

ILA LFMC Model Solutions

Spring 2024

1. Learning Objectives:

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

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.

Sources:

LFM-143-20: Fundamentals of the Principle Based Approach to Statutory Reserves for Life Insurance, Rudolph

LFM-149-21: Insurance Contracts Accounting Guide, PWC, Oct 2019 (Sections 1.1, 3.5, 5.1-5.4, 5.6; Figures IG 2-1, 2-2)

Commentary on Question:

This question tested the candidates' knowledge of statutory and GAAP reserving approaches through the description of assumptions and calculation of a scenario reserve.

Solution:

- (a) Describe the assumptions used for the reserve methodologies by completing the table:

	Mortality	Mortality Improvement	Lapse
VM-20 Net Premium Reserve			
VM-20 Deterministic Reserve			
Liability for Future Policyholder Benefits under Long Duration Targeted Improvements (LDTI)			

1. Continued

Commentary on Question:

This part of the question requires candidates to describe assumptions that are used for various reserve methodologies for universal life with secondary guarantee insurance policies under U.S. statutory and U.S. GAAP. To do well on this part, candidates must demonstrate understanding of:

- *the framework of the principle-based approach to statutory valuation under VM-20, and*
- *the net premium approach under U.S. GAAP for nonparticipating traditional, long-duration contract liabilities, for which assumptions are outlined under ASC- 944-40-30-8*

and be able to apply the frameworks to the assumptions under the respective approaches.

The key aspects of the various approaches that candidates are expected to identify are as follows:

VM-20 Net Premium Reserve – the assumptions are prescribed, and for lapse the level of funding of the secondary guarantee must be considered

VM-20 Deterministic Reserve – the actuary may use their own company experience if credible, otherwise a blend of industry/company data. Mortality improvement is not allowed beyond the valuation date.

LDTI Liability – the assumptions should reflect the company's current expectations, which may include use of their own data where credible.

Candidates were generally able to identify these key aspects and generally did well on this part of the question.

Model Solution to part (a):

VM-20 Net Premium Reserve

Mortality

- Valuation mortality rates are prescribed as the 2017 Commissioner's Standard Ordinary Mortality Table (or later mortality tables adopted by the NAIC)

Mortality Improvement

- Similar to mortality in that it's prescribed

1. Continued

Lapse

- Certain universal life policies may utilize prescribed lapse rates where the rate of lapse is determined by the level of funding of the secondary guarantee
- Otherwise, no lapses are assumed

VM-20 Deterministic Reserve

Mortality

- Assumptions prescribed within VM-20 are limited to certain aspects of the mortality assumption, specifically the definition of the industry mortality table, the method used to grade in to this table, the margins to be applied to mortality rate to form the prudent estimate mortality assumption
- If the company's mortality experience is limited or not available, the company must use an applicable industry basic table in lieu of company experience

Mortality Improvement

- VM-20 prohibits use of mortality improvement for periods beyond the valuation date
- Company experience mortality rates and industry mortality rates can be brought current to the valuation date using mortality improvement factors

Lapse

- Certain aspects of the lapse rate assumption for universal life with secondary guarantee policies are prescribed, specifically the definition of the industry lapse table

Liability for Future Policyholder Benefits under Long Duration Targeted Improvements (LDTI)

Mortality / Mortality Improvement

- Mortality assumptions comprise an integral component of the calculation of long-duration life insurance contract liabilities and should be based on the company's view of expected mortality
- Companies may use their own experience for the mortality assumption, where credible

Lapse

- ASC 944-40-30-14 provides that termination assumptions should be based on estimates of expected terminations and nonforfeiture benefits, using expected termination rates and contractual nonforfeiture benefits e.g., cash value, paid-up insurance value, or extended-term insurance value

1. Continued

- Termination rates may vary by plan of insurance, age at issue, year of issue, frequency of premium payment, and other factors
- Composite rates may be used, but only if the rates are representative of the entity's actual mix of business

(b) Calculate the Scenario Reserve given the projected scenario below. Show all work.

Projection period	0	1	2	3	4	5	6	7	8	9	10
Statement Value of Assets (000s)	20	11	2	(7)	(3)	1	5	9	13	17	21
One-Year Treasury Rate (%)		1.34	0.65	0.14	1.03	1.08	0.74	0.59	1.05	0.57	0.48

Commentary on Question:

This part of the question requires candidates to use a cash flow projection model to determine a scenario reserve under VM-20. The correct solution follows the example provided in the Fundamentals of the Principle Based Approach to Statutory Reserves for Life Insurance. The scenario reserve is determined through a multi-step process as the greatest present value of the negative of projected statement value of assets.

Candidates generally did well on this part of the question. Common mistakes included omission of the 105% multiplier on the treasury rate, neglecting to take the negative of the statement value of assets, and/or assuming a constant interest rate across all years instead of calculating the cumulative discount factor as the product of the previous years' discount factors. A few candidates calculated the discount factor as $1-i$ instead of $1/(1+i)$, which is considered an acceptable alternate solution with no penalty applied.

The excel workbook provided has the detailed calculations for the solution below.

