

ILA LFMC Model Solutions

Fall 2023

1. Learning Objectives:

4. 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:

- (4a) 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:

The Theory of Risk Capital in Financial Firms

Commentary on Question:

This question tested the candidates' understanding of risk capital frameworks. Candidates demonstrated an understanding of the basic concepts but did not demonstrate an in depth understanding.

Solution:

- (a) Critique the following statements regarding a risk capital framework:

Commentary on Question:

Candidates generally did well on this part of the question. For statement A, candidates that answered 'partially true' received full credit if they provided appropriate justification (e.g., if some specific fixed income asset may have higher risk).

1. Continued

A. *All else being equal, a firm that invests predominantly in equities will require more risk capital than a firm that invests predominantly in fixed income securities.*

True

Risk capital depends on the riskiness of the assets. The riskier the assets, the more risk capital.

B. *As long as there are no changes in a firm's underlying gross assets, changes in any liabilities will have no impact on the amount of risk capital required.*

False

Risk capital depends on the amount of net assets (gross assets less liabilities). Changes in either would impact risk capital.

(b) You are given:

- Marginal risk capital is used to allocate risk capital across business units.
- The continuously compounded risk-free rate of interest is 3%.

Correlation of profits by business unit

	Annuities	Mutual Funds	Seg Funds	Term Life
Annuities	1.00			
Mutual Funds	0.25	1.00		
Seg Funds	0.50	0.20	1.00	
Term Life	0.00	0.00	0.00	1.00

Business Unit Group	Annual Volatility of profits	Liabilities at time 0	Risk-free value of net assets at the end of the first year
Annuities (1)	30.0%	2,000	250
Mutual Funds (2)	40.0%	1,000	200
Seg Funds (3)	25.0%	3,000	500
Term Life (4)	20.0%	8,000	500
1 & 2 & 3	22.2%	6,000	950
1 & 2 & 4	16.2%	11,000	950
1 & 3 & 4	15.2%	13,000	1,250
2 & 3 & 4	15.3%	12,000	1,200
1 & 2 & 3 & 4	14.8%	14,000	1,450

1. Continued

- (i) Calculate the variance of business profits of a portfolio consisting of mutual funds and segregated funds.
- (ii) Calculate the proportion of unallocated risk capital for MGP at the end of the second year.

Commentary on Question:

Candidates generally did not do well on this part of the question. Candidates received partial credit for providing high level definition of total, unallocated, and marginal capital. Common errors included:

- Using net assets instead of total assets for the time 0 asset calculation
- Failing to reflect timing in the calculation of asset at time 0, and consequently getting the incorrect results for weighting
- Failing to include weighting in the calculation of variance
- Missing the square root in the calculation for approximate RC

i)

	A	B	C	D
Business Unit Group	Annual Volatility of profits	Liabilities at time 0	Risk-free value of net assets at the end of the first year	Assets at time 0
Annuities (1)	30%	2,000	250	2,242.61
Mutual Funds (2)	40%	1,000	200	1,194.09
Seg Funds (3)	25%	3,000	500	3,485.22
Term Life (4)	20%	8,000	500	8,485.22
1 & 2 & 3	22.2%	6,000	950	6,921.92
1 & 2 & 4	16.2%	11,000	950	11,921.92
1 & 3 & 4	15.2%	13,000	1,250	14,213.06
2 & 3 & 4	15.3%	12,000	1,200	13,164.53
1 & 2 & 3 & 4	14.8%	14,000	1,450	15,407.15

Where $D = C/\text{Exp}(\text{risk free rate}) + B$, and risk free rate is 3% as given – most candidates missed adding back B to get the assets at time 0

Solve for asset at time 0:

$$\text{Risk-Free Value of Net Assets} = (\text{Assets}_0 - \text{Liabilities}_0) * e^{rT}$$

Calculate the weights of a portfolio of only mutual and seg funds

$$\omega_i = \text{Weight}_i = \frac{\text{Assets}_{0,i}}{\text{Assets}_{0,portfolio}}$$

1. Continued

Calculate variance for a portfolio of mutual funds (2) and seg funds (3):

$$\text{Variance} = \sum_i \sum_j \omega_i \omega_j \rho_{i,j} \sigma_i \sigma_j$$

i	j	a	b	c	d	e	f
		p(i,j)	vol(i)	vol(j)	weight(i)	weight(j)	Product
2	2	1	40%	40%	25.5%	25.5%	0.0104
2	3	0.2	40%	25%	25.5%	74.5%	0.0038
3	2	0.2	25%	40%	74.5%	25.5%	0.0038
3	3	1	25%	25%	74.5%	74.5%	0.0347
Sum:							5.3%

Where $f = a * b * c * d * e$

ii)

Solve for Assets at time zero for all business unit groups using formula from part i)
 Calculate the Approximate Risk Capital for each business unit group. Volatilities as given, $T = 2$

$$\text{Approx. Risk Capital} = 0.4 * \text{Assets}_0 * \sigma * \sqrt{T}$$

Where $T = 2$

Calculate the Marginal Risk Capital for each business:

Marginal Risk capital for business unit i = Total RC - RC for the portfolio without business i.

Unallocated Risk Capital = Total Risk Capital - Sum of all Marginals

Proportion = Unallocated Risk Capital / Total Risk Capital

Business Unit Group	Marginal Business	Annual Volatility of profits	Assets at time 0	Approx. Risk Capital	Marginal Risk Capital
1 & 2 & 3	4	22.2%	6,921.92	869.27	420.64
1 & 2 & 4	3	16.2%	11,921.92	1,092.54	197.37
1 & 3 & 4	2	15.2%	14,213.06	1,222.10	67.81
2 & 3 & 4	1	15.3%	13,164.53	1,139.39	150.52
1 & 2 & 3 & 4		14.8%	15,407.15	1,289.91	

Unallocated Risk Capital:

$$= 1289.91 - (420.64 + 197.37 + 67.81 + 150.52) = 453.57$$

Proportion:

$$453.57 / 1289.91 = 35\%$$

1. Continued

- (c) MGP is considering expanding their business to include whole life insurance but is concerned about the impact on risk capital.

