

ILA LFMC Model Solutions

Fall 2022

1. Learning Objectives:

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

Learning Outcomes:

- (6a) The candidate will be able to describe, apply and evaluate considerations and matters related to:
- Insurance company mergers and acquisitions
 - Sources of earnings
 - Embedded Value determinations
 - Rating agency considerations
 - Model Audit Rule and Sarbanes-Oxley Section 404 Considerations
 - Source of Earnings analysis

Sources:

LFM-152-22 – Introduction to Source of Earnings Analysis

Commentary on Question:

This question tested the candidates' knowledge of Analysis in Change in Reserves and Source of Earnings Analysis.

Solution:

- (a) Construct an Analysis in Change in Reserves for the GAAP expectation and actual results.

Commentary on Question:

This was a challenging question for most candidates. Candidates did not need to provide formulas to receive full credit but providing correct formulas received partial credit if calculation results were incorrect. Common errors included: not multiplying by life count; using gross premium instead of net premium; incorrectly applying expected assumptions for actual reserves changes components such as expenses and interest; including actual death benefit paid instead of reserve released for death benefits; and omitting reserves released for surrenders. Candidates who constructed the complete and correct presentation for reserve roll-forward generally achieved more success.

1. Continued

On an expected basis, the Fackler recursive reserve formula is illustrated as follows, after applying the total life count:

$$l_x * [(V_t + NP - ME) * (1 + i^g) - (q_x^{(w)} * CSV) - (q_x^{(d)} * DB)] \\ = l_x * {}_1p_x * V_{t+1} = l_{x+1} * V_{t+1}$$

On an actual basis:

$$l_x * [(V_t + NP' - ME') * (1 + I') - (q_x^{(w)} * CSV + (q'_x{}^{(w)} - q_x^{(w)}) * V_{t+1}) \\ - (q_x^{(d)} * DB + (q'_x{}^{(d)} - q_x^{(d)}) * V_{t+1})] = l'_{x+1} * V_{t+1}$$

Translating these into an Analysis in Change in Reserves:

	Expected	Actual Results
Beginning of Period Reserves	$l_x * V_t$	$l_x * V_t$
Renewal Net Premium	$l_x * NP$	$l_x * NP'$
Reserves Released for Maintenance Expenses	$-l_x * ME$	$-l_x * ME'$
Tabular Interest Added to Reserves	$l_x * (V_t + NP - ME) * i^g$	$l_x * (V_t + NP' - ME') * I'$
Total Reserves Released for Death Benefits	$-l_x * (q_x^{(d)} * DB)$	$-l_x * (q_x^{(d)} * DB) \\ -l_x * (q'_x{}^{(d)} - q_x^{(d)}) * V_{t+1}$
Total Reserves Released for Surrenders	$-l_x * (q_x^{(w)} * CSV)$	$-l_x * (q_x^{(w)} * CSV) \\ -l_x * (q'_x{}^{(w)} - q_x^{(w)}) * V_{t+1}$
End of Period Reserves	= Sum of above components	= Sum of above components

Where $l_x = 5,000$, $V_t = 100$, $NP = NP' = 300$, $ME = 15$, $ME' = 8$, $i^g = 4\%$, $I' = 4.25\%$, $q_x^{(d)} = 0.002$, $q'_x{}^{(d)} = 0.003$, $DB = 100,000$, $q_x^{(w)} = 0.02$, $q'_x{}^{(w)} = 0.0$, $CSV = 0$

EOY number of policies is

$$l_{x+1} = l_x * {}_1p_x = l_x * (1 - {}_1q_x^{(w)} - {}_1q_x^{(d)}) = 5,000 * (1 - 0.02 - 0.002) = 4,890$$

Ending reserve per policy is

$$V_{t+1} = \frac{1,002,000}{4,890} = 204.91$$

1. Continued

	Expected	Actual Results
Beginning of Period Reserves	500,000	500,000
Renewal Net Premium	1,500,000	1,500,000
Reserves Released for Maintenance Expenses	(75,000)	(40,000)
Tabular Interest Added to Reserves	77,000	83,300
Total Reserves Released for Death Benefits	(1,000,000)	(1,001,025)
Total Reserves Released for Surrenders	-	20,491
End of Period Reserves	1,002,000	1,062,766
Change in Reserve	502,000	562,766

- (b) Explain how the Analysis in Change in Reserves from part (a) would change if the reserve was calculated using a present value of cash flows approach without margins, such as under ASU 2018-12.

Commentary on Question:

This part of the questions tested candidates' understanding of how margins impact the reserves and the Analysis in Change in Reserves. Candidates had to comment on the directional impact of margins to both Expected reserve base and deviation of Actual reserves to receive full credit.