1. Continued

Model Solution to part (b):

Projection period	0	1	2	3	4	5	6	7	8	9	10
(1) Statement Value of Assets	20	11	2	(7)	(3)	1	5	9	13	17	21
(2) Negative Statement Value of Assets	(20)	(11)	(2)	7	3	(1)	(5)	(9)	(13)	(17)	(21)
(3) One-Year Treasury Rate (%)		1.34	0.65	0.14	1.03	1.08	0.74	0.59	1.05	0.57	0.48
(4) Treasury Rate x 105% (%)		1.41	0.68	0.14	1.308	1.13	0.78	0.62	1.10	0.60	0.50
(5) Discount Factor $1 / (1 + (4))$	1	0.986	0.993	0.999	0.989	0.989	0.992	0.994	0.989	0.994	0.995
(6) Cumulative Discount Factor	1	0.986	0.979	0.978	0.968	0.957	0.949	0.944	0.933	0.928	0.923
(7) Discounted Negative Accumulated Deficiency = (2) x (6)		(10.85)	(1.96)	6.85	2.90	(0.96)	(4.75)	(8.49)	(12.13)	(15.77)	(19.38)

Greatest Present Value of Accumulated Deficiency (GPVAD) is the maximum of the Discounted Negative Accumulated Deficiencies (7), which is the value from period 3 = 6.85

$$\text{Scenario Reserve} = \text{Starting Assets} + \text{GPVAD} = 20 + 6.85 = 26.85$$

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:
- 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 - Discount Rates for Life and Health Insurance Contracts

Commentary on Question:

This question tested the candidates' understanding of IFRS 17 discount rates for life and health insurance contracts.

Solution:

- (a) Evaluate the impact of each of the following changes to the product features of an annual renewable term (ART) product with respect to liquidity characteristics:
- (i) Replace the ART premium structure with a level premium structure
 - (ii) Add a term conversion option
 - (iii) Add a waiver of premium benefit
 - (iv) Add a return of premium rider that refunds 100% of the last three years of premiums upon termination

Commentary on Question:

Candidates generally did well on this part of the question. To receive full credit, candidates had to identify what the change will do to the exit costs, the inherent value and the liquidity characteristics of the insurance contract. Many candidates provided accurate comments on how liquidity would change but did not consistently explain the cause by describing changes to exit costs.

2. Continued

- (i) A level premium structure and guaranteed premium feature would build up the contract's inherent value. This would decrease the liquidity characteristics of the contract
 - (ii) The conversion option and removal of underwriting requirements would build up the contract's inherent value. This would decrease the liquidity characteristics of the contract
 - (iii) The inclusion of the waiver of premium would build up the contract's inherent value. This would decrease the liquidity characteristics of the contract
 - (iv) Inclusion of return of premium would create an exit value and increase liquidity characteristic of the policy
- (b) A company's liabilities are backed by a portfolio of 50% Government of Canada bonds and 50% corporate A bonds. You are given the following information:

Yield on Government of Canada Bond	5.00%
Corporate A spread	0.40%
Mortgage-backed securities spread	0.70%
Yield on credit default swaps	5.40%
Average market risk premium for equities and real estate	0.50%
Yield on mortgage-backed securities insured by Canada Mortgage and Housing Corporation	5.30%
Yield on mortgage-backed securities not insured by Canada Mortgage and Housing Corporation	6.00%

Calculate the discount rate under the following approaches. Show all work.

- (i) Top-down approach
- (ii) Hybrid approach

Commentary on Question:

Candidates generally did not do well on this part of question. Many candidates understood the correct general formulas to calculate the discount rate under top-down approach, but many candidates calculated the market risk premium and credit premium incorrectly. Many candidates applied incorrect formulas to calculate the discount rate under the Hybrid approach.

2. Continued

- (i) Top-down approach
Discount Rate = Reference Portfolio Yield - Credit Risk Premium - Market Risk Premium
Use own asset as Reference Portfolio (no other options based on available information)
Reference Portfolio yield = 50% *(Yield on Government of Canada Bond) + 50% *(Yield on Government of Canada Bond + Corporate A spread) = 50% * 5.00% + 50% * (5.00% + 0.40%) = 5.20%
Market risk premium = 0.00%
Liquidity premium = Yield on mortgage-backed securities less risk-free-rate = 5.30% - 5.00% = 0.30%
Total spread = Corporate A spread = 0.40%
Credit premium = Total spread - Liquidity premium = 0.40% - 0.30% = 0.10%
- Discount rate = 5.20% - 0.10% - 0.00% = 5.10%
- (ii) Hybrid approach
Yield on Government of Canada Bond = 5.00%
Liquidity premium = 0.30%
Discount rate = Risk free + liquidity premium = 5.00% + 0.30% = 5.30%
- (c)
- (i) Explain why an ultimate risk-free rate is needed.
- (ii) Describe the key principles and desirable characteristics when setting the ultimate risk-free rate.

Commentary on Question:

Candidates did well in part (i). but had difficulty with part (ii).

- (i) Duration of cash flows will extend beyond observable period.
Risk free rates are only observable up to about 30 years.
Beyond that point, actuary needs to develop an ultimate risk-free rate. (URFR)
Actuary would interpolate from last observable point to URFR
- (ii) Key Principles:
- Maximize use of observable inputs
 - Reflect current market conditions from the perspective of a market participant
 - Use best information available to develop unobservable inputs
 - Place more weight on long term estimates than short-term fluctuations

2. Continued

Characteristics:

- Stability: URFR should have less variability than short term rates
- Smoothness: Interpolation from the observable point to URFR should be smooth
- Simplicity: easy to understand, implement and forecast

3. 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:

LFM-658-23: Risk Adjustments For Insurance Contracts Under IFRS 17, Chapter 2 “Principles Underlying Risk adjustments”

LFM-649-22: IAN 100 Application of IFRS 17 (exclude Section C Chapter 11 and Section D), Jan 2019

CIA Educational Note: Risk Adjustment under IFRS 17

Commentary on Question:

This question tested the candidates’ knowledge on IFRS 17. Candidates generally did well in part a, as they were able to provide explanation and justifications on the statements. Many candidates had difficulty with the calculation for part b.

Solution:

- (a) Critique the following statements with respect to IFRS 17:
- A. *All liability cash flows should be discounted at a rate that reflects the variability of cash flows.*
 - B. *The risk adjustment reflects impacts of aggregation and therefore may reduce liability cash flows after accounting for diversification benefits.*
 - C. *Insurance profits under IFRS 17 are calculated and earned at initial recognition.*
 - D. *When the underlying contract uses the variable fee approach (VFA), the associated reinsurance contracts held must also use the VFA to avoid measurement mismatches.*

3. Continued

- E. *The premium allocation approach is a simplified alternative to the general measurement model and can only be used for contracts with coverage periods 12 months or less.*

Commentary on Question:

Candidates generally did well on this part of the question.

