Continued

Equity risk
The risk of economic loss due to potential changes in the prices of equity investments and their derivatives. This includes both the systematic and specific components of equity price fluctuation.
Real estate market risk is the risk of economic loss due to changes in the amount and timing of cash flows from investment property, and holdings of other property, plant and equipment.

Mutual funds risks
The risk on the absence of specific limits to asset classes or if the fund is in violation of the limits stated in the prospectus. The factor for investments in unleveraged mutual funds, exchange traded funds, segregated funds and real estate investment trusts is a weighted average of the market and credit risk factors for the assets that the fund is permitted to invest in.

Index-linked product risks
The risk related with the return guarantees and defaults on the assets backing index-linked products. May include credit risk associated with fixed income securities and counterparty risk associated with derivatives that are purchased under the synthetic strategy.

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

Learning Outcomes:
(1a)   The Candidate will be able to:
- Compare and apply methods for life and annuity product reserves
- Evaluate, calculate, and interpret liabilities
- Recommend and justify appropriate valuation assumptions

Sources:
Canadian Insurance Taxation, Ch. 10 & 11

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

Solution:
(a)   With respect to Prescribed Annuity Contracts (PACs):

        (i)   Identify the categories.

        (ii)   Briefly describe the taxation of PACs.

        Commentary on Question:
        This part of the question tested the candidates' knowledge of policyholder taxation rules on annuity products.

        (i)   PACs can be either registered or non-registered.
                 Registered contracts include contracts like RPPs or RRSPs.
                 Non-registered contracts must be an annuity certain or in payout phase. It must provide for equal benefit payments made no less frequently than annually. The annuitant must be the holder of the annuity. The contract has to be issued by a financial institution.

        (ii)   For registered contracts, no tax is payable in the deferral stage, and 100% of the payments are taxed in the payout phase.
                 For non-registered contracts, payments are taxed net of the capital portion, where the capital portion equals

                 Annuity payment x adjusted purchase price / total payments to be made.

                 Adjusted purchase price = ACB.

4. **Continued**

The final payment before death is prorated between a pre-death and post-death amount, and the post-death portion is taxed as income to the beneficiary.

(b) You are given the following information for two annuity contracts issued January 1, 2015:

	Annuitant 1	Annuitant 2
Accumulating Fund, previous anniversary	10,000	10,000
Accumulating Fund, current anniversary	9,800	0
Mortality Gain/Loss	200 Gain	9,600 Loss

Assume:

- The contracts are in the payout period.
- Annual annuity payment = 1,000
- The Accrual Method is used to calculate the taxable income.
- Annuitant 1 survives the year
- Annuitant 2 dies just before the end of the policy year, with no further amounts payable.

For each contract:

(i) Calculate the taxable amount of income in the current policy year and the adjusted cost basis (ACB) at the beginning of next policy year.

(ii) Describe the benefit of electing PAC treatment.

Commentary on Question:
This part of the question tested the candidates' knowledge of the accrual method. Candidates generally did well on this part of the question.

Conventions
AF_t - Accumulating fund at beginning of year t.
ACB^t_{BOY} – Adjusted cost basis, beginning of year t
ACB^t_{EOY} – Adjusted cost basis, end of year t.

Annuitant 1
Income = Payment - mortality gain – $(AF_0 – AF_1)$
= 1,000 - 200 – (10,000 – 9,800) = 600
$ACB^0_{EOY} = ACB^0_{BOY}$ + mort gain – payment
= 10,000 + 200 – 1,000 = 9,200   ACB at end of current policy year
$ACB^1_{BOY} = ACB^0_{EOY}$ + income =

4. **Continued**

$ACB^1_{BOY} = 9{,}200 + 600 = 9{,}800$ ACB at beginning of next policy year

Annuitant 2
Income = Payment - mortality gain $- (AF_0 - AF_1)$
$= 1{,}000 + 9{,}600 - (10{,}000 - 0) = 600$

$ACB^0_{EOY} = ACB^0_{BOY}$ + mort gain – payment
$= 10{,}000 - 9{,}600 - 1{,}000 = -600$ ACB at end of current policy year

$ACB^1_{BOY} = ACB^0_{EOY}$ + income =
$ACB^1_{BOY} = -600 + 600 = 0$ ACB at beginning of next policy year

(c)   You are given the following information for two Canadian life insurance policies:

Date policy acquired	CSV	Policy Loan	ACB	Tax Rate
01-Jul-83	10,000	5,000	6,000	35%
01-Jul-82	20,000	0	12,000	40%

Calculate the tax payable on each policy for a full surrender.

Commentary on Question:
Candidates generally did well on this part of the question. A common error was calculating the tax payable assuming a partial surrender.

Taxable amount = Proceeds on disposition less the ACB
Proceeds are net of policy loan
Taxable income is floored at zero.

Policy acquired in 1983:
Proceeds = CSV – Loan
$= 10{,}000 - 5{,}000 = 5{,}000$
Taxable income $= 5{,}000 - 6{,}000 = -1000$
As proceeds are negative, no tax is payable

Policy acquired in 1982:
Proceeds $= 20{,}000 - 12{,}000 = 8{,}000$
Tax payable $= 8{,}000 * 40\% = 3{,}200$

5.

