ILA LFMC Model Solutions
Spring 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:

LFM-641-19: OSFI: Own Risk and Solvency Assessment (E-19), December 2017

A Multi-Stakeholder Approach to Capital Adequacy, Conning Research

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

Commentary on Question:
This question tested the candidates' understanding of capital management.

Solution:

(a)   List the key elements of Own Risk and Solvency Assessment (ORSA).

       Commentary on Question:
       Candidates generally listed some of the major areas. Some candidates missed the major areas and listed minor parameters such as "scope of the report", "time horizon", "accounting basis", etc. which did not receive credit.

       The ORSA should contain, at a minimum, certain key elements and considerations, including:
- Comprehensive Identification and Assessment of Risks
- Relating Risk to Capital
- Oversight

1.   Continued

- Monitoring and Reporting
- Internal Controls and Objective Review

(b)   Critique the following statements:

A.   *The results of an economic capital model could lead to forced receivership of the company or downgrade of the company.*

Commentary on Question:
Candidates generally did well in their critique of this statement.

False. Economic capital models take a customized view of the insurer's need for capital, but, unlike the standardized regulatory and rating agency models, have no real consequences for the insurer. The results of the economic capital model are currently used only to provide information to the company.

B.   *Company ABC determines its interest rate risk as a fixed 10% of reserves factor. The risk assessment is deemed as realistic as the reserves reflect the risk.*

Commentary on Question:
Most candidates correctly identified that this statement was false but did not provide sufficient rationale to receive full credit.

False. We do not classify this as a realistic risk assessment because it does not consider the specific risks faced by the company, is not based on current market data or historical analysis and is not updated frequently.

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

Commentary on Question:
Most candidates correctly distinguished the difference in objectives between rating agencies and shareholders and addressed the opposing objectives shareholders face.

False (True for rating agencies but false for shareholders).

Rating agencies, like regulators, are concerned with the ability of the insurer to meet its obligations. Generally, from a rating agency perspective, more capital is the favored position

1. Continued

The shareholders' objective is to maximize their return on capital while maintaining enough capital to absorb unexpected, non-diversifiable risk. In addition, shareholders want enough capital to support growth of new and existing operations that will meet their return-on-capital requirements. Shareholders thus have multiple objectives that pull the amount of required capital in opposing directions. That is, some objectives are satisfied with higher capital levels, some objectives are satisfied with lower capital levels.

D. *The "correlation matrix approach" is a common approach used for evaluating the diversification benefit. The correlation assumptions are often set by a combination of historical data or expert forecasts that analyze the relationship between risk scenarios. The correlations are applied to the risk scenarios.*

Commentary on Question:
Candidates generally did not do well in their critique of this statement. Most candidates correctly identified that the first sentence was correct. Many candidates identified the second sentence as incorrect when in fact it was correct. Many candidates did not identify the last sentence as incorrect. For the second and third sentences, a common mistake was around understanding how risk scenarios are related to the Correlation Matrix Approach.

True statement for how the correlation assumptions are set. False statement for how the correlation assumptions are applied, the correlations are applied to the standalone capital amount not the risk scenarios itself. The implication of this approach is that balance sheets respond linearly to risk scenarios, which can be a severe approximation for some types of business, creating a diversification amount which is a function of individual exposures rather than the underlying relationship between risk drivers.

E. *Under the finite risk horizon approach, the Economic Capital represents the current market value of assets required to ensure that the value of liabilities can be covered at a finite point in the future, at the chosen security level, less the current value of liabilities. Under this approach, a run off projection is still required.*

Commentary on Question:
Candidates generally did not do well in their critique of this statement. The most common error was to state that a run-off project was not required.

True. It is important to note that even under the finite risk horizon approach, a runoff projection is still required, since a terminal value of liabilities at the end of the risk horizon is needed. Future uncertainty surrounding the risk beyond the risk horizon is captured within the value of the liabilities at the end of the year.

1. Continued

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

(i) Capital adequacy

(ii) Risk appetite

Commentary on Question:
Candidates generally did not do well on this part of the question. Many repeated or rephrased answers already given in previous parts of the question.

(i)
Capital adequacy is the core use of EC for most insurers—providing a measure of capital that truly captures the risk of the insurer's own portfolio, free from the distortions of regulatory reserving and capital requirements and the simplified approximations within most rating agency models.

Effective use of EC in measuring capital adequacy requires the EC measure to be integrated into the capital management process, with potential EC requirements along a number of scenario paths being developed and capital funding strategies developed to address these. EC can also be used to help determine asset allocations by lines of businesses.

EC often features strongly in discussions on capital adequacy with regulators, rating agencies, and plays an important role in discussions with shareholders and investment analysts.

(ii)
EC is a key measure of risk from a policyholder perspective and therefore frequently features as an important component of an insurer's risk appetite framework and in the monitoring processes implemented to ensure the insurer remains within that risk appetite.

To do this, target ranges for EC utilization need to be established for each geography, business unit and/or risk, and actual EC monitored against these target ranges. The setting of such ranges and limits needs to consider the expected level of diversification between risks as well as the level of granularity. EC can also be used to develop a tiered approach of deploying capital.

As risk profiles of the organization changes, the use of EC for this purpose requires an ability to update EC.