- A. Cashflows that do not vary should be discounted at rates that do not reflect variability.
Cashflows that do vary based on returns on the any financial underlying items, should be discounted at :
- 1) Discount rates that reflect the variability
 - 2) Or cashflows should be adjusted for the effect of the variability and discounted at a rate that reflects the adjustment made
- Nominal cashflows are to be discounted at rates that include the effect of inflation. Real cashflows are to be discounted at rates that exclude the effect of inflation.
- B. The Risk Adjustment (RA) only adjusts valuation of liabilities where the adjustment is positive, otherwise the risk adjustment would be zero. So the RA would never reduce liability cash flows. Aggregation does impact the RA. Diversification does impact RA.
- C. Expected profits are calculated at initial recognition. Expected profits are calculated at initial recognition. Positive profits are earned over time (not at initial recognition). If profits are negative, the loss is recognized immediately.
- D. Underlying contracts may use the Variable Fee approach, while associated reinsurance held contracts are not eligible to use the Variable Fee approach. This can create measurement mismatches due to significant differences in treatment of investment related impacts.
An area of possible economic mismatch: For reinsurance contracts held, the contract boundary definition means that the measurement of reinsurance contracts held will typically extend to include cash flows associated with future projected cessions up to the point at which the reinsurance contract can be exited for new business. The valuation of underlying insurance contracts will not include any cash flows related to these future projected cessions, since the underlying insurance contracts are only valued as written. This creates a mismatch in terms of timing of recognition of cessions versus underlying contracts.

3. Continued

An area of possible economic mismatch: For underlying contracts, losses are recognised at inception when contracts are onerous at inception, whereas any offsetting net gain on related reinsurance contracts held will be reflected in the CSM and recognised over the lifetime of the reinsurance contract held. This can create a mismatch in terms of timing of profit and loss on contracts that may be economically linked (e.g., pricing of underlying contracts frequently reflects impact of associated reinsurance, particularly for proportionate coverages).

- E. The described main approach of IFRS 17 is referred to as General Measurement Approach (GMA). IFRS17 allows for a simplified alternative approach to be used for contracts of short coverage period (typically not more than 12 months), known as the Premium Allocation Approach (PAA). The PAA is similar to the unearned premium method in that the measurement of the liability for remaining coverage of short duration contracts might be simplified by distributing premiums over the coverage period in line with passage of time or in proportion to expected benefits. The PAA only applies to the part of the total measurement of the contract referred to as liability for remaining coverage, with the liability of incurred claims following the GMA.

(b) You are given the following about DJS, a Canadian life insurance company:

- DJS uses the cost-of-capital approach to determine its risk adjustment
- There are two product lines: life insurance and life annuities.
- The risk adjustment is calculated from annual cash flows.

Target rate of return on capital for life business	6%
Target rate of return on capital for annuity business	10%
Discount rate	5%

- Required capital for both life insurance and annuities is given on a quarterly basis over four years in the Excel spreadsheet.
- (i) Calculate the risk adjustment for DJS.
- (ii) Describe the disadvantages of using the cost-of-capital approach for determining the risk adjustment.
- (iii) Explain why the target return on capital may be different for life insurance and annuity contracts.

3. Continued

Commentary on Question:

Candidates generally had difficulty with this part of the question. Many candidates did not reflect the weighted average cost of capital and did not properly reflect discount rates.

Part (i)

The solution to this part of the question is in Excel.

Part (ii)

Required Capital for a Canadian insurer is LICAT. LICAT uses a total asset requirement, which may increase complexity in the calculation of Ct. Ct may rely on the Risk Adjustment, which it's trying to calculate.

Part (iii)

Risk aversion = Risk aversion can be described as the preference to avoid or mitigate the impact of unfavourable outcomes as compared to favourable outcomes.

Risk appetite = Risk appetite can be described as the decision-making preferences for taking risk to achieve a return.

Risk tolerance = Risk tolerance considers the measure of unfavourable results and the probabilistic measure of risk.

Level of Risk aversion could be different for the two products in question.

4. 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, Swales, et. Al., 4th Ed, 2015, Chapters 4, 5, and 11

Commentary on Question:

This questions tested the candidates' understanding of Canadian taxation applicable to life insurance companies and products.

Solution:

- (a) Critique the following statements:
 - A. *Any business income earned by a non-resident insurer in Canada will always be treated as taxable income in Canada.*
 - B. *A Canadian resident insurance company is subject to income tax on all worldwide income.*

Commentary on Question:

To receive full credit, the candidates must clearly state whether the statement is correct or incorrect, and provide appropriate justification. Candidates generally did better critiquing statement A. A common mistake for candidates with statement B was stating that a Canadian resident insurance company is only subject to income tax on earnings in Canada.

Statement A: This statement is partially true.

The business income of a non-resident insurer in Canada will be taxable if the following conditions satisfied:

1. The non-resident insurer is carrying-on business in Canada.
2. Either a tax-treaty between Canada and the non-resident insurer's home country does not apply or the non-resident insurer has a permanent establishment in Canada.

Statement B: This statement is partially true.

A Canadian insurer is subject to income tax on all insurance business earned in Canada as well as subject to income tax on all non-insurance business earned worldwide.

4. Continued

- (b) A Canadian resident life insurer only does business in Canada and acquired a property on July 1, 2023.

You are given:

Cost of the property	10,000
Expenditures during the year	1,500
Income earned during the year	50
Average annual rate of interest	5%

Calculate the imputed cost for income tax reporting in 2023. Show all work.