Learning Objectives:

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

Learning Outcomes:

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

Sources:

CIA Educational Note: Best Estimates Assumptions for Expenses – November 2006

CIA Standards of Practice: Insurance Sections 2100, 2300, 2400, 2500 & 2700, Feb 2018

Commentary on Question:

This question tested the candidates' knowledge in setting expense assumptions.

Solution:

(a) Evaluate the appropriateness of the following CALM valuation expense assumptions for a life insurance block of business:

  A. *The best estimate annual maintenance expense assumption is 60 per policy. This is based on the most recent expense study of the company. This includes expenses incurred to sell and underwrite policies, to perform the administration of the policies, and to pay claims. It does not include any overhead expenses or expenses associated with policyholder dividends.*

  B. *The maintenance expense inflation rate is 3% per year.*

  C. *Commissions and premium taxes are included separately in the valuation and are not subject to inflation.*

  D. *A margin for adverse deviation of 15% is applied to all expenses.*

  E. *Investment expenses for the assets supporting the liability are not included in the valuation.*

  Commentary on Question:
  Candidates generally did well on this part of the question. Candidates understood the concepts of maintenance expenses, premium tax and commissions and made appropriate evaluations. Common errors were omitting that the inflation rate should be linked to the interest rate scenario for statement B and that no margin should be applied to premium tax and commissions for statement D.

5. **Continued**

Statement A:
- Unit to measure different expenses vary, with per policy units often used for maintenance expenses
- Best estimate assumptions and are usually assessed using an expense study. Best estimate assumptions are generally based on experience, after determining prior experience is a good basis for future expected experience.
- Sale and underwriting expenses should not be included since they are acquisition expenses, not maintenance expenses
- Policy administration expenses are correctly included
- Claims expenses are more often expressed by number of claims than by policy. Using policies in force to unitize claim expenses may cause materially different GAAP policy liabilities than using the number of claims. In this case, the valuation actuary may adjust the valuation results by moving unit expenses to be based on number of claims or making a manual adjustment to projected cashflows.
- Some allocation of overhead expenses would be included in the maintenance expense assumption.
- Expenses related to policyholder dividends should be included, dividends are part of the policy administration.

Statement B:
- The rate of expense inflation should be consistent with the interest rate scenario

Statement C:
- It is common to include commissions and premium taxes separately in the valuation.
- Commission and premium tax rates are not usually subject to inflation

Statement D:
- No MfAD is applied to commissions and premium taxes, as the expense rate is known.
- The 10% MfAD is at the high end of the range for expenses since the range is between 2.5% to 10%. 5% MfAD is more appropriate.

Statement E:
- Investment expenses on assets supporting the liabilities should be included in the valuation

5. Continued

(b) The company is implementing an initiative that is expected to reduce the annual maintenance expense by 5 per policy.

Describe four considerations in updating the valuation expense assumption.

Commentary on Question:
Candidates generally focused on listing the steps in setting up assumptions and models, instead of the considerations, such as the impact of productivity improvement, inflations, and confidence in forecast.

- A particular insurer may have an expectation of reduced expense rates, but the actuary would anticipate only a reduction which is forecasted with confidence.
    - o In determining "forecasted with confidence", the actuary should consider whether management has a clear plan for reducing expenses, as well as a prior history of successfully reducing expenses.
    - o Future productivity gains are assumed for only a temporary period. The temporary period is one for which there is reliable evidence that the actuary may forecast with confidence
- If the actuary is partially, or wholly, offsetting inflation by expected productivity gains, the actuary ensures that the net inflation assumption is consistent with the economic scenario.
- If the expected productivity improvements are based on future investments by the company, then those investments (or their depreciation charges where capitalized) are included in the future projected expense cash flows.
- If the expected productivity improvements are based on recent past investments (including integration expenses arising from an acquisition), it may be useful to remove the investment from the experience used to determine the unit expenses and analyze the initiative separately.
- The actuary considers the effect of productivity improvements or deterioration in different lines of business and special situations to ensure that the net productivity assumption in the valuation is reasonable in the aggregate. Dynamic Capital Adequacy Testing (DCAT) or other strategic planning projections may be a good source of information to assess the reasonableness of planned productivity improvements.

6. **Learning Objectives:**
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Learning Outcomes:
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- Evaluate, calculate, and interpret liabilities
- Recommend and justify appropriate valuation assumptions

Sources:
CIA Standards of Practice: Insurance Sections 2100, 2300, 2400, 2500 & 2700, Feb 2018

CIA Educational Note: Investment Assumptions Used in the Valuation of Life and Health Insurance Contract Liabilities Sep.2015

Commentary on Question:
This question tested the candidates' understanding of CALM, particularly on setting assumptions.

Solution:
(a)   Evaluate the following statements with respect to CALM valuation:

> *A. The contract liability for a particular scenario is equal to the present value of the net liability cashflows discounted using risk free rates plus an appropriate margin.*

> *B. The contract liability for a block of business must be set to the maximum of the amount calculated under the prescribed scenarios.*

> *C. Each assumption is expressed in terms of a best estimate plus a margin for adverse deviation.*

> *D. The term of the liability is equal to the contractual term of the policy.*

> **Commentary on Question**:
> *Candidates were generally able to receive at least partial credit on this part of the question.*

6. Continued

A. False.
Liability is equal to amount of assets forecast to reduce to zero at the end of the projection period; Each scenario includes a projection of risk- free rates plus appropriate margins (0 for risk-free assets).