Recommend two criteria for MGP to use in making this decision.

Commentary on Question:

A sample of valid criteria is provided below. Only two are required for full credit. Most candidates provided two valid criteria. The most common criteria given were the correlation aspect and the additional capital needed for introducing new line of business.

- Entering a business will increase the overall risk capital of the firm. Need to calculate how much this increase is to know how much additional risk capital you need. (risk capital is a function of assets, new business = more assets = increase)
- New business may change the economic cost of risk capital for the firm, should understand those impacts.
- Should understand how correlated the profits of the new business are to current business. It is likely whole life insurance will be somewhat correlated with other insurance products. (correlation is a part of the risk capital formula)
- Should ensure the expected profits of the business are in excess of the risk capital & spread required.

2. Learning Objectives:

2. 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 important insurance company issues, concerns and financial management tools.

Learning Outcomes:

- (2a) The Candidate will be able to describe U.S. valuation and capital frameworks, and explain their impact on the valuation of reserves, capital and financial statements.
- (5a) The candidate will be able to describe, apply and evaluate considerations and matters related to:
 - Insurance company mergers and acquisitions
 - Sources of earnings
 - Embedded Value determinations

Sources:

Fundamentals of the Principle-Based Approach to Statutory Reserves for Life Insurance, July 2019

The Modernization of Insurance Company Solvency Regulation in the US
Insurance Industry Mergers and Acquisitions, Chapter 4

Commentary on Question:

This question tested the candidates' understanding of US statutory reserves, and mergers and acquisitions. Overall, candidates demonstrated a moderate understanding of solvency regulations, but demonstrated a better understanding on how to apply these regulations to real life scenarios.

Solution:

- (a) Describe the key functions of an insurer's corporate governance structure within the supervisory review process.

Commentary on Question:

Candidates generally did not fully describe the 4 key functions.

1. Risk Management:

Includes underwriting and reserving, ALM, investments, liquidity, concentration/diversification of risks.

2. Actuarial Analysis:

Includes methodologies and procedures to assess the sufficiency and uncertainty of technical reserves.

2. Continued

3. Internal Audit:

Independent and objective consulting activity designed to evaluate and improve the effectiveness of a firm's risk management, control and governance process.

4. Internal Controls:

Designed to ensure the effectiveness of a firm's operations with respect to its risk, the availability and reliability of its information and regulatory compliance.

- (b) Describe the two primary goals of the Own Risk and Solvency Assessment (ORSA).

Commentary on Question:

Candidates generally did not describe ORSA's primary goals but rather described how ORSA is conducted.

1. To foster an effective level of enterprise risk management at all insurers, through which each insurer identifies and quantifies its material and relevant risks, using techniques that are appropriate to the nature, scale and complexity of the insurer's risks, in a manner that is adequate to support risk and capital decisions.
 2. To provide a group-level perspective on risk and capital, as a supplement to the existing legal entity view.
- (c) Critique each of the following statements. Justify your answer.
- A. *Given experience trends, the business plan assumes that mortality and lapse experience return to pre-pandemic levels in 2023. To align with the business plan, the current best estimate assumptions are used for the ORSA normal scenario projection.*
 - B. *For the ORSA stress scenario, 105% of current best estimate mortality and 98% of current best estimate lapse rates are used.*
 - C. *To align with the business plan and the normal scenario in ORSA, the best estimate mortality and lapse assumptions are used in the deterministic reserve calculations under VM-20.*

Commentary on Question:

Candidates generally performed well on this part of the question and provided appropriate justification. Most candidates had some trouble with statement C where complete justification was not provided.

2. Continued

- A. The ORSA is essentially an internal assessment of the risks associated with the insurer's current business plan, and the sufficiency of capital resources to support those risks. Either response is acceptable with proper justification:
- a. Expecting experience to return to pre-pandemic levels in 2023 is reasonable given the trends. Aligning the ORSA normal scenario with business plan assumptions is in line with ORSA guidance.
 - b. Expecting experience to return to pre-pandemic levels in 2023 is not reasonable. Recommend setting the assumptions in the ORSA normal scenario to be in line with trends and use 105% of mortality and 95% of lapses.
- B. The assumptions under the stressed scenario are too optimistic. To quantify risk exposure in a stressed environment, assumptions should continue to be adverse compared to 2022 experience.
- C. Under VM-20, the deterministic reserve calculation uses prudent best estimate reserve assumptions. These are not prescribed. VM-20 requires most assumptions to be established using company experience if it is relevant and credible. VM-20 makes clear that margins are to be included for each assumption associated with a material risk that is not stochastically modeled. The margin provides for adverse deviation and estimation error in the development of the anticipated experience rates. Margins should also reflect the magnitude of fluctuations in the historical experience of the company for the risk factor. A company may use its own mortality experience for the purpose of calculating the deterministic and stochastic reserve amounts; to the extent the experience is relevant and credible. To the extent that there is no relevant or credible data, the margin should be determined such that the policyholder behavior assumption is shifted toward the conservative end of the plausible range of behavior—that is, the end of the range that serves to increase the reserve.
- (d) HWL Life is considering acquiring a block of life insurance from GTX Life.

Critique each of the following statements. Justify your response:

- A. *The purchase price should be estimated using original pricing assumptions.*
- B. *The valuation can rely on GTX's public financial statements combined with a base case forecast provided by their senior management.*
- C. *Comparable Company Analysis is a more useful tool than Comparable Transaction Analysis.*

2. Continued

- D. *Distributable earnings should be estimated as the pre-tax statutory earnings less the increase in economic capital.*

Commentary on Question:

Candidates generally performed well on this part of the question and provided appropriate justification.

- A. Statement is false. Assumptions should be based on best estimates. Management should consider management expectation and industry experience.
- B. Statement is false. More detailed financial projections from the seller should be obtained. A base case typically includes optimistic or aggressive assessment of future results, so some adjustments may also be required/desired. Adjustments for the merger itself (for example diversification, expense savings) should also be made
- C. Statement is false. Both are tools that can be used in tandem to evaluate an acquisition, not one over the other. Each could be useful.
- D. Statement is false. Distributable earnings should be based on after-tax earnings less increase in required statutory capital.