Commentary on Question:

*Most candidates were able to come up with the general formula as the Imputed Cost for Income Tax = Net Cost during the year * Annual rate – Income earned during the year.*

However, many candidates could not correctly calculate all components in the formula. Common mistakes included:

- 1) Subtracting (instead of adding) the Expenditures from the Cost of the property when calculating the Net Cost during the year.*
- 2) Including a full year of interest on the Net Cost even though the question indicated that the property was acquired on July 1, 2023.*

Partial credit was received if candidates could identify (but not necessarily accurately calculate) the key components of the Imputed Cost for Income Tax.

- A. Identify the interest rate to be used: $i = 5\%$
- B. Calculate the average net cost during the year (July 1 – Dec 31):
 $\text{Net Cost} = 10000 + 1500/2 = \10750
- C. Calculate the number of days during the year from July 1 to Dec 31.
 $183/365 = 0.5014$
- D. Calculate the Gross Benefit = $A \times B \times C = \$10750 \times 5\% \times 0.5014 = \269.49
- E. Identify the Income derived during the period = \$50
- F. Calculate the final imputed cost for income tax = $D - E = \$269.49 - \$50 = \$219.49$

4. Continued

- (c) Explain how an insurance company would classify and treat each of the following for taxable income reporting:
- (i) A corporate bond with fixed semi-annual coupons that will be held to maturity.
 - (ii) A corporate bond with fixed semi-annual coupons held at fair value.
 - (iii) A share of a corporation where the insurer holds an immaterial interest.
 - (iv) Property acquired with the intent of generating rental income.

Commentary on Question:

This question requires candidates to not only identify the treatment of each listed taxable income but also provide proper explanation to the treatment. For example, simply stating that “this type of income is treated as Special Debt Obligation” is not sufficient to receive full credit. Candidates also need to provide some explanation that under SDO, the asset is held to maturity and its income will be carried at amortized cost, etc.

- (i) Corporate bond with fixed semi-annual coupons held to maturity
Corporate bond will be treated as Specified Debt Obligation (SDO). Since the corporate bond will be held to maturity, it is considered SDO that is not marked to market. This asset is carried at amortized cost. Income from this asset (fixed semi-annual coupons) is determined using a level yield method.
- (ii) Corporate bond with fixed semi-annual coupons held at fair value
Since the corporate bond is held at fair value, it is treated as SDO that is marked to markets. The value of this assets is determined on a fair value basis. All changes in the value will flow through income and be taxed immediately.
- (iii) Share of a corporation where insurer holds an immaterial interest
Share where the insurer does not hold a material interest should be treated as marked to market. The value of the share is carried at fair value and any changes in the value of the share will flow through income and be taxed immediately.
- (iv) Property acquired with the intent of generating rental income
Since the property was acquired with the intent of generating rental income, it will be treated as a capital property. Income will be determined on a realized basis, and only 50% of the capital gain will be subject to income tax.

5. 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.
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:

- (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
- (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:

LFM-659-24: Understanding IFRS 17: Solving for New Challenges, Fiera Capital, Oct 2021

LFM-645-23: OSFI LICAT Guideline, Chapters 1 - 11, excluding Sections 4.2-4.4 and 7.3-7.11

Commentary on Question:

This question tested the candidates' knowledge of IFRS 17 and LICAT. In general, candidates did well on this question.

Solution:

- (a) Critique the following proposed actions.
- A. *Moving a portion of the portfolio from provincial to investment grade corporate bonds will increase returns. ABC can still maintain the same asset liability matching policy so net income volatility will not be affected.*

5. Continued

- B. *Acquiring private debt would decrease the IFRS 17 discount rates to reflect the illiquid nature of these assets, which would increase liabilities.*
- C. *High yield bonds are highly correlated with other fixed income assets and would introduce additional interest rate sensitivity.*
- D. *Acquiring preferred shares will increase yields in a low interest rate environment. However, in a rising and volatile interest rate environment, they do not offer any advantages over higher yielding bonds.*
- E. *Changing the investment strategy will change the length of the observable period of the IFRS 17 discount rate due to changes in the asset portfolio duration.*
- F. *Moving a portion of the portfolio from provincial bonds to investment grade corporate bonds will have no impact on LICAT required capital if the assets and liabilities remain duration matched.*
- G. *Establishing stable long-term assumptions for the ultimate period will decrease the liability duration and allow assets and liabilities to be duration matched without the need for derivatives.*

Commentary on Question:

For this part of the question, candidates needed to provide appropriate justification to receive full credit. Most candidates were able to apply their knowledge of IFRS 17 and LICAT to assess the proposed actions with justification.

Statement A

- Use of corporate bonds will increase expected yield related to the additional credit exposure;
- Magnitude of credit spread changes tends to be larger in corporate bonds vs provincial bonds;
- Volatility of results will increase because IFRS 17 Liabilities are not affected by credit risk spreads (not included in discount rates).

Statement B

- Liquidity premium in IFRS 17 discount rates reflects liquidity characteristics of insurance contracts, not assets;
- IFRS 17 discount rates would not decrease due to use of private debt.

Statement C

- High yield bonds can be a good option to increase investment returns;
- High yield bonds have a low to negative correlation to other fixed income assets

5. Continued

- Liabilities with cash flows in the 10-20 year range are highly sensitive to interest rate changes;
- To minimize volatility high yield bonds should be used for liabilities that have low interest rate sensitivity. (cash flows at the short and long end of the curve)

Statement D

- Preferred shares are a higher yielding asset class offering a significant source of income in a low-yield environment;
- Portfolio diversification is an advantage - preferred shares have a negative correlation with traditional bonds; (preferred share price can rise in an increasing interest environment when bond price fall);
- Preferred shares can reduce volatility relative to other high yielding assets.

Statement E

- The general consensus in Canada is that the observable period is 30 years. This would not be affected by changes in asset strategy;
- Using long-term historical averages of nominal Government bonds is one approach to setting the ultimate rate. However, other approaches may also be appropriate.