B. Could be true, but not necessary;
The actuary should consider other scenarios which are appropriate to the circumstances of the company; The actuary could also determine reserves using a stochastic process

C. Partially true.
This is true for non-scenario tested assumptions; There is no margin included for scenario tested assumptions

D. False.
Term of the liability ends at earlier of: First renewal date after the valuation date at which there is no constraint and Renewal date that maximizes the reserve; Term can be extended to recover acquisition costs if assumed in pricing of product

(b) List four considerations for setting an appropriate valuation investment strategy assumption.

Commentary on Question:
Candidates generally did not do well on this part of the question.

Investment strategy considers the following elements:
Reinvestment activity
Disinvestment activity
Term of invested assets
Reinvestment and disinvestment assumptions should be consistent with the expected activity of the company
Strategy should not assume any increased risk
Strategy should not consider any future new business

(c) You are calculating CALM reserves for a life insurance portfolio that is backed solely by fixed income bonds. The company has decided to add a portfolio of diversified North American common shares to the fixed income assets. You have good historical data for these shares.

(i) Describe considerations for determining the valuation assumptions used for equity returns.

(ii) Describe changes to the investment strategy used in valuation due to the addition of equities.

6. **Continued**

(i)   Best estimate return should be based on historical average
Margin set at 20% of best estimate capital gains return
In addition, a one- time market correction of 30% would be assumed.
Timing would be determined by testing.
Margin for dividend return set at a level between 5-20%
Since liab CF not linked to NFI assets, Additional provision such that the percentage of NFI assets does support no more than 20% of CF for the first 20 years and 75% thereafter

(ii)   Reinvestment scenario can be adjusted to allow for NFI assets, but not exceeding the percentage allowed in the company's investment policy at each duration

(d)   Determine the net credit spread after margin using Approach I as described in the applicable CIA Educational Note at:

(i)   Time 0

(ii)   End of year 3

(iii)   End of year 20

Show all work.

Commentary on Question:
Candidates were generally able to receive at least partial credit on this part of the question. Candidates generally calculated the correct credit spread at time 0 but struggled calculating the credit spread at year 5 and year 30.

Best estimate credit spread: Grades linearly from 130 bps to 110 bps over 5 years
Credit spread Margin = 10% of 110 bps = 11 bps
Credit spread net of margin: Grades linearly from 130 bps to 99 bps over 5 years
Default provision = 10bps * (1+50%) = 15 bps
Credit spread net of margin and default = 115 bps grading to 84 bps over 5 years
Since 84 bps is > long term average of 75 bps, spread linearly grades from 84 bps to 75 bps from years 5 to 30.

6.   Continued

Year 0 = 115
Year 3 = 115 - (115 - 84) * (3/5) = 96.4
Year 20 = 84 - (84 - 75) * (15/25) = 78.6
Note that actuary should test if interpolation between years 5 and 30 is
conservative. If it is not, they should not interpolate.

7.   **Learning Objectives:**
2.   The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.

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

Sources:
Can-2-8, LFM-649-20 IAN 100 Application of IFRS 17 (exclude Section D), Jan 2019

Can-2-5, IFRS 17 Insurance Contracts Example (Spreadsheet Model)

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

Solution:
(a)
(i)   Outline the terms of the IFRS 17 Standard that indicate when discounting can be used in the determination of coverage units.

(ii)   Explain the impact that the use of discounting coverage units would have on the pattern of income in future time periods.

Commentary on Question:
For part (i) candidates generally provided a few examples of where discounting can be used in the determination of coverage units. To receive full credit, candidates had to indicate that the standard does not specify if discounting should be used to determine coverage units or not.

Candidates generally did well on part (ii). To receive full credit, candidates had to explain the impact on the pattern of income (not only the impact on CSM).

(i)   IFRS 17 does not specify whether discounting should be used in the determination of coverage unit or not. IASB concluded that this should be a matter of judgement.

(ii)   Discounting coverage units for future service will reduce the relative weighting in future time periods when calculating the CSM amortization factor. Therefore, using discounting will increase the amount of CSM released in earlier time periods and accelerate the emergence of profit.

7. Continued

(b)   You are given the following statement with respect to IFRS 17:

> *For a UL Policy where the death benefit is the Face Amount plus the Account Value, we recommend using the face amount to determine coverage units for this type of contract because the future Account Values are uncertain.*

Evaluate the appropriateness of this recommendation. Justify your response.

Commentary on Question:
Candidates were generally able to identify that only using FA to determine coverage units is not appropriate. Full credit was received if candidates provided the justification of why FA + AV should be used in determination of the service units.

It is not appropriate to use only face amount to determine the coverage units for this product. Coverage units reflect "*the quantity of the benefits provided under a contract and its expected coverage duration*". The Account Value is part of the benefits provided should the insured event occur. Therefore, the appropriate coverage units should be determined based on the total amount of (FA + AV).

(c)   Calculate the contractual service margin at the end of year 2. Show all work.