2. **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-657-22: The IFRS 17 Contractual Service Margin: A Life Insurance Perspective

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

Solution:
(a) Consider each of the following:

- A direct insurance contract which is profitable at issue
- A direct insurance contract which is not profitable at issue

(i) Explain how profit or loss is recognized both at issue and over the duration of the contract under IFRS 17.

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

Commentary on Question:
In general, candidates could distinguish features of profitable versus onerous contracts. Most candidates explained how CSM releases into profits but neglected the risk adjustment releases. In general, candidates explained the systematic tracking of a loss component but did not explain that favorable changes to future assumptions can offset the loss component completely and that the re-established CSM will be amortized gradually again.

2. **Continued**

   (i)   Under IFRS17, insurance contracts can be classified as profitable or onerous at contract inception.

- For profitable policies:

  - PV of fulfilment cashflows will be negative and a contractual service margin (CSM) will be established at inception, in lieu of an initial profit being recognized in the P&L. Profit recognition will be deferred

  - CSM will be amortized gradually as insurance services are provided and the CSM will also be adjusted to reflect gains/losses from future service changes. Other experience variances (not reflected in the CSM) will flow through the P&L or OCI

  - Besides the CSM releases, risk adjustment releases also contribution to the P&L of a contract over time as an additional source of profit.

- For non-profitable contracts:

  - CSM calculated at inception is negative and since the CSM cannot be negative, its floored at 0 and an equivalent loss component will be established. While positive CSM is released at profit gradually, the loss component is recognized in its entirety in the P&L.

  - Other changes which would have been reflected by adjusting the CSM go to the P&L and OCI to adjust (offset) the loss component

  - If the contract has positive adjustment to future service that can fully offset the Loss Component, a positive CSM can be re-established and amortized over the future contract duration via the P&L

  - Risk adjustment release will provide additional profits in the P&L over time.

   (ii)   Reinsurance treatment under IFRS17,

- CSM will be established for Reinsurance Contract Held (RCH) regardless of the RCH being profitable or not
- Any adjustments to current or future service will adjust the CSM or flow through the P&L or OCI as appropriate
- CSM under the RCH can be negative and will continue to be amortized like a profitable IFRS17 contract (i.e. loss component not established)
- Ceded and direct IFRS17 profits are reported separately unlike IFRS4. Therefore, reinsurance contracts will have no impact on the reporting of the direct contracts

2. **Continued**

(b)

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

    (ii)   You are provided with the following target profit margins for the products sold by your company, expressed as a percentage of the present value of premium:

Issue Age Band	Whole Life	Group Health Insurance	Payout Annuities
<=45	5.00%	50.00%	1.00%
46-65	3.00%	45.00%	1.00%
66+	-5.00%	5.00%	2.00%

Assume actual experience is consistent with the target profit margins.

Recommend how the contracts should be allocated for IFRS 17 measurement purpose. Justify your response.

Commentary on Question:
Candidates generally did well on this part of the question. Candidates were able to describe the key steps involved in setting levels of aggregation and allocate the portfolio by risk differences and profitability gaps. For part (ii) some candidates mentioned the required allocation in the groupings but did not identify which groups the risk would be allocated to (i.e., onerous, or profitable with no significant risk of being onerous or other).

Some candidates grouped all ages in Group Health together as "profitable with no risk of being onerous" since the question stated that experience would emerge as expected. This implied profit margins would not become loss making in the future. Credit was received if this reasoning was provided along with all ages being combined into one group.

(i)   Level of aggregation can be determined using two main steps:
- Companies need to identify portfolios – These portfolios should consist of risks of a similar nature, profile, etc. The risks in a portfolio would be managed together.

2. **Continued**

- Above portfolios would be allocated into groups. These groups would be
  - Based on the profitability of the underlying contracts
  - Profitability based contract groups would be:
    - Onerous contracts
    - Profitable contracts with no significant possibility of being onerous
    - Other; at the very least
  - Contracts in a given group would not be issue more than 12 months apart
  - Additional grouping maybe be set up as deemed appropriate

(ii)   All three products represent materially different risk profiles and should split into three groups at the very least. Profitability within the products is varied and justifies further splits. Recommended grouping:

- Whole Life:
  - Ages <=45 & 46-65 : Other
  - Ages 66+ : Onerous
- Group Health
  - Ages <=45 & 46-65 : Profitable with no significant risk of becoming onerous
  - Ages 66+ : Other
- Payout annuities
  - All Ages : Other

(c)   You are given the following information for a group of insurance contracts:

- Contractual Service Margin (CSM) at issue: 1,000
- The CSM is amortized linearly over a 10-year period
- The locked-in interest rate = 4%
- Current interest rates are the same as the locked-in interest rates
- Basis changes are effective at the end of the year
- For simplicity, the risk adjustment is set to 0

For each of the following outcomes:

1) Actual death claims during the year are 300 greater than expected death claims
2) A favorable mortality basis change of 400
3) An unfavorable mortality basis change of 1,500

(i)   Calculate the impact on profitability at the end of the first year

(ii)   Calculate the impact on insurance contract liabilities at the end of the first year

2.   Continued

Commentary on Question:
Candidates generally did not do well on this part of the question. Many candidates combined the three outcomes into one outcome. For candidates that addresses each outcome separately, most failed to identify the offsetting BEL impact of positive or negative changes to the mortality basis which would dilute the impact of the basis change on the ICL.