Statement F

- While there would be no impact on interest rate risk, there would be impacts to market risk (asset risk) as corporate bonds would have a different factor than provincial bonds.

Statement G

- True. If the ultimate rate is stable, the liability duration is decreased because the discount rate would not change as much in response to change in interest rates, lowering the liability duration.

5. Continued

(b) You are given:

ABC is evaluating 3 proposed investment portfolios:

Asset Class	Current Portfolio		Proposed Portfolio 1		Proposed Portfolio 2		Proposed Portfolio 3	
	Allocation	Expected Return	Allocation	Expected Return	Allocation	Expected Return	Allocation	Expected Return
Provincial bonds	100%	2.60%	60%	2.60%	30%	2.60%	20%	2.60%
Corporate bonds	0%	3.40%	40%	3.40%	50%	3.40%	30%	3.40%
High yield bonds	0%	4.30%	0%	4.30%	20%	4.30%	25%	4.30%
Private debt	0%	4.25%	0%	4.25%	0%	4.25%	25%	4.00%
Total	100%	2.60%	100%	2.92%	100%	3.34%	100%	3.62%
Standard deviation of asset returns		10.00%		10.80%		11.40%		11.80%

Recommend which one of the 3 proposed portfolios should be implemented by ABC. Justify your response.

Commentary on Question:

To receive full credit on this part of the question candidates needed to calculate the return per unit of risk correctly, and to appropriately justify their recommendation. Candidates may make a different recommendation than the one in the model solution as long as adequate justification was provided. Most of the candidates gave the correct calculation of return per unit of risk and recommended portfolio 3 based on the calculation.

Return per unit of risk = Portfolio Return / Standard Deviation of Returns

- Current portfolio = 26.00
- Proposed Portfolio 1 = 2.92% / 10.8% = 27.04
- Proposed Portfolio 2 = 3.34% / 11.4% = 29.30
- Proposed Portfolio 3 = 3.62% / 11.8% = 30.64

Proposed Portfolio 3 maximizes return per unit of risk

5. Continued

Recommendation

Recommend Portfolio 2; Return per unit of risk is significantly higher than portfolio 1.

Portfolio 3 has slightly higher return per unit of risk but other factors weigh in:

- Private debt has low volatility but is short duration. Suitable for portfolio where interest rate exposure is to be limited.
- Allocation to private debt in portfolio likely exceeds short-term liabilities - probably excessive for this liability portfolio. May be difficult to maintain duration matching with this allocation.
- Volatility of financial results for portfolio 3 may exceed volatility of returns captured in return per unit of risk measure due to asset liability mismatches and due to differences in asset returns and effect of discount rate changes on liabilities.

6. Learning Objectives:

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

Learning Outcomes:

- (5a) The candidate will be able to describe, apply and evaluate considerations and matters related to:
- Insurance company mergers and acquisitions
 - Embedded Value determinations
 - Climate risk management

Sources:

Embedded Value: Practice and Theory, SOA, Actuarial Practice Forum, March 2009
Will IFRS 17 replace EV, Milliman, Sep 2018

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

Commentary on Question:

This question tested the candidates' understanding of insurance company issues, concerns and financial management tools.

Solution:

- (a) Describe the treatment for each of the following items under Market Consistent Embedded Value (MCEV), fulfilment value (IFRS 17) and fair value (IFRS 13) by completing the table below:

	Market Consistent Embedded Value	Fulfillment Value (IFRS17)	Fair Value (IFRS 13)
Future Renewal of In-force Business			
Future New Business			
Expense Assumption			
Profit Emergence			

6. Continued

Commentary on Question:

Candidates showed good understanding of the treatment for Future Renewal of IF business and Expense Assumption. Many candidates pointed out whether Future NB is included/excluded without providing more clarification, such as future NB is included to some extent in case of M&A, and thus partial marks were received. For Profit Emergence, only a few candidates were able to point out the variance from expected values which are recognized in subsequent period under MCEV.

	Market Consistent EV	Fulfillment Value (IFRS17)	Fair Value (IFRS 13)
Future Renewal of IF business	Included.	Excluded if out-of-boundary conditions such as fully repriceable are met.	Included.
Future NB	Excluded, but NBV in past year is separately calculated.	Excluded, but change of elements due to new business acquisition in the reporting period is disclosed.	In the case of M&A, future new business value is included to some extent (based on ability to acquire NB.)
Expense Assumption	All overhead included.	Only directly attributable expenses are included.	All overhead is included, economic efficiency of 3rd party reflected.
Profit Emergence	Recognized when NB is acquired. Variance from expected values are recognized in subsequent periods.	Profits due to NB acquisition are deferred as CSM, and recognized over insurance period. If losses are expected, they are recognized immediately.	n/a

6. Continued

- (b) Using the financial information for the block of business given in the Excel spreadsheet:
- (i) Calculate the actuarial appraisal value. Show all work.
 - (ii) Calculate embedded value. Show all work.

Commentary on Question:

Few candidates received full credit for this part of the question. Many candidates knew that the difference between AAV and EV. Some candidates were not able to use the data provided in the questions correctly. Partial marks were received for the calculations.

Calculations are provided in the Excel spreadsheet.

PV of DCF = PV of After-tax earnings minus Increase in Required Capital
DCF = premium + investment income – benefits – expenses – commissions – increase in statutory reserves – taxes – increase in required capital

(i)
PV of DCF = Appraisal value = 101.15

(ii)
PV of DCF = NB = 23.17
EV = Appraisal value – NB = 77.98

- (c) Critique the decision to set the bid price for this block of business at the actuarial appraisal value.

Commentary on Question:

Candidates generally recognized that AAV is not the most appropriate for bid price. Many candidates provide 1 or 2 adjustments outside the scope of AAV. Full marks received if 3 or more adjustments were provided.