Commentary on Question:
There were two common errors on this part of the question.
1. *The CSM amortization factors were calculated as (current service)/(the sum of services unit for year 1-3). That is, the denominator was the sum of services unit for all three years instead of (current service + future service);*
2. *Survivorship was not considered when calculating the current service coverage units. Partial credit was received if the CSM amortization factors were calculated correctly.*

Candidate generally identified 3% as the locked-in rate.

The calculations for year 3 are provided for illustration only and were not required to receive full credit.

7. Continued

Year	1	2	3
Coverage Unit	1200	1210	1221
Survivorship	100%	100%*(1-5%) = 95%	95%*(1-5%) = 90.3%
Current Service	1200*100% = 1200	95%*1210 = 1150	90.3%*1221=1102
Future Service	1150+1102=2252	1102	0
Current Service + Future Service	1200+2252=3451	1150+1102=2252	1102+0=1102
CSM amortization factor	1200/3451=35%	1150/2252=51%	1102/1102=100%
CSM at period start	100	67.19	33.87
CSM interest accretion	100*3%=3	67.19*3%=2.02	33.87*3%=1.02
CSM amortization	103*35%=35.81	(67.19+2.02)*51%=35.33	(33.87+1.02)*100%=34.89
CSM at period end	103-35.81=67.19	(67.19+2.02)-5.33=33.87	0

8. **Learning Objectives:**
6. The candidate will understand important insurance company issues, concerns and financial management tools.

Learning Outcomes:
(6a) The candidate will be able to describe, apply and evaluate considerations and matters related to:
- Insurance company mergers and acquisitions
- Sources of earnings
- Embedded Value determinations
- Rating agency considerations

Sources:
Comm 5-6: Insurance Industry Mergers and Acquisitions, Chapter 4 (Sections 4.1-4.6)

Commentary on Question:
This question tested the candidates' understanding of the techniques used to evaluate a possible merger and/or acquisition opportunity. Candidates had to distinguish appropriate methods for quantitatively evaluating the opportunity and why those methods were appropriate.

Candidates determined an actuarial appraisal value and justified the adjustments to that value given certain differences between the companies involved in the transaction. This required an understanding of the components of the actuarial appraisal as well as the assumptions used.

Solution:
(a) Describe the three basic techniques used by investment bankers to value life insurance companies.

Commentary on Question:
Candidates generally did well on this part of the question. To receive full credit, candidates were expected to describe the key characteristics of the three different valuation methods.

1) Comparable Company Analysis
- Applies relevant financial statistics of the selling company to appropriate multiples of companies that are deemed to be comparable and for which a valuation exists to generate an implied range of values
- No company is identical so outcome is subjective (includes judgement)
- Peer group that is large and has similar accounting/tax framework and core business segments

8. **Continued**

    2) Comparable Transaction Analysis
- Review financial data relating to relatively recent insurance merger transactions of similar size in terms of deal value
- Involves companies in similar sectors, subsectors, or lines of business
- Adjustments made to compute range (subjective in nature)

    3) Discounted Cash Flows
- Estimates present value of future after-tax cash flows for foreseeable future (about 5 years)
- Estimates total cash flows produced after 5 years (using P/E ratio)
- Weighted average cost of capital (WACC) is typically used as the discount rate, with sensitivities performed to provide a range

(b) Identify four components that are included in the determination of the Adjusted Book Value (ABV) of a company.

Commentary on Question:
Candidates generally did not do well on this part of the question. Most candidates were only able to identify a company's net worth as a component of the ABV. To receive full credit candidates had to identify 4 of the 7 components below.

The ABV represents the net worth of an insurance company on a statutory basis with certain adjustments for liabilities or non-admitted assets that are in the nature of surplus. The major items that comprise the ABV are the following:

1) Capital and surplus: statutory capital stock, contributed surplus, and retained earnings (net worth)

2) Asset Valuation Reserve: capital set aside to cover equity and credit losses, determined based on distribution of asset portfolio.

3) Interest Maintenance Reserve: represents past interest-related capital gains that have not yet been amortized into income.

4) Deferred Tax Asset: tax-affected differences between statutory and tax carrying values

5) Non-admitted assets: recognize the realizable value of assets that have been non-admitted for statutory purposes (e.g. furniture and equipment for agents)

6) Surplus notes and other debt: recognize debt (at holding company level, internal and external surplus notes) in actuarial appraisal

8.   Continued

   7) Marked to Market assets: reflect the market value of assets in value since looking for distributable cash flows for both surplus and liabilities

(c)   Company B assumed the following terminal valuations in Year 5:

- After-Tax Future Book Profits = 170
- Cost of Required Capital = 30

Determine the actuarial appraisal value of Company B using the assumptions above.

Commentary on Question:
Candidates generally did well on this part of the question. Most candidates were able to correctly calculate the Value of In-force Business and Value of New Business. A common error was not using the after-tax investment earnings rate when determining the cost of capital.