The reserve is designed to release reserves for the expected rates of deaths and surrenders built into the reserves. Margin serves as the cushion to absorb the deviation of actual experience from the expected bases; if reserves were calculated without margin, then the amounts of expected reserve and reserve release on decrements would be smaller.

On an actual basis, more or less reserves are released to account for the differences between the expected and actual life count due to the higher than expected deaths and lower than expected surrenders; additional reserves equal to the difference between the number of contracts expected to decrement and those that actually decremented multiplied by the ending reserve factor becomes the reconciling item. If reserves were calculated without margin, then the reconciling item would increase in magnitude because the difference between anticipated decrement and actual decrement would be larger.

- (c) Construct a Source of Earnings analysis for the GAAP expectation and actual results.

1. Continued

Commentary on Question:

This part of the question tested candidates' understanding and key considerations of an SOE analysis, and how actual vs. expected changes affect various earnings components. Candidates were expected to construct a complete Source of Earnings analysis. Errors carried over from part (a) were not penalized. Several candidates failed to recognize that a reserve increase due to lower than the expected surrenders results in a negative impact to earnings. Candidates who constructed the complete and correct presentation for the SOE analysis generally achieved more success.

	GAAP	Actual	Actuals - GAAP
In Force Profit Margin			
Gross Premium - Renewal	1,625,000	1,625,000	-
GAAP Net Premium	(1,500,000)	(1,500,000)	-
Net Profit Margin	125,000	125,000	-

Experience - Investment Income			
Investment Income	77,000	83,300	6,300
GAAP Tabular Interest	(77,000)	(77,000)	-
Net Investment Income Margin	-	6,300	6,300

Experience - Mortality			
Actual Benefits	(1,000,000)	(1,500,000)	(500,000)
GAAP Reserve Released for Claims	1,000,000	1,001,025	1,025
Net Mortality Margin	-	(498,975)	(498,975)

Experience - Expenses			
Total Expense Charges	(75,000)	(40,000)	35,000
Release of Expense Reserves	75,000	75,000	-
Net Expense Margin	-	35,000	35,000

Experience - Surrender			
Actual Benefits	-	-	-
GAAP Reserve Released for Surrender	-	(20,491)	(20,491)
Net Surrender Margin	-	(20,491)	(20,491)

Total Gains / (Losses)	125,000	(353,166)	(478,166)
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1. Continued

- (d) Explain the main drivers of differences between the expected and actual results.

Commentary on Question:

Candidates generally performed well on this part of the question. Full credit was received for explaining the main drivers beyond just identifying them.

The largest variance came from mortality experience. Since the actual mortality rate is 50% higher than expected, there is not enough margin in the mortality assumed in the reserves to offset the adverse mortality experience, resulting in current period loss.

Lower than expected lapses also contributed to a loss due to lack of expected reserve release. These losses were partially offset by gains in expenses and investment income due to favorable experience.

2. Learning Objectives:

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

Learning Outcomes:

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

Sources:

LFM-150-22: Captive Insurance Companies, NAIC, Feb 2021

Commentary on Question:

This question tested the candidates' knowledge of captive insurance companies.

Solution:

- (a) ABC Life is evaluating the use of an off-shore affiliate captive for reinsuring this portfolio.
 - (i) Evaluate the advantages and disadvantages of this approach.
 - (ii) Describe two potential captive structures.

Commentary on Question:

Most candidates received partial credit for mentioning tax benefit or reserve relief in part (i). Full credit was not achieved in part (ii) for simply listing the structure. Credit was received for other possible structures (Group, Association, Industrial, Branch, Micro, Protected Cell, Risk Retention Group Captives) with appropriate descriptions.

(i) Advantages: Captives can provide flexibility in managing risks and can be used to finance redundant XXX reserves. As well there may be some tax advantages

Disadvantages: Principle based reserves may reduce the need for these transactions – and they are facing increased regulatory scrutiny.

(ii) Pure Captives – insures the risk of its parent company and affiliates.

Rental Captives – a captive insurer formed to enter into a contractual agreement with policyholders and that only insures those policyholders or associations

- (b) Explain each of the following regulations in relation to the use of captives or foreign affiliates by ABC's U.S. subsidiary:
 - (i) Actuarial Guideline XLVIII (AG-48)
 - (ii) Principle Based Reserves (VM-20)

2. Continued

Commentary on Question:

Most candidates received little to no credit on this part of the question due to lack of details in the responses specific to AG-48 and VM-20.