The total value for a company will reflect adjustments for items outside the scope of the appraisal that increase or reduce value such as:

- Value associated with branding or market position
- A buyer's synergies
- Or general market conditions

Therefore, AAV is not the most appropriate for bid price, as it does not reflect these important items.

7. 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.
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:

- (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
- (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:

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

CIA Educational Note: Risk Adjustment under IFRS 17

CIA Educational Note - Market Consistent Valuation of Financial Guarantees for Life and Health Insurance Contracts

Commentary on Question:

This question tested the candidates' knowledge of IFRS17

Solution:

- (a) Critique the following statements with respect to IFRS 17. Justify your response.
- A. *For products with asymmetrical cash flows, the risk adjustment should include a provision to account for this risk.*

7. Continued

- B. *Cash flows that are assumed to vary with assumptions related to financial risk should be projected using returns on assets backing the cash flows.*
- C. *Insurance contracts have the same contractual service margin (CSM) at initial recognition when measured with either the variable fee approach or the general measurement model. The CSM will be different in subsequent periods under the two approaches.*
- D. *The ceded risk adjustment will always be proportional to the direct risk adjustment.*

Commentary on Question:

For statement A, most candidates correctly identified that risk adjustment is for non-financial risks only; however, most candidates did not identify that the asymmetry of cashflows should not be part of risk adjustments.

For statement B, most candidates did not identify that returns on assets backing the cashflows should not be used under IFRS 17.

Most candidates correctly critiqued statement C.

Most candidates did not correctly critique statement D. Most candidates mentioned some high-level differences such as risk of non-performance or accounting mismatches without adequately explaining how it would affect the proportionality of the reinsurance.

A. Incorrect.

Under IFRS 17, it would be included in the estimate of future fulfillment cash flows rather than the risk adjustment under IFRS 17. Risk adjustment is for non-financial risks under IFRS 17. The actuary should also determine if the adjustment due to asymmetry of the cashflows is material or not.

B. Incorrect.

These cash flows would be projected consistent with observable market prices under IFRS 17 and reported as part of the estimates of future cash flows. Possible approaches include deterministic projection with implied market rates, or stochastic modelling under either a risk-neutral or real world with deflators framework.

IFRS 17 does not prescribe the methodology to value the cost of options and guarantees. judgement is required to determine the technique that best meets the objective of consistency with observable market variables in specific circumstances.

7. Continued

C. Correct.

Subsequent measurement differs under the two approaches: GMM recognizes the interest accretion on the CSM measured using locked-in rates. VFA adjusts the CSM for changes in the entity's share of fair value, which implicitly reflects interest accretion, and is measured using current rates.

D. Partially correct.

Where the price of reinsurance is proportional to the level of risk being ceded from the direct entity's perspective, the ceded RA would be proportional to the direct RA, and the direct RA would be unaffected by the presence of reinsurance unless the reinsurance affects the level of compensation required on the direct contract.

When the price of reinsurance is not proportional to the level of risk being ceded from the direct entity's perspective, then the ceded RA may not be proportional to the direct RA.

- (b) You are given the following information for a potential 50% coinsurance arrangement.

Assume the net risk adjustment is calculated and apportioned between the direct and ceded amounts on the basis of the amount insured.

- (i) Complete the following chart in the Excel spreadsheet:

	Direct	Ceded	Net
PV Premium		1,250	(1,695)
PV Claims		(1,250)	1,250
Best estimate liability		0	
Risk adjustment		(320)	320
CSM before reinsurance offset			125
Reinsurance offset (Loss Recovery Component)			
CSM after reinsurance offset			
CSM after zero floor			

7. Continued

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

Commentary on Question:

Most candidates correctly calculated the Direct PV Premium, Direct PV Claims, BEL, RA, and CSM before reinsurance offset.

*Most candidates calculated the reinsurance offset incorrectly. The most common mistake was to set the Ceded reinsurance offset to be 50% of Direct CSM, when the correct calculation should be: Direct reins offset = 50%*direct CSM = 97.7. Ceded reins offset = net - direct = 0 - 97.7 = (97.7).*

Another common mistake was that the Net CSM after zero floor was set equal to the Net CSM after reins offset when the correct calculation should be that Net CSM after zero floor = Ceded CSM after zero floor.

Most candidates' calculations led to them correctly stating that the reinsurance arrangement is beneficial to the company, but to receive full credit, candidates must also identify that the reinsurance turned the contract from onerous to profitable.

(i)

	Direct	Ceded	Net
PV Premium	(2,945)	1,250	(1,695)
PV Claims	2,500	(1,250)	1,250
BEL	(445)	0	(445)
RA	641	(320)	320
CSM before reinsurance offset	(195)	320	125
Reinsurance Offset	98	(98)	0
CSM after reinsurance offset	(98)	223	125
CSM after zero floor	0	223	223

PV direct premium = net prem - ceded prem = (1,695) - 1,250 = (2,945)

PV direct claims = net claim - ceded claim = 1,250 - (1,250) = 2,500

Direct BEL = net - ceded = net prem + net claim - ceded = (1,695) + 1,250 - 0 = (445)

Direct RA = net RA - ceded RA = 320 - (320) = 640

Direct CSM before reins offset = net - ceded = 125 - (RA) = 125 - 320 = (195)

Direct reins offset = 50%*direct CSM = 98

Ceded reins offset = net - direct = 0 - 98 = (98)

Direct CSM after reins = CSM before reins – reins offset = (195)- 98 = (98)

Ceded CSM after reins = CSM before reins – reins offset = 320- (98) = 223

Direct CSM after zero floor = 0

Ceded CSM after zero floor = Ceded CSM after reins offset = 223

Net CSM after zero floor = ceded CSM after zero floor = 223

7. Continued

(ii)

The company should proceed, as the reinsurance arrangement changes the contract from onerous to profitable.