Actuarial Appraisal Value (AAV) = Adjusted Book Value (ABV) + Value of Inforce Business (VIB) + Value of New Business (VNB) - PV Cost of Capital (CoC)

$v = 1/1.10$

VIB + VNB = $6*v + 3*v^2 + 8*v^3 + 10*v^4 + 170*v^5 = 126.33$

Coc Rate = c = Discount Rate - Investment Earnings Rate * (1- Tax Rate) = 10% - 5%*(1-21%) = 6.05%

PV CoC = c * ($15*v + 20*v^2 + 22*v^3 + 25*v^4$) + $30*v^5$ = 22.49

AAV = 40 + 126.33 - 22.49 = 143.84

(d)   Recommend three adjustments Company A should consider making to the valuation of Company B in part (c). Justify your answer.

Commentary on Question:
Candidates generally identified the factors that could result in an adjustment. However, candidates generally struggled in justifying how such factors would affect the appraisal value.

8. Continued

       1) Since the companies use the same administrative system vendor, there could be synergies associated with implementing new products and managing inforce business, increasing perceived value. Similarly, the newer product offerings may be attractive for the existing client base, increasing perceived value.

       2) Company A has a larger distribution channel than Company B and may be able to achieve a larger new business contribution than Company B projected, thereby increasing the perceived value.

       3) Company A's lower beta would justify a lower discount rate under CAPM, thereby increasing the perceived value.

(e) Since Company B reports on U.S. GAAP, the investment bankers suggest that U.S. GAAP financials should be used in the actuarial appraisal. Critique this suggestion.

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

It is not appropriate to use U.S. GAAP financials for an actuarial appraisal. Statutory earnings and capital, not GAAP earnings and equity, define the cash flow available to be distributed to owners of a company.

9. **Learning Objectives:**

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

Learning Outcomes:

(5a) Explain and apply methods in determining regulatory capital and economic capital.

Sources:

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

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

Commentary on Question:

This question tested the candidates' knowledge of statutory capital and economic capital. Candidates were expected to answer from a SPIA perspective.

SPIA is assumed to be a product where single premium exchanged for life contingent payments with a variety of single and joint payment options and varying amounts to survivors, certain periods or refund features. Portions of a SPIA business may also have some non-life contingent payments in the form of payouts for a set number of years.

An actual company of this type might consider offsetting the longevity risk of SPIA business with the mortality risk of life business. NAIC is currently working to add an RBC longevity charge which will further encourage risk offsetting. In economic capital, offsetting is already occurring through the stochastic modeling of mortality.

Solution:

(a) Assess the treatment of the key risks for SPIA under each of the following:

(i) Economic capital

(ii) Statutory risk-based capital

Commentary on Question:

In this part of the question, candidates were to elaborate on capital with the information that the company sells primarily SPIA and has been using statutory capital.

9. Continued

Only key risks were requested. Some candidates described the RBC framework of C0-to-C4 factors and applicable categories which received partial credit. A few candidates discussed disintermediation risk that would be applicable to deferred annuities but not immediate annuities. A few candidates confused longevity (risk of death later than expected) for mortality (risk of death earlier than expected). A few candidates incorrectly mentioned COVID-19 as an event that would reduce profitability in existing SPIA business. A few candidates identified cures for major diseases (or other mortality improvements) as events that might reduce profitability in existing SPIA business.

Of the following six points any four receive full credit:

- Key SPIA risks are investment and longevity
- Risk-Based Capital (RBC) includes for investment risk, specifically duration mismatch, in C3-factors & C3-analysis
- RBC has no capital charge currently for longevity in C2-factors
- Factor-based capital models (RBC), by ignoring inherent mortality volatility, could potentially understate future economic capital. This shortcoming can be overcome with a principles-based approach that uses stochastic techniques and dynamic assumptions for mortality and other variables.
- When static assumptions are used to calculate economic liabilities the reserve results tend to converge around a mean. If dynamic assumptions are used instead the tail percentile values show a much wider dispersion, leading to a better understanding of the risk profile.
- Assessment: RBC may underestimate the amount of capital needed for longevity risk compared to the amount of economic capital needed.

(b) Critique the following statements related to the capital needed for PCLC's SPIA product:

A. *VaR is preferable over CTE because it recognize and allocates diversification benefits.*

B. *The liability runoff approach uses the preferred time horizon because of the importance of finding the amount of capital today that will provide sufficient protection for the lifetime of the portfolio.*

C. *The use of an economic valuation method provides the best assessment of risks across different companies and countries regardless of any regulatory or accounting framework.*

D. *If PCLC holds 400% of total RBC for its SPIA block the surplus will be sufficient to cover all the future benefits.*

9. Continued

Commentary on Question:
In this part of the question candidates were to critique the statements while connecting the answer to the company and the specific characteristics of the SPIA product. Candidates that did well critiqued the statements from the perspective of the company and the SPIA product.

For full credit, a rationale for true or false and some tie to characteristics of SPIA is necessary. The following sentences for each statement are somewhat more than what would be needed for full credit on that statement:

A. False. SPIA is long-tailed business and CTE better captures tail events, recognizes diversification with other benefits and is also coherent. However, VaR is easier to implement and explain to a non-technical audience since an economic view would be new for PCLC.