- (i) AG-48 was instituted 1/1/2015 to standardize the financing reserving for XXX and AXXX reserves – there were significant amounts of these reserves, and many insurers were employing captives
- (ii) PBR was intended to allow more company experience in reserving and to bring it into line with other reserving regimes.
 - it was also hoped that PBR would reduce the incentives for these transaction
- (c) Critique the use of captive insurance companies in the following circumstances:
 - A. *A reinsurance company has acquired a block of term life insurance written in 2007. It has done this by accepting the business using 100% coinsurance.*
 - B. *A large life insurance company is writing its newest product of term life insurance.*
 - C. *A carrier has a large block of Universal Life (UL) policies that was written in 2016.*

Commentary on Question:

Candidates generally did not perform well on this part of the question. Candidates did not demonstrate understanding of reserve requirements by product type at different dates and how captives can be used as a financial management tool.

- A. This block is subject to XXX reserving and using a captive might require Primary security assets
This arrangement may not be favorable to the company although AG-48 reserves might be preferable to XXX – there might be other arrangements.
- B. This is subject to PBR. As this is a large company, a small company PBR exemption is probably not available.
A captive is probably not needed for financing considerations as PBR was intended to reduce the need for these transactions
- C. This business would be subject to AXXX reserving
Using a captive would require AG-48 primary securities.

2. Continued

This financing may or may not be favorable to the company although AG-48 reserves might be lower than AXXX but the company may not want to tie up assets to provide primary security

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:
- 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: Approximations to the Canadian Asset Liability Method (CALM): November 2006

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

Commentary on Question:

This question tested the candidates' knowledge of approximation methods to CALM and their understanding of currency risk.

Solution:

- (a) You have determined the CALM liabilities for a block of life insurance as at September 30, 2021.
- (i) Identify two approaches for determining an interest rate vector which can be used to reproduce policy liabilities which have been determined under CALM using a serial discount calculation.
 - (ii) Identify an approach for solving for an explicit mismatch margin expressed in basis points.
 - (iii) Explain the approach for completing the Detailed Roll-Forward method to estimate the CALM liability as at December 31, 2021.

Commentary on Question:

For part (i) many candidates only identified one approach. For full credit, candidates had to demonstrate their understanding of how the approach reproduces CALM. Full credit was received if a candidate detailed the reliance of the asset portfolio supporting the liabilities in interest rate setting and reproducing liabilities under the most adverse scenario. Candidates generally did not provide sufficient explanation for full credit.

3. Continued

For part (iii) candidates had to demonstrate knowledge of the steps required in the methodology. Candidates generally did not explain the approach with enough detail, instead describing a generalized approach with generic steps such as updating data and assumptions.

(i)

- Solve for a non-level equivalent interest rate vector that discounts the liability cash flows to the CALM GAAP policy liabilities. Determine VIR based on the projected gross yield of asset segment supporting liabilities.
- Solve for an equivalent level interest rate based on the most adverse scenario. Ensure that PV cash flows reproduce CALM liabilities under most adverse scenario
- Grade from the balance sheet yield to an ultimate reinvestment rate assumed in the selected adverse scenario. Adjust yields to ensure that discounted cash flows reproduce CALM liabilities

(ii)

- Solve for an equivalent interest rate vector that reproduces CALM liabilities under the base scenario.
- Determine a level adjustment to the VIRs which increases the PV of the discounted cash flows from the base result to the CALM booking scenario.
- Obtain the gross policy liability (GPL) via CALM analysis at the testing date. Discount the asset and liability cash flows using the interest rate at the time 0 to obtain the Market Value of the Asset (MVA) and the Market Value of the Liability (MVL). Determine the C-3 margin to be added to the liability cashflows such that $GPL = (\text{statement value of assets}) + (MVL^* - MVA)$ where MVL^* includes the C-3 cash flow.

(iii)

1. Start with the liabilities as of September 30th.
2. Determine an interest rate vector based on the projected returns of the asset portfolio.
3. Add the liability movement:
 - a. Equals PV of liabilities at t - PV of liabilities at t-1.
 - b. Adjust for new business: the difference between the inforce VIR and the VIR applicable to new business.
 - c. For unexpected liability movements (for example lapses and deaths): the difference between the inforce VIR and the VIR applicable at the time of these movements.

3. Continued

4. Adjust for changes in asset values (realized and unrealized gains/losses).
5. Remove any changes in asset values that do not affect policy liabilities.
6. Adjust for changes that are not captured by the fair value movement
7. Adjust for any basis changes

- (b) You have a liability of 1,000 denominated in Canadian Dollars (CAD) and payable at the end of 10 years. The assets backing this liability are denominated in US Dollars (USD) and the currency risk is not hedged.