8. 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.
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:

- (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
- (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:

LFM-151-22: IAIS—International Capital Standard, ComFrame, Holistic Framework for Systemic Risk in the Insurance Sector, Sullivan & Cromwell LLP, Dec 2019, Only pages 1-3, 8-28

LFM-620-24: OSFI Guideline E15: Appointed Actuary - Legal Requirements, Qualification and External Review (Aug 2023)

LFM-635-24: OSFI Guideline E16: Participating Account Management and Disclosure to Participating Policyholders and Adjustable Policyholders, OSFI, 2023

LFM-632-23: OSFI B-3 Sound Reinsurance Practices and Procedures

Commentary on Question:

This question tested the candidates' knowledge of international capital standards and valuation principles.

8. Continued

Solution:

- (a) You are given:
- Five years ago, MLL introduced a life insurance product, Super Life (SL), with high guaranteed cash surrender values, targeting the top 5% of income-earners in Canada.
 - No other insurers offer a similar product to SL in the market.
 - Approximately half of all Canadians in the target demographic have purchased an SL policy from MLL.
 - MLL cedes 80% of SL's mortality risk to a single Canadian reinsurer and retains the remaining 20%.
 - MLL follows a very low risk investment strategy with 70% invested in fixed income assets and the remaining 30% held in cash.
- (i) Describe the three key exposures that can lead to systemic risk for MLL under the Holistic Framework from the IAIS.
- (ii) Recommend an approach for applying each of the three key elements of the Holistic Framework to manage systemic risk.

Commentary on Question:

Candidates generally received partial credit for part (i). Few candidates successfully stated the 3 key exposures with sufficient detail.

Candidates generally did not do well on part (ii). Most candidates confused key elements for key exposures.

Three key exposures leading to systemic risk for MLL:

Exposure 1: Liquidity Risk

- The risk an insurer is unable to realize its investments/assets when financial obligations come due
- Risk is higher if assets backing liabilities are illiquid
- Maple Leaf Life's investment strategy is very liquid (70% FI, 30% cash), so risk is low

8. Continued

Exposure 2: Interconnectedness

- How connected the financial system and real economy are
- Macroeconomic exposure (i.e. correlation with the economy)
 - Investment strategy is fixed income assets, but the exact holdings are unknown
 - The product is sold to half of the top 5% income earners in Canada, so the product's failure could have unknown impacts on the economy since many of the wealthiest Canadians own it
- Counterparty exposure (i.e. reliance on counterparties sharing correlated risk among each other)
 - 80% of the mortality risk is reinsured, so there is a dependency on the reinsurer to fulfil its obligations to MLL and its other clients

Exposure 3: Limited Substitutability

- Inability to continue the supply of insurance products if one insurer fails
- If MLL were to fail, there's no guarantee another insurer would launch a similar product (though they could), and currently 2.5% of all Canadians are benefiting from the product

Approach for applying the three key elements of the Holistic Framework:

Element 1 – an enhanced set of supervisory policy measures to prevent systemic risk, including supervisory powers of intervention to respond when a potential risk is identified

- MLL can enhance their ERM policies to include risk identification of systemic risk, including governance, liquidity stress testing, liquidity portfolio, contingency fund planning, or liquidity risk management report
- MLL can develop a counterparty risk appetite statement

Element 2 – a global monitoring exercise to assess global trends and detect build-up of systemic risk

- MLL can implement "Individual Insurer Monitoring" of their own, focusing on the key elements of that framework (including size, global activity, etc.)
- MLL can also monitor global trends where they may have exposure to changes in economic environment and the associated potential risks

8. Continued

Element 3 – an implementation assessment, where the IAIS will assess the implementation of enhanced supervisory policy measures and powers of intervention

- - Internally, Maple Leaf Life can establish an auditing process to ensure the measures identified (in Step 1) are monitored and implemented correctly

(b) MLL is launching a new participating whole life product.

- The launch date is January 1, 2025.
- MLL requires the project manager to secure reinsurance.
- The project manager has decided the following:
 - Reinsurers should provide quotes by the launch date
 - Reinsurers to be selected no later than January 31, 2025
 - Reinsurance treaties are to be fully executed by June 30, 2025
- Senior management will recommend to the Board a policy for determining dividends and managing the participating account
- As part of the annual year-end President's Report to the board, the CEO will include a disclosure on the fairness of proposed policyholder dividends and the allocation of investment income and expenses
- The Appointed Actuary will perform a triennial review of the fairness of any changes made to the participating product
- Policyholder disclosures on the management of the participating account will be based on excerpts taken from internal company documentation, with redactions from the legal team to remove proprietary details

Critique the proposed product development decisions with respect to the relevant OSFI guidelines. Justify your answer.

Commentary on Question:

This part of the question tested the candidates' understanding of how reinsurance contracts are established and the role of the appointed actuary. Most candidates performed well on this part of the question.

Based on how the project manager appears to have official responsibility for determining when reinsurance is secured during the product development process, MLL may need to establish a Reinsurance Risk Management Policy or revise it to ensure better oversight over this aspect of product development. This is also apparent as the proposed timelines do not comply with OSFI Guideline B-3. A binding "summary document" (e.g. letter of intent) should be in place by the launch date (i.e. when the reinsurance becomes effective) which doesn't appear to be the case, and the fully executed treaty should be signed within 120 days; June 30 is therefore too late.

8. Continued

MLL is correct to develop a policy for managing dividends and the par fund which must be approved by the board of directors. However, the annual disclosure must come from the Appointed Actuary, not the President/CEO. In most cases, the CEO may not be the Appointed Actuary.

While the Appointed Actuary must periodically opine on the impact to fairness of product changes, it must be at least annual rather than triennial.

Although MLL is required to provide certain disclosures to policyholder including on how the participating account is managed, taking excerpts from technical documentation may not satisfy the requirement to be understandable with a rudimentary knowledge of life insurance (i.e. not being a technical expert). Moreover, by having the legal team redact the language, it may lead to the disclosure being too generic or boilerplate.