B. False. Given SPIA is long-duration, providing sufficient capital over the long-term is important. The time horizon needed may be longer than a finite risk horizon. Liability runoff approach attempts to find the amount of capital today that will provide sufficient protection for the lifetime of the portfolio, thus ignoring the reality that capital levels will be annually reevaluated. Interim solvency checks would need to be implemented. Liability runoff approach can give insufficient recognition of the ability to control risk through asset/liability trading. Liability runoff approach may have management actions though they are difficult to anticipate over the lifetime of the business.

C. False. These bases may not be appropriate for all insurance products, especially SPIA. Risk-free rates and the short-term market volatility may be inappropriate for long duration annuities, and they do not appropriately recognize insurer's ability to hold assets and liabilities for the long term. Company-specific assumptions make comparisons across companies and countries extremely difficult.

D. False. Statutory (RBC) does not necessarily capture all the risk. The risk charge for longevity applicable to SPIA is 0 in the current framework. RBC is only for purposes of checking whether regulatory activity might be needed and is only valid for a point in time.

9. Continued

(c)

    (i)   Calculate the economic capital for PCLC's asset and longevity risk. Show all work.

    (ii)   Explain the relationship between the statutory capital and economic capital for asset risk.

    (iii)   Explain the relationship between the statutory capital and economic capital for longevity risk.

    (iv)   Recommend an appropriate risk capital approach using the total asset requirement for the SPIA product. Justify your response.

Commentary on Question:
In this part of the question candidates were to interpret the data and perform calculations for economic capital (all statutory capital numbers are provided). Common errors included picking the highest of the 10 stochastic simulations when the 90th percentile is the second highest out of the 10; and calculating the economic reserves as the average discounted at 4.5% instead of the other set of values discounted at 5.0%. Few candidates correctly calculated the economic capital total asset required.

Note that a positive value was listed for statutory capital for longevity risk even though in part a) and part b) it was indicated there is no RBC factor for longevity currently. The correct interpretation is to use the given value.

    (i)   Average economic liability $^{@}$5.0% = 104.5
            90th percentile of economic liability $^{@}$5.0% = 108
            90th percentile of economic liability $^{@}$4.5% = 110

        From the values already know economic TAR = 110 and reserve = 104.5, now have to uncover how much of 5.5 is longevity (walk up percentiles) and how much is asset (walk across discount rates).

        Economic:
        Capital for asset risk = 90th $^{@}$4.5% - 90th $^{@}$5.0% = 2 (=110 – 108)
        Capital for longevity risk = 90th $^{@}$5.0% - Ave $^{@}$5.0% = 3.5 (=108 – 104.5)

	Economic	Statutory
Reserve =	104.5	99.0
Capital for asset risk =	2.0	2.0
Capital for longevity risk =	3.5	1.0
Total Asset Required =	110.0	102.0

9. Continued

        (ii)   For asset risk, economic and statutory are the same because the supporting assets earn the statutory interest rate and the company enters into a total return swap. Statutory discount rate of 5.0% minus 0.5% total return swap rate results in economic discount rate of 4.5%. Economic and statutory frequently differ as economic relies on stochastic model results and statutory relies mostly on factors multiplied by exposures.

        (iii)   For longevity risk, economic is higher than statutory because statutory does not reflect mortality volatility and uses a static/prescribed mortality assumption. Economic with the tail percentile value show a much wider dispersion of results. Economic better captures the risk profile.

        (iv)   Statutory Total Asset Required = 102 (= 99 + 2 + 1)
Economic Total Asset Required = 110 (=104.5 + 2.0 + 3.5)

              Recommend Economic Risk Capital approach to better capture the SPIA risk profile. Statutory doesn't fully capture longevity.

(d)

        (i)   Construct a multi-tiered capital objective for PCLC assuming it takes a statutory view.

        (ii)   Explain how the multi-tiered capital objective would be different if PCLC took an economic view.

Commentary on Question:
In this part of the question candidates were to create and explain multi-tier structures for statutory and economic capital. Full credit was received by identifying multiple stakeholders and some kind of reasonable capital objective to satisfy the stakeholder. For statutory capital, some candidates merely listed the various RBC regulatory action levels as the multi-tier structure. For economic capital, some candidates merely listed different levels of VaR or CTE as the multi-tier structure.

There are different stakeholders to satisfy who have differing objectives that might not be consistent across tiers. For example, policyholders want claims and obligations paid and do not care about debtholders or shareholders, while debtholders want debt repaid and does not care about the policyholder or the shareholder. Tiers reflect that the policyholder is always first.

9. Continued

(i) Statutory multi-tier capital objective

Tier	Stakeholder	Objective
1	Policyholders	Meet Policyholder cash flows at they fall due with a 95% certainty over the life of the business
2	Debtholders	Meet debt payments as they fall due with 90% certainty
3	Operational Company	Ensure regulatory capital ratio above 200% Authorized Control Level over the next five years

(ii) Economic multi-tier capital objective

Tier	Stakeholder	Objective
1	Policyholders	Meet Policyholder cash flows at they fall due with a 95% certainty over the life of the business
2	Rating Agencies	Maintain capital to support or exceed current rating level with a 90% certainty
3	Operational Company	Ensure Objective 2 is met with an 80% certainty over the next five years

For PCLC, economic capital will generally exceed statutory capital due to a more complete risk view, especially longevity risk applicable to SPIA. In addition, rating agencies, as a part of economic capital, behave as a business governor when the company is still well above regulatory action levels that are part of statutory capital.