	Base	Case 1	Case 2	Case 3
CSM BoY	1,000	1,000	1,000	1,000
Interest	40	40	40	40
Basis Change	0	0	400	-1,500
P/L Release	104	104	144	0
Loss Component	0	0	0	460
CSM EoY	936	936	1,296	0
Ins Revenue	104	104	144	0
Ins Expenses	0	-300	0	0
Loss Component				-460
IFRS17 P&L	**104**	**-196**	**144**	**-460**
P&L Impact		**-300**	**40**	**-564**
BEL Impact	0	0	-400	1,500
CSM Impact	0	0	360	-936
RA Impact	0	0	0	0
ICL Impact		**0**	**-40**	**564**

* impact relative to base case

(1) Current period change, no impact to CSM. $300 in claim variance will directly flow into P&L and drop profits by 300 compared to base scenario. ICL will remain unchanged
(2) Favorable basis change $400 will increase CSM as it is a future service change. Increase CSM will amortize i.e. CSM increase by 40 (10% x 400) compared to base case. Basis change would increase EoY CSM balance by 360 (400 – 40) and BEL would be lowered by 400. Net ICL impact = - 40
(3) Unfavorable impact will wipe out CSM and loss component of 460 would be established. BEL would increase by 1500 and CSM drops off by 936. Net ICL impact would be 564

3.

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-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).

LFM-650-20: FASB in Focus - Accounting Standards Update No 2018-12:Targeted Improvements to the Accounting for Long-Duration Contracts Issued by Insurance Companies

Commentary on Question:

This question tested the candidates' understanding of improvements to the accounting standards for insurance contracts.

Solution:

(a) Describe four objectives of ASU 2018-12 that improve the accounting for insurance contracts.

Commentary on Question:

Candidates generally described all or most of the 4 improvements.

1. A more current measure of insurance liability
   - Calculations will be regularly refined for actual experience and updated assumptions.
   - Liability discounted at upper-medium grade rate fixed income rate that reflects the characteristic of the liability rather than the invested assets supporting the liability.
   - Cashflow assumptions will be reviewed, and if there is a change, updated at least annually with changes reflected separately in net income.
   - Discount rate assumptions will be updated at each reporting date, with change reflected in other comprehensive income.

2. A more uniform and current, market-based measure of market-based options or guarantees.

   - Market risk benefits will be measured at fair value
   - The effect of changes recognized in Other Comprehensive Income (OCI)

3. Continued

3. Simplified amortization of deferred acquisition costs.
   - DAC will be amortized on a constant-level basis over the expected lifetime of the contract.
   - The expense pattern will be more easily predictable and wil not fluctuate with company's investment or underwriting performance.
   - DAC will not be subject to impairment testing.

4. Several new disclosures will be required.
   - Disclosures included liability roll-forwards
   - And information about significant inputs, judgements, assumptions and methods used in measurements.

(b) Reserves for a term life insurance product are calculated under ASU 2018-12. Critique the following statements:

A. *The valuation actuary requests an update to the mortality assumption resulting from adverse experience. Due to time constraints, no other assumptions were reviewed.*

B. *The proposed update to the mortality assumption results in net premiums exceeding gross premiums for some cohorts. In response, the valuation actuary has requested premium deficiency testing.*

Commentary on Question:
Candidates were generally able to identify the issue with these statements and give reasonable explanations, but most candidates did not provide further suggestions or recommendations to remedy the statements.

A.)
- An insurance entity cannot choose to simply update the historical cashflows and the insurance inforce without considering the need to review its future projections, even though more detailed experience studies and detailed review of future assumptions may be scheduled for later in the year.

- If an insurance entity concludes that one assumption needs to be updated or actual cashflows must be adjusted, the entity is unlocking the net premium ratio and needs to revalidate that all other assumptions are still appropriate.

B.)
- Under 2018-12, the net premium ratio is capped at 100%.

- Therefore, a premium deficiency test is not required for non-participating traditional life insurance.

3. Continued

- Expected benefits in excess of premiums are expensed immediately.

- If conditions improve whereby the contracts are no longer expected to have net premiums in excess of gross premiums, the improvement would be captured in the remeasurement process and reflected in earnings in the period of improvement.

(c)   Assume:

- Gross premiums are paid the beginning of the year
- Benefits are paid at the end of the year
- The locked discount rate is 4%
- The current rate at the end of year 4 is 3.5% for all future years

Calculate the following:

(i)   (*1 point*) Net Premium in year 1

(ii)   (*3 points*) Liability Remeasurement Gain or Loss in year 4.

Show all work.

Commentary on Question:
Candidates were generally able to calculate the first year net premium, but struggled with the process of Liability Remeasurement. Common mistakes included wrong timing for Present Value Calculations and wrong choice of mortality rates.