9. 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:

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

Commentary on Question:

This question tested the candidates' understanding of economic capital and the Canadian regulatory capital framework. Overall, candidates demonstrated a moderate understanding on part (a) and a good understanding on parts (b) and (c).

Solution:

- (a)
- (i) Describe the components of an economic capital calculation
 - (ii) Describe the economic capital considerations pertaining to the term life acquisition.

Commentary on Question:

For part (i) of the question, most candidates were able to identify that economic capital is determined from the point of view of the company which; however, most candidates did not describe the components of the calculation sufficiently to demonstrate full knowledge. Some candidates confused economic capital with the Canadian regulatory capital framework (LICAT) which resulted in no credit. For part (ii) of the question, candidates did well to describe the diversification benefit that would be realized from the term life acquisition, but few candidates were able to provide sufficient considerations.

9. Continued

Part (i):

- Important to distinguish between the available capital (excess of assets over liabilities held by the insurer) and the required capital (the amount of assets in excess of liabilities needed to withstand future adverse outcomes)
- The accounting valuation of assets and liabilities used will not necessarily agree with the baseline valuation that is preferred for EC
- The most important feature is that the correct total asset requirement (liabilities plus required capital) at time 0 is derived
- EC attempts to measure a capital requirement based on the most realistic assessment of future economic risks
- The effect of real world risks is measured and the capital required to cover these outcomes with a specified degree of security is then calculated
- EC is measured consistently with the economics of the company
- The valuation basis should allow a realistic assessment of the risks in a way that provides a meaningful perspective across a potentially diverse set of exposures

Part (ii):

- Need to consider the EC requirements of the target company from XYZ Life's perspective
- Need to consider the result of aggregating the acquired block on XYZ's own capital requirements
- Diversification impacts of the acquisition when appropriate should be taken into consideration
- Can be EC offsets when combining different aspects of the same risk
- An increase in capital may be required if acquired business is lower than XYZ's target

(b) Critique each of the following statements pertaining to LICAT required capital. Justify your answer.

- A. *XYZ's lapse risk required capital component will decrease due to the acquisition.*
- B. *For the purpose of determining the lapse designation, XYZ will test whole life and term life on a combined basis.*
- C. *XYZ is not allowed by regulation to acquire the term block if it would cause capital to decrease below the Internal Capital Target.*

Commentary on Question:

Most candidates were able to receive partial credit for each of the three statement critiques s by providing a valid explanation for each statement. No credit was received if candidates did not provide proper justification.

9. Continued

A. Disagree

- Lapse risk component applies to both lapse-supported & lapse-sensitive products.
- Since the new business is being added, the risk will increase, and this required capital component would increase.

B. Disagree

- Lapse supported and lapse sensitive products are assumed to be negatively correlated for LICAT.
- Lapse supported products should be shocked with a decrease in lapse rates while lapse sensitive products should be shocked with an increase in lapse rates.

C. Disagree

- Internal Capital Target is not a regulatory requirement.
- Capital resources may fall below the Internal Target, the insurer has to inform OSFI promptly along with a plan on how it expects to manage the risks and/or restore its Capital Resources to its internal targets levels within a relatively short period of time.

- (c) Premium data, required capital components and capital factors are given in the Excel spreadsheet.

Calculate the Total Operational Risk Capital for XYZ as of December 31, 2024. Show all work.

Commentary on Question:

Most candidates provided the formula for the calculation of the operational risk required capital. The business volume required capital calculation and the general required capital calculation were performed well in general. However, the calculation for the large increase in business volume required capital was not well applied by most of the candidates. Even if they were able to demonstrate the knowledge that the exposure is the excess of current year's premiums over 120% of the prior year's premiums, which provided them with partial credit, most candidates did not split the businesses between the individual and group business segments. Another common mistake for this calculation was including the 2023 premiums for the Term Life that were not part of XYZ's business in that year.

- 1) General formula for the calculation of the operational risk required capital
- $$\begin{aligned} \text{Operation Risk RC} &= \text{Business Volume RC} \\ &+ \text{Large Increase in Business Volume RC} + \text{General RC} \end{aligned}$$

9. Continued

2) Calculate the business volume required capital

$$\text{Business Volume RC} = \text{Factor} * \text{Premiums (over last year)}$$

$$\text{Business Volume RC} = 2.50\% * (400 + 250 + 250) = 22.50$$

3) Calculate the large increase in business volume required capital

$$\text{Large Increase in Business Volume RC}$$

$$= \text{Factor} * [\text{Premiums in excess of a 20\% year} - \text{over} \\ - \text{year increase}]$$

→ This formula should be applied separately for Individual Life, Group Life and Other business.

$$\text{Large Increase in Business Volume RC (Individual)}$$

$$= \text{Max}(0; 2.50\% * \{(400 + 250) - 1.2 * (500 + 0)\}) = 1.25$$

$$\text{Large Increase in Business Volume RC (Group)}$$

$$= \text{Max}(0; 2.50\% * \{250 - 1.2 * 200\}) = 0.25$$

$$\text{Large Increase in Business Volume RC} = 1.25 + 0.25 = 1.50$$

4) Calculate the general required capital

$$\text{General RC}$$

$$= \text{Factor}_1 * [\text{Credit, Market, Insurance RC net of reinsurance \& credit}]$$

$$+ \text{Factor}_2 * [\text{Seg Fun Guarantee RC}] + \text{Factor}_3$$

$$* [\text{Premiums for reinsurance held contracts}]$$

$$\text{General RC} = 5.75\% * (100 + 320 + 130 - 20) = 30.475$$

5) Calculate the operational risk required capital

$$\text{Operation Risk RC} = 22.50 + 1.50 + 30.475 = 54.475$$