3. Learning Objectives:

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

Learning Outcomes:

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

Sources:

Canadian Insurance Taxation, 4th Ed, 2015, Chapter 3-6, 9, 10, 11 & 24

Commentary on Question:

This question tested the candidates' knowledge on Canadian insurance taxation. Candidates generally did well on this question.

Solution:

- (a)
- (i) List the requirements for an annuity to be recognized as a prescribed annuity.
 - (ii) Describe the differences in the tax treatment between prescribed and non-prescribed annuities.

Commentary on Question:

Most candidates listed some of the requirements and obtained at least partial credit.

- (i) The first category of prescribed annuities is RRSPs, RPPs and similar annuities. Payments received from these plans are fully subject to tax with no tax-free capital portion.

To qualify as a prescribed annuity contract (PAC) under the second category:

- be an annuity certain or a life annuity
- have a payout period
- have been issued by a financial institution or other prescribed entity
- have equal annuity payments at regular intervals, not less frequent than yearly
- the annuitant must be the owner & deal with issuer at arms length
- the annuitant must be an individual, specified trust, or qualified disability trust
- no loans permitted under the contract

3. Continued

- (ii) The differences between the tax treatment of prescribed and non-prescribed annuities include:
- Prescribed annuities are more commonly taxed under the proportional method, with lower taxes in early stages
 - Non-prescribed annuities can be taxed under the accrual or proportional methods, depending on when the contract was issued.
 - For level payment products, the differences between accrual and proportional methods is less significant
 - Under accrual taxation (for non-prescribed), interest on purchase money borrowed is tax-deductible

- (b) A policyholder purchases a payout annuity for 10,000. You are given the following information as of the first anniversary:

Accumulating fund	Payment during the year	Mortality gain
9,700	1,000	200

Calculate the taxable income to the policyholder assuming the policyholder survives to the end of the first year:

Commentary on Question:

Candidates generally did well on this part of the question. Partial credit was received if the formulas were provided but the calculations were not correct.

$$\begin{aligned}AF &= 9700 \\ACB &= 10,000 - 1,000 + 200 = 9,200 \\Taxable\ income &= AF - ACB = 500\end{aligned}$$

- (c) You are given the following for a 5-year prescribed annuity certain contract:
- Purchase price = 10,000
 - Monthly income = 200

Calculate the policyholder's annual taxable income. Show all work.

Commentary on Question:

Most candidates calculated the taxable income correctly. Some candidates had difficulty calculating the non-taxable capital portion. A few candidates calculated the monthly taxable income instead of annual taxable income. Partial credit was received if the formulas were provided but the calculations were not correct.

3. Continued

$$\begin{aligned} &\text{Capital (non-taxable) portion} \\ &= \text{annuity payment} \times (\text{adjusted purchase price} \div \text{total expected payments}) \\ &= (12 \times 200) \times (10000 \div (60 \times 200)) \\ &= 2000 \end{aligned}$$

$$\text{Taxable income} = \text{total income less capital portion} = (12 \times 200) - 2000 = 400$$

- (d) You are given the following information for a block of life insurance policies issued in 2020:

Maximum Tax Actuarial Reserves (MTAR)	
31-Dec-20	31-Dec-21
30,000	25,000

- Average interest rate on long term government of Canada bonds = 4.8%
- Investment income reported to policyholders during 2021 = 100

Calculate the amount of Investment Income Tax (IIT) payable for the 2021 taxation year. Show all work.

Commentary on Question:

Most candidates answered this question correctly, demonstrating how the net income is calculated. Common errors included using one of the reserves instead of the average reserve and not applying the 55% factor. Partial credit was received if the formulas were provided but the calculations were not correct.

$$\text{Average reserves} = (30,000 + 25,000) \div 2 = 27,500$$

$$\text{IIT rate} = 4.80\%$$

$$\begin{aligned} \text{Investment income} &= \text{Average reserves} \times \text{IIT rate} \times \text{factor} \\ &= 27,500 \times 4.80\% \times 55\% = 726 \end{aligned}$$

$$\text{Investment income reported amount} = 100$$

$$\text{Net income} = \text{Investment income} - \text{Investment income reported amount} = 626$$

$$\text{IIT Taxable payable} = \text{Net income} \times 0.15 = 93.9$$

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:
 - The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
 - Compare and apply methods for life and annuity product reserves
 - Evaluate, calculate, and interpret liabilities
 - Recommend and justify appropriate valuation assumptions

Sources:

The IFRS 17 Contractual Service Margin: A Life Insurance Perspective
OSFI B-3 Sound Reinsurance Practices and Procedures
IFRS 17 Insurance Contracts – IFRS Standards Effects Analysis, May 2017

Commentary on Question:

This question tested the candidates' knowledge of IFRS 17. Candidates generally did well on parts (a), (b) and (c) of the question. Most candidates demonstrated an understanding of CSM concept and contract boundary under IFRS17.

Solution:

- (a) Explain in general how profit is recognized over the duration of the contract for policies that are directly issued and profitable at issue.

At issue, there is no impact to P&L from writing profitable contracts. The profit is deferred via CSM.

Subsequently, experience relating to future service adjusts CSM and does not flow through P&L, unless the CSM is exhausted.

CSM is amortized into P&L according to coverage units over the lifetime of the group (unless the CSM is exhausted by other impacts). This CSM amortization flows into P&L.

Additionally, RA release and experience items related to current period are reported in P&L.

- (b) Recommend a contract boundary for Easy-Term. Justify your response.

The contract boundary can be set at the renewal point (after three years) as long as XYZ has the practical ability to adjust premiums based on the medical questionnaires.

If XYZ does not have the practical ability to adjust premiums based on a reassessment of mortality risk at renewal, then the contract boundary should be 6 years.