(i)
Net Premium Ratio Calculation (at issue)

Year	Benefits	Gross Premiums
1	550.0	1000.0
2	542.1	964.9
3	532.9	929.3
4	527.1	893.2
5	523.5	855.5
6	522.7	812.7
7	515.2	768.0
8	512.4	723.1
9	505.6	675.8
10	496.7	650.4

3. **Continued**

PV of Total Benefits (Yr 1-10)
= NPV(4%, 550.0, 542.1, … 496.7) = 4,254.43   (a)

PV of Total Gross Premiums (Yr 1-10)
= NPV(4%, 1,000.0, 964.9, … 650.4) *(1+4%) = 7,087.52 (b)

Net Premium Ratio
= (a)/(b) = 60.03%   (c)

First Year Net Premium
= 60.03% * 1,000.0 = 600.3   (d)

(ii)
Beginning of Year 4 Calculation

PV Future Benefits (Yr 4-10)
= NPV(4%, 527.1, … 496.7) = 3,094.1   (e)

PV Future Net Premiums (Yr 4-10)
= NPV(4%, 893.2, … 650.4) *(1+4%) * 60.03%= 2,903.8 (f)

Liability for Future Policy Benefits (LFPB)
= (e) – (f) = 190.27   (g)

Revised Net Premium Ratio:

	Year	Benefits	Gross Premiums
Actual	1	650.0	1000.0
Actual	2	642.1	814.6
Actual	3	632.9	784.6
Actual	4	627.1	754.1
Projected	5	534.2	838.4
Projected	6	544.5	780.2
Projected	7	548.1	721.9
Projected	8	557.0	665.3
Projected	9	561.8	608.2
Projected	10	564.4	572.4

PV of Total Benefits (Yr 1-10)
= NPV(4%, 650.0, 642.1, … 564.4) = 4,786.26   (h)

3. **Continued**

PV of Total Gross Premiums (Yr 1-10)
= NPV(4%, 1,000.0, 814.6, … 572.4) *(1+4%) = 6,459.67 (i)

Revised net Premium Ratio
= (h)/(i) = 74.09%

Beginning of Year 4 Calculation:

PV Future Benefits (Yr 4-10)
= NPV(4%, 627.1, … 564.4) = 3380.2   (j)

PV Future Net Premiums (Yr 4-10)
= NPV(4%, 754.1, … 572.4) *(1+4%) * 74.09% = 3,293.0 (k)

Liability for Future Policy Benefits (LFPB)
= (j) − (k) = 87.2   (l)

Liability Remeasurement (Gain) or Loss
= (l) − (g) = 87.2 − 190.3 = - 103.1   (m)
Since the change is negative, it is a gain

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:
CIA Draft Explanatory Report: IFRS 17 Expenses, Apr 2021

IFRS 17 Insurance Contracts Example (Spreadsheet Model)

Commentary on Question:
This question tested the candidates' understanding of IFRS valuation principles.

Solution:
(a)   State the criteria for an expense to be classified as directly attributable under IFRS 17.

Commentary on Question:
Candidates generally did well on this part of the question. Candidates generally understood the concept of directly attributable and were able to classify expenses as directly attributable or not with the appropriate explanation.

An expense would be considered directly attributable if it is incurred for the clear purpose of either issuing insurance contracts or fulfilling obligations under insurance contracts. From this perspective, expenses such as investment management, asset liability management and risk management would not be considered directly attributable. While these expenses are incurred to support the profitable operation of an insurance entity, the primary purpose of these functions is one or two steps removed from acquiring insurance contracts or fulfilling obligations under insurance contracts

4. Continued

(b)   Classify each of the following expenses as directly attributable or not directly attributable under IFRS 17. Justify your response.

   (i)   Investment expenses for products that relate to the management of assets that are not part of the underlying items

   (ii)   Regulatory and statutory reporting expenses

   (iii)   Generic marketing expenses

   (iv)   Expenses pertaining to a UL sales conference

Commentary on Question:
Candidates generally did well on this part of the question. Candidates generally understood the concept of directly attributable and were able to classify expenses as directly attributable or not with the appropriate explanation.

   (i)   The intent of the IASB appears to be exclusion of investment expenses related to management of assets that are not part of an underlying item, as B65(ka)(i) describes enhancing benefits as generating "an investment return from which the policyholder will benefit if an insured event occurs. Normally investment returns on non-underlying assets accrue to the entity, not the policyholder, hence the associated expenses would not be directly attributable.
An alternative would be that investment activities do enhance policy-holder benefits (e.g., larger amount of coverage offered to the policy-holders for the same premium when investments are considered), in which case investment expenses could be considered directly attributable expenses. The actuary would be mindful of the interdependency between including certain types of investment expenses in the FCF and the identification of investment-return services in insurance contracts.

   (ii)   Given that these expenses are essential for insurance companies (listed companies for the shareholder-related expenses), there could be a rationale for classifying them as directly attributable expenses. -- For example, supporting functions such as legal, finance and actuarial may be directly attributable at the business unit level because those functions support the business – e.g. compliance with regulatory requirements. These expenses may be considered directly attributable expenses. However, given that these expenses are one or two steps removed from acquiring or fulfilling insurance contracts, there could be a rationale for classifying them as non-directly attributable expenses. the same functions at a Corporate level generally would not be directly attributable as those functions are supporting the entity as a whole – e.g. regulatory requirements as a public company, consolidation of results for financial reporting, etc.