10.

Learning Objectives:

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

Learning Outcomes:

(1a) The Candidate will be able to:
- Compare and apply methods for life and annuity product reserves
- Evaluate, calculate, and interpret liabilities
- Recommend and justify appropriate valuation assumptions

Sources:
CIA Draft Ed note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life & Health Insurance Contracts

OSFI LICAT Guideline, Chapters 1 - 11, October 2018

Commentary on Question:
This question tested the candidates' knowledge of LICAT required capital, risk adjustment for non-financial risks and calibration using LICAT.

Solution:

(a) Describe the considerations in using the margin approach to determine the risk adjustment.

    (i) List the three elements required for using the cost-of-capital approach to determine the risk adjustment.

    (ii) Identify any adjustments to the capital basis which may be required to support calculating a cost-of-capital risk adjustment.

Commentary on Question:
Candidates generally did well on this part of the question. A common error was describing different approaches in calculating required capital.

- Margin would need to be reported at a group level. At a minimum, there will be two groups: life and annuities.
- Would need to determine if the level of margin is consistent with the entity's overall risk profile
- Would need to reflect diversification between life, annuity blocks. Could be done through use of correlation matrices.
- Would need to ensure that that the margins are appropriate both for gross insurance and for ceded liabilities. This may require a change if the reinsurance is not proportional.
- Testing may be required to determine sign of the margin.

10. Continued

- Confidence level would need to be separately determined. This would have to be consistent with the aggregate Risk Adjustment required by the Company.
- IFRS 17 provides no direction regarding the discounting of the RA, the risk adjustment for non-financial risk is conceptually separate from the estimates of future cash flows and the discount rates that adjust those cash flows. The use of discounting (or not) and the methodology to determine discount rates are at the discretion of the entity. Regardless of the discounting methodology chosen, the actuary would maintain a consistent methodology between different reporting periods.
- Margins would be recalibrated in the event that aggregate RA landed outside the defined confidence level range.

(b) Describe how the IFRS 17 disclosure requirements related to the confidence level of the risk adjustment may be satisfied under each of the following methods:

(i) Quantile technique

(ii) Cost-of-capital approach

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

When a quantile technique is the primary method for determining the risk adjustment, the confidence level is a direct input, and so the disclosure requirement is thereby satisfied

When the cost of capital approach is the primary method for determining the risk adjustment, a secondary method is required to quantify the confidence level. This usually requires knowledge of the underlying distribution of the PV of cash flows. For example, a normal distribution could be assumed if appropriate. Alternatively, if a second point on the distribution can be identified (such as that implied by LICAT), the confidence level of the risk adjustment can be extrapolated

(c) Calculate the confidence level corresponding to the risk adjustment to the nearest 5%. Show all work.

Commentary on Question:
Candidates generally did not do well on this part of the question. Candidates generally failed to demonstrate that for the risk adjustment, the sum of level and trend risk for mortality, longevity and lapse risks could reasonably be assumed to represent a lifetime 85th percentile shock.

10. Continued

The question provided several "PV of CFs". The description was ambiguous enough for candidates to interpret the PV to include one or both product lines. As a result, candidates received full credit if the calculation of the various components used the BEL of the individual product line or the BEL of the two product lines.

1. Mortality Risk Component
   Mortality Volatility Risk (MVR) = 2.7 *A* E/ F = 2.7 * 38 * 2,000/3,500 = 59
   Mortality Level Risk (MLR): The mortality level risk component is the difference between the present value of shocked cash flows and the present value of best estimate cash flows, determined separately for life and death supported business
   shock factor = Min(25%, 11% + 20% * volatility RC/next year's expected claims = Min(25%, 11% + 20% * 59/400) = 14%
   MLR = (113 – 60)/10% * 14% = 74
   (Full credit was received for using a BEL of 100 instead of 60)
2. Mortality Trend Risk (MTR) For life supported product, the trend risk shock for life supported business is a permanent 75% decrease to the Best Estimate Assumption for mortality improvement for 25 years, followed by no mortality improvement (i.e., a 100% decrease) thereafter.
   MTR = 120 – 60 = 60
   (Full credit was received for using a BEL of 100 instead of 60)
3. Longevity Level Risk (LLR) Registered annuity business –shock by -10%, Non-registered annuity business – shock by -20%
   (25+40) - 40 = 25
   (Full credit was received for using a BEL of 100 instead of 40)
4. Longevity Trend Risk (LTR): the shocked cash flows for trend risk are calculated using best estimate cash flows with 175% of the Best Estimate Assumption for mortality improvement.
   LTR = 125 – 40 = 85
   (Full credit was received for a using BEL of 100 instead of 40)
5. Mortality Risk = 74 + 60 =134 (only level and trend risks are considered for risk adjustment calculations)
   Longevity Risk = 25 + 85 = 110
   Expense Risk: An increase of 10% in all policy years could reasonably be assumed to represent a lifetime 85th percentile shock
   Expense risk = PV(+10% expense cashflow)-BEL
   Expense Risk = 110 – 100 = 10
   Credit Risk, Market Risk and Operational Risk are ignored in this context
6. Diversified base solvency buffer = $(134^2 + 110^2 – 2*0.2*134*110)^{0.5} = 155$
7. Adjusted LICAT solvency buffer = 155 + 10 = 165

10. Continued

8. Diversified Risk Adjustment $= (43^2 + 16^2 - 2*0.2*43*16)^{0.5} = 42.78$
9. Solve for sigma at 85th percentile, $165 / 1.0364 = 158$ (real Z value is 1.0364, but rounded 1.04 is given; note it is assumed LICAT is calibrated to 85% per reading)
    Equate to risk adjustment of 42.78/ 158= 0.27
    Confidence level to nearest 5%= 60%

11.