4. Continued

- (c) Determine the impact to profit or loss at initial recognition for each group. Show all work.

	Group A – New Business Issued in Year 1 following transition (values at initial recognition)	Group B – New Business Issued in Year 1 following transition (values at initial recognition)
PV of premiums	2,500	2,500
PV of benefits	1,000	1,200
PV of directly attributable maintenance expenses	450	450
PV of non-attributable maintenance expenses	50	50
Directly attributable acquisition expenses	510	510
Non-attributable acquisition expenses	35	35
Risk Adjustment	400	400
CSM at Initial Recognition (no floor)	=2500-1000-450-510-400 =140	=2500-1200-450-510-400 =-60
CSM at Initial Recognition (cannot be less than zero)	140	0
Loss Component At Initial Recognition	0	60
P&L impact	0	-60

Group A:

CSM at initial recognition is positive.

No Impact on insurance service result at initial recognition since CSM defers profit.

Group B:

This group of contracts is loss-making (onerous). The CSM at initial recognition is not allowed to be negative; no CSM is established at initial recognition.

Loss component must be established at initial recognition; this loss must be recognized in the P&L (Insurance Service Result) immediately.

- (d) XYZ Insurance issues another group of life insurance contracts in 2024 with a loss of 100 on the date of issue. A reinsurance treaty covers these contracts from issue.

4. Continued

You are given the following information with respect to the reinsurance contract:

Proportion of loss covered	75%
PV of reinsurance premiums payable	800
PV of reinsurance claims recoverable	900
Risk Adjustment ceded	20

- (i) Discuss the setting of assumptions used for the valuation of reinsurance contracts held and the underlying direct insurance contracts.
- (ii) Calculate the impact of the reinsurance contract to the company.
- (iii) Determine the impact to profitability to the group of contracts of the reinsurance contract held. Show all work.

Commentary on Question:

For part (i) candidates understood that the valuation of reinsurance contracts held and the underlying direct insurance contract are separate, but did not discuss the assumption setting.

Candidates generally did not do well on parts (ii) and (iii). Few candidates were able to calculate the correct treaty CSM and the correct loss recovery component.

i)

Assumptions should be consistent but not necessarily identical.

Differences need to be justified.

Applies to assumptions at initial recognition and subsequent measurement.

Mortality assumptions: Assumptions could be identical but reinsurance assumptions would be adjusted for non-performance risk of reinsurer

Discount rates: Locked in rates could be different based on effective date of treaty even if methodology is identical.

ii)

No Zero Floor applied (CSM's can be positive or negative)

Treaty = $-(800 - 900 - 20) = 120$ gain

iii)

Loss component for direct issued contracts is 100 (given in stem of part (d))

Impact can be determined based on percentage of claims reinsured since reinsurance is proportional

Loss recovery component from $120 * 75\% = 90$

Reduces loss to $100 - 90 = 10$

4. Continued

- (e) Critique the following statements with respect to XYZ Insurance's reinsurance policies.
- A. *The Assistant Vice President of Reinsurance oversees XYZ Insurance's reinsurance risk management policy. The reinsurance risk management policy specifies which XYZ Insurance products can be reinsured and the ceding limits.*
- B. *Reinsurers are chosen based on the reinsurer's published capital ratio and external ratings.*
- C. *All reinsurance contracts are required to be fully executed by all parties prior to the effective date of the contract.*

Commentary on Question:

To receive full credit candidates had to justify their critiques.

- A)
OSFI expects senior management to oversee the development and implementation of the RRMP. At a minimum, senior management should review the RRMP annually.
It's appropriate for the AVP to handle day-to-day responsibilities, but senior management must provide oversight, ensure the RRMP is operationalized by providing sufficient resources, and ensure that there are adequate controls to monitor both compliance with and effectiveness of the RRMP.
- B)
This is not appropriate. FRIs should not rely solely on external ratings but are required to perform their own due diligence.
Need to consider more than published capital ratios. Other factors that should be considered include claims payment records, funding sources and access to capital, management, retrocession, etc.
OSFI expects a high level of due diligence and evaluation of counterparties should be updated throughout the life of the reinsurance contract.
- C)
While it is best practice to have reinsurance contracts fully executed prior to the effective date, OSFI recognizes that this is not always possible.
In order to mitigate the risk arising from not fully executing, company should:
- obtain contractually binding summary documents prior to the effective date of the reinsurance coverage;
 - address, within the summary document, any material issues most likely to arise, including all variable or unique agreement terms;
 - ensure that all final comprehensive reinsurance contracts, including any amendments thereto, bear the duly authorized signature of both the ceding company and the reinsurer.

5. 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:
- The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
 - Compare and apply methods for life and annuity product reserves
 - Evaluate, calculate, and interpret liabilities
 - Recommend and justify appropriate valuation assumptions

Sources:

CIA Educational Note: IFRS 17 Measurement and Presentation of Canadian Participating Insurance Contracts, Apr 2021

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

Commentary on Question:

This question tested the candidates' understanding of IFRS17 with respect to participating products. Candidates had to select an appropriate measurement model and coverage units, qualitatively describe appropriate opening CSM, and discuss differences between participating guarantees and market instruments (e.g., put options) and how those differences can be reflected under IFRS17.

Solution:

- (a) State the criteria for an insurance contract to be deemed an “insurance contract with direct participation features”.

Commentary on Question:

Candidates generally performed well on this part of the question.

An insurance contract for which, at inception:

- The contractual terms specify that the policyholder participates in a share of a clearly identified pool of underlying items; and
- The entity expects to pay to the policyholder an amount equal to a substantial share of the fair value returns on the underlying items; and
- The entity expects a substantial proportion of any change in the amounts to be paid to the policyholder to vary with the change in fair value of the underlying items.

5. Continued

- (b) Recommend a measurement model for valuing the contracts for each block at the transition date using the fair value approach. Justify your response.

Commentary on Question:

Candidates generally did well recommending a measurement for the Closed Block, but struggled with recommending a measurement for the Open Block.