4. Continued

(iii) The ultimate purpose of these costs is issuance of insurance contracts, hence these expenses could be classified as directly attributable. That purpose is generally one or two steps removed from directly selling or enabling acquisition of specific new contracts or portfolios of contracts, and therefore these expenses could be classified as non-directly attributable expenses unless there is stronger direct linkage to the issuance of insurance contracts.

(iv) The classification of these expenses into directly attributable expenses could be dependent on their nature. For example, if the conference is focused on specific product(s), it could be considered as directly related to issuance of insurance contracts and would therefore be part of the directly attributable expenses. Conferences on general strategy would be considered nondirectly attributable expenses as the purpose is one or two steps removed from issuance of insurance contracts. Judgment would be applied if the level of granularity required to assess the nature of these expenses is not available.

(c) Your company offers a term life insurance product with the following features:

- Term of the product: 5 years
- Face amount = 10,000
- Single Premium = 200

You are given the following assumptions to be used to value the contract under IFRS 17:

- Maintenance costs / year = 25
- Mortality rate = 1 / 1000 for all ages
- Lapse rate = 10% per year
- Locked-in discount rate = 4%
- Risk adjustment = 10% of the liability for mortality and expenses
- The single premium is paid at inception of the policy
- Expenses are assumed to occur at the beginning of the year
- Death benefits are assumed to be paid at the end of the year

(i) Determine the CSM or loss component at issue. Show all work.

(ii) Assume that a basis change increases reserves at the end of the second year by 20 measured at the locked-in discount rate.

Calculate the CSM balance for all years. Show all work.

4. **Continued**

Commentary on Question:
Candidates generally had trouble determining the CSM. The survival factors were either calculated incorrectly or were forgotten to be applied to the cash outflows. Timing of the cash flows also need to be considered.

Please see excel workbook.

5.

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:

LFM-645-23: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), July 2022, Ch. 1-11 (excluding Sections 4.2-4.4 & 7.3-7.10)

LFM-636-20: OSFI Guideline A-4 Internal Target Capital Ratio for Insurance Companies, December 2017

Commentary on Question:

This question tested the candidates' understanding of various capital management approaches.

Solution:

(a)   For each of OSFI's capital targets specified below:

- Minimum Capital
- Supervisory Target Capital
- Internal Capital targets

(i)   Explain the purpose of the target and the minimum thresholds for each.

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

Commentary on Question:

Candidates generally did well on this part of the question. Candidates generally provided the purpose of each capital target and the impact of having capital levels fall below the target. Few candidates explained that internal targets should be set above supervisory targets based on the ORSA.

5. **Continued**

      (i)   Minimum Capital
            90% Total / 55% Core
- Minimum level necessary to cover the risks specified in the guidelines.

            Supervisory Target
            Total 100% / Core 70%
- Minimum level necessary to cover the risks specified in the guidelines and provide a margin for other risks.

            Internal Capital targets
- Target level of capital needed to cover all risks of the insurer
- Internal targets should be set above supervisory targets based on the ORSA

      (ii)   Minimum Capital
- OSFI would be very concerned if capital was to fall below the minimums.

            Supervisory Target
- Insurer would undergo in creased supervision if capital levels fall below supervisory targets.

            Internal Capital targets
- Insure should provide regulator with plan to increase capital if level falls below internal target

(b)   You are given the following information for a Canadian stock life insurance company with respect to the LICAT requirements:

Base solvency buffer	8,000
Surplus allowance	1,000
Eligible deposits	1,000
Contributed surplus	3,000
Adjusted retained earnings	3,000
Adjusted other comprehensive income (AOCI)	1,000
Goodwill	2,000
Policy-by-policy negative reserves	2,000
Tier 2 capital instruments	2,500

Assume:

- All business is individually underwritten Canadian life business
- Negative reserves are not recoverable on surrender

5. Continued

    (i)   Calculate the Total Ratio.

    (ii)   Calculate the Core Ratio.

    (iii)   Outline the implications of the company's current capital ratios.
Core ratio is below supervisory target. Company will be subject to increased supervision

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

Show all work.

Commentary on Question:
Candidates generally applied the correct formulas to calculate the total ratio and core ratio. Few candidates performed the cap on Tier 2 and 70% on negative reserves.

    (i)   Total Ratio = (Available Capital + Surplus Allowance + Eligible Deposits)/Base Solvency Buffer
Available Capital = Tier 1 + Tier 2

Tier 1 = Contributed surplus + Adjusted Retained Earnings + Adjusted AOCI

Tier 1 deductions = 70% negative reserves + Goodwill

Tier 2 = tier 2 capital instruments + 70% Negative reserves

Tier 2 cannot be more than 100% of tier 1 capital

5. **Continued**

	Gross Tier 1	7,000
1	Deductions from Tier 1	3400
2	Net Tier 1	3,600
	Tier 2 capital instruments	2,500
1	Negative reserves	1400
2	Total Tier 2	3,900
2	Limited to a max tier 1	3,600
	Total ratio	
	Total Capital	7,200
	Eligible Deposits	1,000
	Surlus Allowance	1,000
	Base solvency Buffer	8,000
3	Ratio	115

(ii) Core Ratio = (Tier 1 Capital + 70% Surplus Allowance + 70% Eligible Deposits)/base Solvency Buffer

	Core Ratio	
	Tier 1 Capital	3,600
	70% Eligible Deposits	700
	70% Surplus allowance	700
	BSB	8,000
3	Ratio	62.5

(iii) Core ratio is below supervisory target. Company will be subject to increased supervision

(iv) Obtain more capital and cede more business.
In this case, accept moving the ceded reinsurance to a registered reinsurer
(the question assumes eligible deposits) to provide full capital relief

6. **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.