Learning Objectives:

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

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

Learning Outcomes:

(1a) The Candidate will be able to:
- Compare and apply methods for life and annuity product reserves
- Evaluate, calculate, and interpret liabilities
- Recommend and justify appropriate valuation assumptions

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

Sources:

CIA Educational Note: Future Income and Alternative Taxes

Commentary on Question:

This question tested the candidates' understanding about future income and alternative taxes.

Solution:

(a)

(i) Explain why tax cash flows may differ from zero for a particular valuation scenario even if forecasted GAAP income before tax is zero.

(ii) Explain the distinction between permanent and temporary tax differences as determined for GAAP reporting purposes.

Commentary on Question:

Candidates were generally able to explain the difference between permanent and temporary tax differences. However, candidates generally struggled to explain why tax cash flows may differ from zero.

(i) Tax cash flows reflect the difference in measuring assets and liabilities on tax and financial reporting basis. These differences give rise to non-zero tax cash flows. On the other hand, events such as loss carryforwards and carry-backs can also cause the forecasted GAAP income before tax to be differed from zero.

11. Continued

(ii) A permanent difference is one where differences in income in reporting periods between tax versus GAAP are not fully offset (i.e., reversed) over the lifetime of the item giving rise to the difference.

A temporary difference (i.e., timing difference) is one for which there are period-to-period differences between tax and GAAP income which are fully offset (i.e., reversed) over the lifetime of the item giving rise to the difference.

(b) State whether the following create a permanent or temporary tax difference.

(i) Incurred but not reported reserves

(ii) Forward starting swaps

(iii) Investment income tax in Quebec

(iv) Reserves for a foreign subsidiary

Commentary on Question:
Candidates generally struggled to identify the tax difference type for the reserves for a foreign subsidiary and forward starting swaps.

(i) This is a temporary difference. Period-to-period differences between tax and GAAP income are fully offset over the lifetime

(ii) This is a temporary difference. Some derivative instruments are valued at cost for tax purposes and at market for GAAP purposes.

(iii) This is a permanent difference. Income in reporting periods between tax and GAAP are not fully offset or reversed over the lifetime.

(iv) This is temporary difference. Period to period differences in GAAP and tax income are fully offset (or reversed) over the lifetime.

(c)

(i) Calculate the insurance contract liability after carve-out as at year-end 2020. Show all work.

(ii) Describe guidance provided in the CIA Standards of Practice with respect to projected tax savings which should reduce the insurance contract liability.

11. Continued

Commentary on Question:
A common error was not recognizing that the DFTP and FTCO are in asset positions, which will decrease ICLBCO and increase ICLACO.

Candidates generally struggled to explain the recoverability of projected tax savings.

(i) Difference in reserve = Statutory Reserves – Maximum Tax Actuarial Reserves
Difference in reserve2020 = 5,760 - 5,000 = 760
Difference in reserve2021= 5,184 - 4,500 = 684

Reversal of temporary differences = Difference in reserve in current year – difference in reserve in prior year
Reversal of temporary differences2020 = 684 - 760 = -76
Reversal of temporary differences2021 = 0 - 684 = -684

After-tax future tax cashflow of temporary differences = tax rate x temporary differences
After-tax future tax cashflow2020 = 35% x (-76) = -26.6
After-tax future tax cashflow2021 = 35% x (-684) = -239.4

After-tax discount rates = discount rate x (1-tax rate) = 4% x (1-35%) = 2.6%

Discounted future tax provision (DFTP) 2020 = (-26.6/1.026) + (-239.4/1.026^2) = -253.35
Insurance contract liability before carve-out (ICLBCO) 2020 = Statutory reserve 2020 + DFTP2020 = 5760 + (-253.35) = 5506.65

Future tax carve-out (FTCO) 2020
= [tax rate x (Maximum tax actuarial reserve2020 – ICLBCO2020]/(1-tax rate)
= 35% x (5000 – 5506.65)/(1-35%)
= -272.81

Insurance contract liability after carve-out2020
= ICLBCO2020 - FTCO2020
= 5506.65 - (- 272.81)
= 5779.46

11. Continued

(ii)   Projected tax savings would be used to reduce insurance contract liabilities only to the extend the benefits of those tax losses are recoverable. The actuary needs to identify those alternative sources of taxable income allowable as sources of recovery in the valuation.

The sources of recoverability on the actuarial side are different than the sources of recoverability on the accounting side. To avoid double counting of sources of recovery, actuaries need to discuss recoverability issues with accounts.

The value of insurance contract liabilities will depend not just on the available sources of recovery, but also on the order those available sources are applied in the valuation.