Closed Block: Fails criteria C. The assessment is done at the transition date and the guarantees are deeply in the money, meaning there is no dividend room left. Therefore, the amounts payable to the policyholder will not vary substantially with the fair value of the underlying items. The Closed Block does not meet the criteria for VFA and should be measured using the general measurement approach.

Open Block: Meets all three criteria and should be measured using the VFA.

- Criteria A – the management of participating accounts in Canada is heavily regulated and the financial results are separately reported, so a participating account forms a “clearly identified pool”. Open Block par policies share in the experience of the participating account, so it comprises an “underlying item”.
- Criteria B – the proportion of changes in fair value shared with policyholders is substantial, as the permitted transfers to the shareholder under the ICA are small. Investment experience is shared with the policyholders, and smoothing is permitted as IFRS17 takes a lifetime view.
- Criteria C – Open Block guarantees are far out of the money and MSY is paying dividends greater than those illustrated. There is ample dividend room available to absorb experience and MSY passes that experience through via regular divided reviews.

- (c)
- (i) Explain potential differences between market instruments and participating guarantees that MSY Life must consider.
- (ii) Explain how MSY Life can reflect these differences while meeting the IFRS 17 requirement to be consistent with observable market prices.

Commentary on Question:

Candidates generally performed poorly on this part of the question. Candidates struggled to describe the differences between market instruments and participating guarantees.

5. Continued

Differences between market instruments and participating contract guarantees include:

- Gtees are not limited to financial risk, but based on a combination of all risks shared with policyholders (including mortality, lapse, expense, etc.)
- Unlike options available on the market, par gtees are illiquid – the policyholder cannot withdraw the value of the gtee
- Gtees may apply over the long-term only – losses may be recouped before dividend payments are resumed
- Market instruments with similar features, such as put options, are not usually available for the length of time the gtee would be in force.
- Management has discretion of the timing and extent of dividend scale change and the investment strategy of assets underlying the gtee. This discretion could be used to mitigate potential gtee costs, provided policyholders are treated fairly.
- There may be non-guaranteed elements that can be adjusted to mitigate potential gtee costs, such as PUA rates.

MSY needs to make adjustments to reflect these differences. Potential adjustment include:

- Adding illiquidity premium to the risk-free rate in each RN scenario to reflect the illiquidity of the par gtees.
- Adjusting dividend payments in each scenario, reflecting anticipated management actions and policyholder reasonable expectations. This can be challenging in tail or usual scenarios.
- Reflect non-financial risk, for example dampen sensitivity to interest rate changes to reflect that the gtee is over the long run and includes non-financial risks.

- (d) Describe how the opening contractual service margin for Open Par Block should be determined.

Commentary on Question:

In general, candidates understood how to calculate CSM (and were able to describe CSM generally or for non-participating products) but did not fully articulate the effect of participating features.

CSM should represent the present value of expected future contributions to surplus (i.e. future shareholder transfers) less amounts captured in the liabilities.

5. Continued

- (e)
- (i) Describe considerations in selecting and projecting an appropriate coverage unit for individual participating life insurance.
 - (ii) Recommend a coverage unit for each of MSY Life's participating blocks. Justify your answer.

Commentary on Question:

Most candidates suggested appropriate coverage units for the Closed Block (i.e., under GMM) but few candidates suggested appropriate coverage units for the Open Block (i.e., under VFA).

Part (i)

General considerations include:

- whether there is dividend room remaining
- potential payment of dividends and their effect on the projection of face amount or the underlying items
- projection of future coverage units should account for additional insurance coverage that could be provided under various dividend options (e.g. PUA) and additional investment component amounts that could result (e.g. dividends on deposit, CSV of PUAs)

Part (ii)

Closed Block – recommend using face amount * tPx, consistent with the recommended approach for non-participating whole life insurance. This is appropriate because there is no dividend room left, so it makes sense to select a coverage unit that would be used for non-participating whole life.

Open Par – recommend using the fair value of the assets in the participating account. As Open Par is measured under VFA, the management of the underlying items would be a good representation of investment-related services provided to the policyholder & use of the fair value of the underlying item as the coverage unit would be appropriate

6. 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:
- The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
 - Compare and apply methods for life and annuity product reserves
 - Evaluate, calculate, and interpret liabilities
 - Recommend and justify appropriate valuation assumptions

Sources:

CIA Educational Note: IFRS 17 Estimates of Future Cash Flows for Life and Health Insurance Contracts, Sep 2019

IFRS 17 Insurance Contracts Example (Spreadsheet Model)

CIA Draft Explanatory Report: IFRS 17 Expenses, Apr 2021

Commentary on Question:

This question tested the candidates' knowledge of IFRS17.

Solution:

- (a) Critique each of the following statements with respect to IFRS 17. Justify your response.
- A. *The estimate of future cash flows must incorporate the full range of possible outcomes. Therefore, we need to develop stochastic models to estimate the value of each non-financial assumption.*
 - B. *Identifying onerous contracts will require individual testing of each contract.*
 - C. *All taxes paid by the company, such as premium taxes, Investment Income Taxes (IIT), and incomes taxes, should be included in the future cashflows.*

Commentary on Question:

Candidates generally did well on this part of the question. To receive full credit, the candidate must clearly state whether the statement is correct or incorrect, and provide appropriate justification.

6. Continued

- A. While estimates of future cash flows under IFRS17 should be unbiased and represent a reasonable estimate of the mean of the cash flow distribution, scenarios are not required to be stochastically generated, and development of stochastic models is not expected for all IFRS17 reporting.

The guideline does not require that all possible (or even any) scenarios be explicitly constructed.

If the actuary expects that the cash flow distribution is materially skewed, then the mean of the probability-weighted cashflows should account for such skewness.

For offsetting tail risks, if there is an expectation of potentially significant offsetting exposures in the tails of the cash flow distribution (i.e., upside risk and downside risk from extreme scenarios), then this may not impact the expected value, but the risk adjustment may be higher than if there were no exposure to extreme scenarios

- B. The guideline allows an entity to identify the group of onerous contracts by measuring a set of contracts rather than individual contracts.