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

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

(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:
CIA Draft Educational Note: IFRS 17 – Fair Value of Insurance Contracts, Oct 2021

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

Commentary on Question:
This question tested the candidates' knowledge of appraising a book of business and cost of capital.

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

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

   Commentary on Question:
   Generally, candidates correctly defined the actuarial appraisal value (AAV) and its components for part (i). Alternative names were acceptable as long as candidates were able to correctly describe the components. For part (ii), most candidates identified the disclosure items for AAV rather than the information included in an actuarial appraisal report.

6. Continued

    (i)   The components of the actuarial appraisal value (AAV) are the Adjusted Book Value (ABV), the Value of Inforce Business (VIB) and the Value of New Business (VNB).

        ABV is the net worth of a company on a statutory basis, or the excess of statutory asset over statutory liabilities.
VIB is the present value of future profits of business that is currently on the insurance company's books.
VNB is the present value of profits of expected future new business.

    (ii)   Typical actuarial appraisal reports include the following information:
- Actuarial Appraisal Value
- Projection of statutory earnings and capital requirements
- Sensitivity analysis of critical assumptions.

(b)   You are provided with the following information for a life insurance company:

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Base Solvency Buffer	1000	800	600	400	200	0
Surplus Allowance	50	40	30	20	10	0

Target Capital ratio	150%
Pre-tax earned rate on assets supporting capital	4%
Effective tax rate	25%
Weighted average cost of capital	10%

Assume there is no reinsurance.

Calculate the cost of capital. Show all work.

Commentary on Question:
Most candidates applied an adequate evaluation of the cost of capital for a life insurance company. Common mistakes included not discounting, incorrect computation of cost of capital rate and/or miscalculation of the required capital.

The cost of capital is calculated as follow

$$CoC = \sum \frac{r_t \times C_t}{(1 + d_t)^t}$$

where r_t is the cost of capital rate, which is equal to
        = WACC – after-tax earnings on assets supporting surplus
        = 10% - (1-25%)*4%
        = 7%

6. Continued

d_t is the discounting rate at 10%.

C_t is the projected required capital
= Target Capital Ratio* Base Solvency Buffer – Surplus Allowance

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
BSB	1000	800	600	400	200	0
Surplus Allowance	50	40	30	20	10	0
Required Capital (C_t)	1450	1160	870	580	290	0
r_t x C_t	101.5	81.2	60.9	40.6	20.3	0
PV (CoC)	$245.47					

The cost of capital is 245.

7.

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 tests candidates' understanding of the ACB calculation on life insurance policies, and the general mechanics for performing the tax-exempt test on life insurance policies.

Solution:

(a)   Explain how an exempt test policy (ETP) would be constructed.

Commentary on Question:

Candidates generally did well on this part of the question. Most candidates explained that the criteria must be met from issue and at every policy anniversary.

Endowment policy at age 85 / 20 pay was accepted as an alternative to endowment policy at age 90 / 8 pay.

Exempt Policy
- A policy is qualified as an exempt policy if its accumulating fund does not exceed the accumulating fund of a hypothetical exempt test policy.
- To remain exempt, the policy must meet this test at the time of issue and at each succeeding policy anniversary until the life insured reaches age 85.

Exempt Test Policy
- Endowment policy at age 90 / 8 pay
- Issued at the same time as the real policy

7. Continued

(b) Critique each of the following statements:

    A.   A policy is considered exempt if the accumulating fund of the policy is less than the accumulating fund of the ETP.

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

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

Commentary on Question:
Candidates generally did well in their critique of statements A and C. Candidates generally struggled to explain why B is false. A non-exempt policy would have been subject to accrual taxation, and this would have reduced the taxable amount on disposition.

A. Partially True
    (i) The accumulating fund of the policy must be less than the accumulating fund of the exempt test policy
    (ii) This must be true on a projected basis to age 85
    (iii)These must have always been true

B. False
    (i) Only death benefits up to the untaxed gains that have accrued are taxable.

C. Partially True
    (i) Increases up to 8% increase the death benefit of the existing ETPs.
    (ii) Any increases above 8% result in an additional ETPs

(c) You are given the following information for a UL policy:

- The policy is issued on January 1, 2020 to a female non-smoker, age 50.
- The policy has a level death benefit of 100,000.
- The cost of insurance is deducted at the beginning of the year
- Interest is credited at the end of each policy year at a rate of 5%.
- The policy is funded with a single premium of 10,000.
- The policy is considered to be an exempt policy.
- There are no policy loans.

7. **Continued**

	Rates / 1000 of death benefit	
Age	Cost-of-Insurance	Net cost of pure insurance (NCPI)
50	0.5	1.0
51	1.0	1.5
52	1.5	2.0

Assume that the policy is surrendered at the end of year 3.