The entity must have reasonable and supportable information to conclude that a set of contracts will all be in the same group.

If the entity does not have this reasonable and supportable information, then determination must be made at individual contract level.

- C. IFRS17 excludes income taxes from estimates of future cashflows. Transaction based taxes such as premium taxes that arise directly from insurance contracts are included in future cashflows.

IIT is a Canadian-specific consideration. IIT is directly related to insurance contracts and would be included in the estimates of future cashflows, based on the following considerations:

IIT is not considered an Income tax per IAS 12 Income Taxes

While IIT is the entity's obligation, it is intended to tax the build-up of investment income within life ins contract, and it arises directly from existing insurance contracts.

6. Continued

- (b) Assess how each of the following expenses would be treated under IFRS 17, including any areas of judgement. Justify your response.
- (i) Business expenses for developing a new universal life product that was never launched.
 - (ii) Acquisition costs incurred by a company from engaging external auditors and lawyers for acquiring a block of in-force segregated fund policies from another company.
 - (iii) Costs from a risk and control peer review of ALM processes.
 - (iv) An advertising campaign aimed at increasing brand awareness.

Commentary on Question:

Candidates generally did well on this part of the question. Expenses described in parts (i) and (ii) required candidates to clearly state the specific treatment to receive full credit. Expenses described in parts (iii) and (iv) are grey areas (could be either attributable or not). Full credit was received for either assessment as long as the appropriate justification was provided.

(i). These expenses are incurred with the main purpose being issuing of new insurance contracts. However, since they don't ultimately sell the business, there are no insurance contracts actually issued to attribute the expenses to.

These would be product development cash flows that cannot be directly attributed to a block of business.

(ii). The incurred expenses arise as a direct result of acquiring new business. These costs are required by XYZ to administer the business, as without the costs they would not own the block.

Therefore, these costs are directly attributable.

(iii). This is outlined in the source as a grey area and could be either attributable or non-attributable. Reasoning:

Non-attributable: These costs are not related to the issuance of contracts (two-steps removed)

Attributable: XYZ could not fulfill their obligations of the contracts without these costs, so should be attributable.

6. Continued

(iv). Similar grey area as iii) (listed as "generic marketing" in the source)

Non-attributable: The campaign's purpose is brand-awareness, which does not have a direct influence on a particular product to allocate the expenses to.

Attributable: Without brand awareness, XYZ might not sell any policies. These costs, while being one-step removed from actual sales, are required to grow the business, and should be allocated accordingly.

(c) You are given insurance cash flow projections in the Excel spreadsheet.

Assume the following:

- The contractual service margin and acquisition expenses are amortized linearly over the 5-year duration of the contract
- The risk adjustment is 10% of expected future claims
- The locked-in discount rate is 5%
- All expenses in the table are attributable.
- Claims and maintenance expenses occur at the end of the year. Premiums and acquisition expenses occur at the beginning of the year.
- Actual claims are 110% of expected in year 1; no change to expected claim cash flows after year 1.
- Actual maintenance expenses are 95% of expected in year 1; no change to expected maintenance expense cash flows after year 1.
- Actual investment yields in year 1 are 6%
- Income tax rate is 0%

Calculate the profit or loss in year 1 under IFRS 17. Show your work.

Commentary on Question:

In general, candidates calculated the initial CSM correctly. Partial credit was received for demonstrating knowledge that the key components of the P&L are Insurance Service Result and Net Financial Result, and Insurance Service Result is Insurance Revenue net Insurance Service Expense. Common mistakes include:

- 1) Interest rate accrued on CSM is overlooked in CSM amortization;*
- 2) Insurance Financial Expense is not deducted from Financial Gain/Loss;*
- 3) Accretion of interest is overlooked in Acquisition Expense Amortization.*

The excel workbook provided has more detailed calculations as well as an alternative solution.

6. Continued

Expected Cashflows (Initial Recognition)

time	0	1	2	3	4	5
Premiums		295,000	280,191	266,125	252,753	240,052
Acquisition Expenses Attributable		(250,000)				
Maintenance Expense Attributable		(41,000)	(47,490)	(45,106)	(42,839)	(40,687)
Claims		(60,000)	(56,988)	(67,659)	(64,259)	(73,236)
Total Net CFs		(56,000)	175,713	153,360	145,654	126,129

Actual Cashflows

time	0	1
Premiums		295,000
Acquisition Expenses Attributable		(250,000)
Maintenance Expense Attributable		(38,950) = (41,000) × 0.95
Claims		(66,000) = (60,000) × 1.1
Total Net CFs		(59,950) = Premiums - Acquisition Expenses - Maintenance Expense Attributable - Claims

Expected Risk Adjustment CFs (Initial Recognition)

	0	1	2	3	4	5
Claims = Risk Adjustment (10%) × Expected Claims		(6,000)	(5,699)	(6,766)	(6,426)	(7,324)

Liability on Initial Recognition

PV of Premiums	1,219,061 = NPV (Locked-in Rate, Premium CFs)
PV of Maintenance Expense Attributable	(188,210) = NPV (Locked-in Rate, Maintenance Expense Attributable CFs)
PV of Claims	(277,528) = NPV (Locked-in Rate, Claims CFs)
PV of Attributable Acquisition CFs	(250,000)
PV of Risk Adjustment CFs	(27,753) = NPV (Locked-in Rate, Expected RA CFs)
Total	
CSM at Initial Recognition	475,570
Best estimate liabilities (BEL)	(503,324)

CSM Roll forward

Opening	0
Changes related to Future Services: NB	475,570
Changes related to Future Services: Assumptions	0
Expected Cash Inflows	0
Expected Cash Outflows	0
Insurance Finance Expense = Locked-in Rate × (Opening + Changes related to Future Services: NB)	23,779
Changes Related to Current Services: Experience	0
Changes Related to Current Services: Release = - 20% × all above items	(99,870)
Closing = sum of all above items	399,479

6. Continued

Profit and Loss Statement (year 1)	
CSM release	99,870
RA release	6,000
Expected claims release	60,000
Expected maintenance expense release	41,000
Amortization of deferred acquisition expense	50,000
Insurance Revenue	256,870

Actual claims incurred	(66,000)
Actual maintenance expense incurred	(38,950)
Amortization of deferred acquisition expense	(50,000)
Insurance Service Expense	(154,950)

$$\begin{aligned} \text{Insurance Service Result} &= \text{Insurance Revenue} + \text{Insurance Service Expense} \\ &= 256,870 - 154,950 \\ &= 101,920 \end{aligned}$$

$$\begin{aligned} \text{Investment Income} &= \text{Investment Yield Rate} \times (\text{Premium} - \text{Maintenance Expense Attributable}) \\ &= 6\% \times (295,000 - 25,000) \\ &= 2,700 \end{aligned}$$

BEL Interest accretion	= Locked-in Rate \times (Premiums - Acquisition expense - BEL) = 5% \times (295,000 - 250,000 - 503,324) = 22,916
RA Interest accretion	= Locked-in Rate \times (RA) = 5% \times (27,753) = (1,388)
CSM Interest accretion	= Locked-in Rate \times (CSM) = 5% \times (475,571) = (23,779)
Insurance Finance Expense	= (2,250)

$$\text{Net financial result} = \text{Investment Income} + \text{Insurance Finance Expense} = 2,700 - 2,250 = 450$$

$$\begin{aligned} \text{Net income (before tax \& OCI)} &= \text{Insurance Service Result} + \text{Net Financial result} \\ &= 101,920 + 450 \\ &= 102,370 \end{aligned}$$

7. 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:
- The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance and annuity products
 - Compare and apply methods for life and annuity product reserves
 - Evaluate, calculate, and interpret liabilities
 - Recommend and justify appropriate valuation assumptions

Sources:

CIA Educational Note: Selective Lapsation for Renewable Term Insurance Products, February 2017

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

Commentary on Question:

This question tested the candidates' understanding of policyholder valuation assumptions.

Solution:

- (a) List four factors to be considered when determining the selective lapse rate assumption.

Commentary on Question:

Candidates generally did well on this part of the question. Most candidates listed at least three correct factors. Some candidates incorrectly listed four different types of lapse rate assumptions, which was not what the question was testing.

Any four of the following would receive full credit:

Size of premium increase, period between premium increase, duration, policy size, distribution system used, heaped renewal commissions, external market conditions, proportion of healthy lives remaining, conversion, issue age

7. Continued

(b) You are given the following assumptions for a renewable 10-year term life insurance product:

- Total lapse rate at duration 10 is 20%
- Base lapse rate at duration 10 is 5.5%
- Selective proportion is 75%
- Attained age mortality at duration 11 is 0.9 per thousand
- Residual mortality at duration 11 is 2 per thousand

Calculate the select mortality at duration 11 based on the VTP2 revised method. Show all work.

Commentary on Question:

This part of the question had a defect in the information given, with the result that the 'correct' answer was a negative mortality rate. Credit was received based on the candidates understanding of the concepts, with consideration given if a candidate engaged in reworking of the response. It is not the SOA's policy to ask a question with an illogical answer, and this was an unintended outcome. We apologize to candidates for this occurrence.

Candidates generally demonstrated an understanding of the VTP2 revised method and were able to construct the formula correctly. For deriving the selective lapse and average lapse rate at year 10, many candidates omitted the base lapse rate adjustment.

Selective lapse rate year 10 = (total lapse rate - base lapse rate) * selective proportion / (1 - base lapse rate)

$$= (20\% - 5.5\%) * 75\% / (1 - 5.5\%) = 11.51\% \text{ [S]}$$

Average Lapse Rate Year 10 = (total lapse rate - base lapse rate) * (1 - selective proportion) / (1 - base lapse rate)

$$= (20\% - 5.5\%) * (1 - 75\%) / (1 - 5.5\%) = 3.84\% \text{ [A]}$$

$$q = (q'(1-A) - (1-S-A) * q'') / S = -7.19$$

where

q = select mortality

q' = attained age mortality = 0.9 per thousand

q'' = residual mortality = 2 per thousand

7. Continued

- (c) Your company is administering a block of life insurance contracts and a block of payout annuities.
- (i) Describe the steps that you would perform to determine the minimum mortality improvement assumption.
 - (ii) Identify any additional considerations in assessing the level of diversification between the two blocks.

Commentary on Question:

Candidates generally demonstrated some knowledge on the approach. It was important for candidates to provide a description on the steps.

Separately for annuity and life insurance products, derive the liability with the following assumptions:

- a. project mortality using the base mortality improvement rates, reduced by a margin
- b. project mortality using the base mortality improvement rates, increased by a margin

where both base and margin are described in the CIA paper.

Initially the prescribed mortality improvement rates selected would be those producing the higher liability, determined at an appropriate level of aggregation.

When considering an appropriate level of aggregation, the actuary would consider various factors, such as

- plan of insurance and benefits provided
- socioeconomic profile of the insured
- insurer's underwriting practices
- age distribution, etc.

Part (ii)

Considerations include:

- whether the blocks are of similar composition, e.g. attained age, gender, country of issue/residence, similar access to health care, similar durations, etc.
- socioeconomic profiles of the underlying population of each block

Diversification factor would be between 0% and 50%.

The resulting impact of adding or deducting the margin, adjusted for diversification, to the base mortality improvements must increase liabilities as much as the maximum of (increase for death sensitive, increase for death supported) using the margin without diversification, for each age group where the actuary can justify diversification

7. Continued

(d) You are provided with the following information for a 3-year payout annuity contract:

- Issue date: December 31, 2020:
- Issue age: 60
- Mortality margin = 5%
- Mortality improvement margin = 1%
- Diversification factor = 0%

Best estimate mortality rates	
Attained Age	qx
60	0.0010
61	0.0011
62	0.0012

Best estimate mortality improvement rates			
Attained age	Calendar Year		
	2020	2021	2022
60	0.025	0.020	0.015
61	0.024	0.019	0.014
62	0.023	0.018	0.013

Calculate projected mortality rates by duration including mortality improvement rates and margins.