Determine the taxable income of the policyholder at time of surrender.
Show all work.

Commentary on Question:
Candidates generally did well on this part of the question. A common error was calculating the cost of insurance based on the face amount instead of the NAAR.

Face Amount = 100,000
Interest Credited Rate = 5%
Premium = 10,000

$NAAR_t$ = Face Amount – Fund at beginning of year$_t$
Insurance costs$_t$ = $NAAR_t$ × Cost-of-Insurance Rate$_t$
Interest$_t$ = (Fund at beginning of year$_t$ – Insurance costs$_t$) × Interest Credited Rate
Fund at end of year$_t$ = Fund at beginning of year$_t$ – Insurance costs$_t$ + Interest$_t$
$NCPI_t$ = $NAAR_t$ × NCPI Rate$_t$

	Fund at beginning of year	Net amount at risk (NAAR)	Insurance costs	Interest	Fund at end of year	NCPI
1	10,000	90,000	45	498	10,453	90
2	10,453	89,547	90	518	10,881	134
3	10,881	89,119	134	537	11,285	178

Proceeds of disposition on surrender at the end of year 3 = CSV_3 = 11,285
Adjusted Cost Basis (ACB) = Premium – Total NCPI = 10,000 – (90 + 134 + 178) = 9,597
Income = Proceeds of disposition – ACB = 11,285 – 9,597 = 1,688

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.

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 Report - Lapse Experience Study for 10-year Term Insurance, Jan 2014, pp. 6 -32

CIA Educational Note: Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies: July 2002 (only sections 100, 200, and 300)

Commentary on Question:
The questions tested the candidates' understanding of IFRS 17 valuation principles.

Solution:
(a) You are given the following assumptions for a block of 10-year term life policies:

Issue Age	Duration	Mortality
40	9	0.0040
40	10	0.0050
40	11	0.0060
49	1	0.0035
50	1	0.0045
51	1	0.0055

The total cohort, exhibiting average mortality, contains the following groups:

- The proportion of the total cohort that persists is 8%
- The proportion of those additional lapses who lapse with average mortality is 12%
- The proportion of those whose lapsation has already been accounted for in the base mortality table is 5%

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8. Continued

Calculate the mortality rates reflecting mortality deterioration at policy year 10 for a policy with issue age 40, under

(i)   VTP2

(ii)   Dukes-MacDonald 2 (DM2)

Show all work.

Commentary on Question:
Candidates generally struggled with this part of the question. Candidates were able to identify P, A, U, and S. However, few candidates used the correct formulas of VTP2 and DM2.

From the description of Lapses:
Persists P = 8%
Lapse with Average Mortality A = 12%
Lapse with Underlying Mortality U = 5%
Given that P = 1-S-A-U, so Lapse with Select Mortality S = 1-P-A-U = 75%

VTP2:
$$q''_{[x]+t} = \frac{(1-A)*q'_{[x]+t+t} - S*q_{[x+t]}}{1-S-A} = 0.0137, \text{ where } q'_{[x]+t} = q'_{[40]+10} = 0.0050$$

$$q_{[x+t]} = q'_{[49+1]} = 0.0035$$

DM2:

$$q''_{[x]+t} = \frac{(1-U)*q'_{[x]+t+t} - S*q_{[x+t]}}{1-S-U} = 0.0106$$

(b)   Critique the following statements with respect to lapse and mortality deterioration assumptions for a block of 10-year term:

A.   *It is not necessary to adjust mortality deterioration for the skewness of lapses.*

B.   *Payment frequency and mode of payment have no impact on lapse rates, so can be excluded from the lapse study.*

C.   *Lapse rates on substandard mortality rating policies are likely to be lower than standard or preferred, as unhealthy lives are less likely to lapse. As a result, the actuary can assume substandard lapse rates are 50% of standard.*

8. **Continued**

        D.   *Selective lapses are lapses whose mortality experience would be worse than that of newly selected lives.*

Commentary on Question:
Candidates generally did well on this part of the question. A common error was assuming lapses rates on substandard groups are lower than standard or preferred groups.

A. The statement is false. Without adjustments, mortality deterioration methods assume lapses occur at the end of the policy year. This does not reflect reality. Projected mortality is underestimated in the year following renewal dates unless adjustments are made. Adjusting mortality deterioration to reflect lapse skew is recommended, especially in years following renewal dates.

B. This statement is false. Survey of Canadian insurers found that policies paid less frequently and those NOT paid by PAC or other similar method had higher lapse rates. However, the data may not be credible. These policy characteristics should be included in the lapse study to determine whether they impact lapses and whether the company has credible data to include them as a dimension in lapse assumptions. Can also consider blending with industry data if not credible.

C. This statement is false. While intuitively this statement makes sense, CIA lapse experience study shows that lapse rates for substandard policies are actually higher than standard or preferred policies. The company should examine their own lapse data by underwriting class to see whether they have credible data. If not they can consider blending with industry data.

D. The statement is false. Selective lapses are lapses whose mortality experience would be identical to that of newly selected lives.