Commentary on Question:

Candidates generally did not do well on this part of the question. Common errors include: applying the margins in the opposite direction; incorrectly applying the mortality improvement to the current year mortality rate; and not compounding the mortality improvement for the third year.

$$q_{60} = 0.001 * (1 - MfAD) = 0.00095$$

$$q_{61} = 0.0011 * (1 - MfAD) * (1 - (0.019 + MI Mfadx(1 - DivF))) = 0.001015$$

$$q_{62} = 0.0012 * (1 - MfAD) * (1 - (0.018 + MI Mfad(1 - DivF))) * (1 - (0.013 + MI Mfad(1 - DivF))) = 0.001083$$

8. Learning Objectives:

4. 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:

- (4a) 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:

OSFI: Own Risk and Solvency Assessment (E-19), December 2017

OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), July 2022, Ch. 1-11 (excluding Sections 4.2-4.4 & 7.3-7.10)

OSFI Guideline A-4 Internal Target Capital Ratio for Insurance Companies, December 2017

Commentary on Question:

This question tested the candidates' knowledge of the methods, approaches and tools of financial management.

Solution:

- (a) Critique each of the following approaches for setting an internal capital target:
- Set the target at a fixed percentage of the OSFI core ratio supervisory target capital requirement*
 - Set the target to the average of its three biggest competitors' ratios*
 - Set the target considering expected new business*
 - Set the target to 140% of the LICAT total ratio.*

Commentary on Question:

Candidates generally did well on this part of the question and were able to critique each approach while providing rationale. Most candidates were able to critique whether the approach is correct/incorrect and provide rationale of supporting such. To receive full credit, candidates must provide rationale to support their assessment of whether an approach is correct or incorrect.

8. Continued

- A. Internal Targets should be based on an insurer's assessment of its own capital needs. For example, Internal Targets should normally not be determined by simply adding a margin on the Supervisory Targets.
- B. Once an insurer has determined its own capital needs, these initial results should be assessed to determine if they are appropriate in relation to external or third-party capital expectations, including OSFI's expectation that Internal Targets exceed Supervisory Targets. In setting Internal Targets, an insurer should assess the adequacy of its Capital Resources for supporting its current risk profile and enabling it to continue its current operations in the normal course, under varying degrees of stress and under a wind-up scenario.
- C. The assessment of adequacy of capital should consider the capital needed to support an insurer's longer term business strategies and new business and planned growth.
- D. While 140% could be a possible target, it should be based on scenarios while assessing its own capital needs. Also, life insurers are expected to also determine an Internal Target of core capital

(b) You are provided with the following mortality capital components:

	Life	Annuity
Level	100	50
Trend	75	40
Volatility	25	10
Catastrophe	10	5

Assume that the life block is life supported and the annuity block is death supported.

Calculate the LICAT total mortality buffer for the combined blocks.
Show all work.

Commentary on Question:

Most candidates were able to demonstrate their understanding of the LICAT mortality capital calculation by determining the mortality capital for the life block and annuity block separately; and received partial credit. However, many candidates were not able to determine and calculate the aggregate capital, diversification credit and final mortality buffer for the combined block.

$$\text{RC mort} = \text{Sqrt}(\text{RC vol}^2 + \text{RC cat}^2) + \text{RC level} + \text{RC trend}$$

$$\text{RC aggregate} = \text{Sqrt}(\text{RCL life}^2 + \text{RCL death}^2 - 1.5 \times \text{RCL life} \times \text{RCL death})$$

$$\text{Diversification credit} = \text{RCL life} + \text{RCL death} - \text{RC aggregate}$$

$$\text{Mortality BSB} = \text{RC mort for life} + \text{RC mort for annuity} - \text{diversification credit}$$

8. Continued

$$\text{RC mort for life} = \sqrt{25^2 + 10^2} + 100 + 75$$

$$\text{RC mort for life} = 201.93$$

$$\text{RC mort for annuity} = \sqrt{10^2 + 5^2} + 50 + 40$$

$$\text{RC mort for annuity} = 101.18$$

$$\text{RC aggregate} = \sqrt{(100+75)^2 + (50+40)^2} - 1.5 \times (100+75) + (50+40)$$

$$\text{RC aggregate} = 122.88$$

$$\text{Diversification credit} = (100+75) + (50+40) - \text{RC aggregate}$$

$$\text{diversification credit} = 142.12$$

$$\text{Mortality Buffer for the combined block} = 160.99$$

- (c) ABC Life is considering reinsuring a block of business with an unregistered reinsurer. Assume that the ceded liabilities are positive.
- (i) Describe the impact of using an unregistered reinsurer on ABC Life's total LICAT capital ratio as compared to using a registered reinsurer.
 - (ii) Identify the available options to limit any adverse capital impacts from using unregistered reinsurance.

Commentary on Question:

Candidates generally did not do well on part (i). Most candidates did not demonstrate their understanding of the differences between registered reinsurance and unregistered reinsurance, and the capital implications of using either. Candidates must explain the impacts on required capital and available capital when using an unregistered reinsurance (vs. a registered reinsurance) to receive full credit. For part (ii) most candidates were able to identify the options to limit adverse capital impacts from using unregistered reinsurance and received full credit by identifying them.

- (i) ABC will lose their capital credits for registered reinsurance, resulting in an increase in required capital.

ABC will have to adjust their available capital to account for ceded liabilities arising from unregistered reinsurance, resulting in a reduction of available capital.

8. Continued

- (ii) Available options include:
- Obtaining a letter of credit. A letter of credit must be issued by or have a separate confirming letter from a Canadian Bank. Capital credit for letter of credit is limited to 30% of the gross requirement for aggregate positive liabilities ceded to unregistered reinsurers plus 30% of the gross requirement for offsetting liabilities ceded to unregistered reinsurers.
 - Obtaining collateral. Collateral assets must be held in Canada, be owned by the unregistered reinsurer, be held to secure payments, and be freely transferrable.