(c)   You are given:

- The overall actual-to-expected ratio (AER) for life insurance mortality continues to exhibit a trend that is consistent with the company's mortality improvement assumption
- If COVID-19 pandemic-related life claims are excluded, the AER improves by 10%, which is significantly higher than the expected rate of mortality improvement
- At the onset of the pandemic, the company began rescinding selected life policies for which the responses to the application form were inconsistent with the insured's medical records

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8. **Continued**

Assess the appropriateness of continuing to use the current best estimate mortality assumption. Justify your answer.

Commentary on Question:
This part of the question tested the candidates' understanding of the different drivers of mortality. Candidates generally identified the mortality impact due to each driver. Few candidates understood multiple offsetting drivers of mortality that could impact the mortality in the long term or short term. Most candidates described the mortality impacts separately due to COVID and the new underwriting practices, but few candidates emphasized the long-term mortality trend might be positive due to tightened underwriting process and it could offset the high mortality related to the COVID that was considered to be a short term trend.

The proposal to retain the current mortality assumption may be flawed. Although overall experience is trending to expectations, there appears to be a positive trend from tightened underwriting practices offset by excess claims related to COVID-19.

Assuming the tighter underwriting practices are expected to be permanent, it may be reasonable to expect a better baseline level of mortality. The pandemic could be considered a recent known event that should not drive the long-term mortality trend.

9. **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 Draft Educational Note: IFRS 17 – Fair Value of Insurance Contracts, Oct 2021

Commentary on Question:

This question tests candidates' understanding of fair value approaches for the transition to IFRS17.

Solution:

(a)

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

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

Commentary on Question:

Candidates who understood the two approaches generally did well on this part of the question.

CSM = PV(CoC) - PV(after tax profits in FCFs) and CSM = PV(CoC) - PV(RA releases) were both accepted for the Appraisal Value Approach CSM.

Adjusted Fulfilment Cash Flow Approach
- Fair value determined by adjusting fulfilment cash flows to reflect market participant perspective
- Adjustments can be made by a simple add-on, adjusting IFRS 17 assumptions and / or a cost of capital approach
- CSM = FV - FCF

9. Continued

Appraisal Value Approach
- Price established by a buyer to acquire a block of business
- Present value of inforce = PV(profits) - Cost of Capital
- CSM = PV(CoC) - PV(after tax profits in FCFs)

(b) Assess whether each of the following items should be reflected when determining the fair value of a group of contracts:

     A.   An outsourcing agreement with a third party which reduces the level of expected directly attributable maintenance expenses
     B.   A lapse assumption based on the most recent industry study
     C.   A mortality assumption based on a blend of the Company's internal data and the most recent industry study
     D.   A mortality improvement assumption based entirely on the Company's own internal methodology

Justify your response.

Commentary on Question:
This part of the question tested candidates' understanding of fair value of insurance contracts. Candidates confused fair value with considerations in assumption setting for new product development, and therefore, did not demonstrate adequate knowledge on this question.

Expense synergy
- This arrangement is unique to the Company
- This should be adjusted to reflect the full level of expenses

Lapse assumption
- This is based on the industry experience
- No need to adjust

Mortality assumption
- Most companies will use a blend of industry and internal data
- Left to the judgement of the Company

Mortality Improvement
- Not reflective of market participant
- This should be adjusted to reflect a more current market view

9. Continued

(c) You are provided with the following cash flow information for a group of contracts at the transition date (time period 0):

Time period	0	1	2	3	4	5
Best estimate cash flows		1,000	1,000	1,000	1,000	1,000
Risk adjustment		25	25	25	25	25
Non-Directly Attributable Expenses		50	50	50	50	50
Target Capital	1,500	1,000	800	600	300	0

You are given:

- IFRS 17 discount rate = 5%
- Hurdle rate = 10%
- Earned Rate on Surplus = 4%
- Tax rate = 25%
- Own Credit Risk = 0%

Determine the CSM at the transition date. Show all work.

Commentary on Question:
Candidates generally correctly calculated BEL, RA, FCF, and Cost of Capital rate. Common errors included not applying the appropriate rate for the present value calculation. Few candidates demonstrated sufficient understanding of adjusted FCF, profit margin, FV, and CSM calculation. Some candidates demonstrated knowledge of the CSM methodology but did not complete the calculations correctly.

At the transition date:
Best Estimate Liabilities (BEL) = PV (Best estimate cash flows @ IFRS 17 discount rate) = $4,329.48
Risk Adjustment (RA) = PV (Risk adjustment @ IFRS 17 discount rate) = $108.24
Non-Directly Attributable Expenses = PV (Non-Directly Attributable Expenses @ IFRS 17 discount rate) = $216.47
Adjusted fulfilment cash flows = BEL + RA + Non-Directly Attributable Expenses = $4,654.19

Cost of Capital rate = Hurdle rate – Earned Rate on Surplus × (1 – Tax rate) = 10% - 4% × (1 – 25%) = 7%
Cost of Capital = Cost of Capital rate * PV(Target Capital @ hurdle rate) = $260.82

9.   **Continued**

Profit Margin = Cost of Capital – PV (Risk adjustment @ hurdle rate) = $260.82 – $94.77 = $166.05

Fair Value (FV) = Adjusted fulfilment cash flows + Profit margin = $4,820.23
Fulfilment Cash Flows (FCF) = BEL + RA = $4,437.71
CSM = FV – FCF = $382.52