You are given the following information at the valuation date:

- Exchange Rate: 1.00 USD buys 1.25 CAD
- U.S. 10-year risk-free rate: 3.00%
- Canadian 10-year risk-free rate: 2.75%
- One standard deviation of the changes in the exchange rate over a ten-year period is 0.15
- The minimum margin for adverse deviation for currency risk is 5%

- (i) Calculate the best estimate liability and the provision for adverse deviation (PfAD) for the currency risk in CAD at the valuation date. Show all work.
- (ii) Assume that you have entered into a forward contract which fixes the exchange rate for 1.00 USD at 1.20 CAD at the end of the 10 years. Assume that all other information provided above remains unchanged.

Recalculate the total liability including PfAD under this assumption.

Commentary on Question:

For full credit, candidates had to show all their work, and state the overall liability held and the resulting PfAD.

The most common omissions for part (i) were the calculation for a liability assuming no change in exchange rate and stating the final overall liability held. Many candidates only calculated the PfAD.

For part (ii) many candidates did not understand that the resulting PfAD would be 0 as the forward contract removes the possibility of a movement in exchange rates.

3. Continued

(i)

	Liability with no change in exchange rates	Base Exchange Rate Scenario Liability	Adverse Exchange Rate Scenario Liability	Liability based on 5% minimum margin scenario
Ultimate Fx Rate	= S = 1.25	= S * ((1 + CAD rfr) / (1 + USD rfr))^10 = 1.25 * ((1 + 2.75%) / (1 + 3%))^10 = 1.2200	= S * (1 - StDev) = 1.25 * (1 - 0.15) = 1.0625	= Base Ult. Fx * (1 - MfAD) = 1.22 * (1 - 5%) = 1.1590
Ult. USD Liability = 1000 / Ult. Fx Rate	= 1000 / 1.25 = 800.00	= 1000 / 1.22 = 819.68	= 1000 / 1.0625 = 941.18	= 1000 / 1.1590 = 862.82
Current USD Liability = Ult.USD Liability / (1 + USD rfr)^10	= 800 / (1 + 3%)^10 = 595.28	= 819.68 / (1 + 3%)^10 = 609.92	= 941.18 / (1 + 3%)^10 = 700.32	= 862.82 / (1 + 3%)^10 = 642.02
Current CAD Liability = Current USD Liability * S	= 595.28 * 1.25 = 744.09	= 609.92 * 1.25 = 762.40	= 700.32 * 1.25 = 875.40	= 642.02 * 1.25 = 802.52

Total liability held = Higher of the adverse and the MfAD scenarios
= 875.40

PfAD = Total liability held - Base Liability
= 875.40 - 762.40
= 113

(ii)

If the exchange rate is fixed at 1.20:
Liability = Liability with no change in exchange rates
* Original exchange rate
/ Forward Contract Exchange Rate
= 744.09 * 1.25 / 1.2
= 775.10

3. Continued

Currency risk can be defined as the risk of incurring losses resulting from adverse movement in exchange rates. Since there is no possibility of a movement in exchange rates under the forward contract, the resulting liability held is the base liability and there is no margin.

4. Learning Objectives:

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

Learning Outcomes:

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

Sources:

CIA Educational Note: Valuation of Universal Life Policy Liabilities - February 2012

LFM-634-19 CIA Standards of Practice: Insurance Sections 2100, 2300, 2400, 2500 & 2700, Dec 2019

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

CIA Research Paper: Lapse Experience under UL Level COI Policies, Sep 2015, pp. 4 - 8

Commentary on Question:

This question tested the candidates' knowledge of Universal Life product design, actuarial assumptions, valuation principles, and margins for adverse deviation.

Solution:

- (a) Critique and, if applicable, recommend changes to the following practices in setting current best estimate valuation assumptions for the UL products:
- A. *Base mortality is calculated using internal data, and is differentiated by issue age, duration, gender, and smoking status. The same mortality assumptions are used for both UL products and the term riders.*
 - B. *Mortality improvement is projected using the CIA's prescribed "MI-2017" table.*
 - C. *With respect to lapse assumptions:*
 - *For Level COI and YRT COI, early duration lapse rates are set based on available data, varying by issue age and duration.*
 - *For Level COI, the ultimate lapse rate for durations 10+ is set at 2%.*

4. Continued

- D. *If the fund balances are zero in a projection year, the policy owners are assumed to pay additional premiums to keep their policies in force.*
- E. *The option to exercise the term rider addition is not considered in the setting of assumptions due to the minimal take up rate.*

Commentary on Question:

Statement A tested candidates' knowledge on the base mortality assumption and experience studies. Candidates generally did well on this statement. Candidates received full credit for any three bullet points below.

Statement B was subjective. Candidates could earn full credit either agreeing or disagreeing with the statement with proper justification. If disagreeing, candidates had to identify the CIA minimum prescribed assumption.

Statement C tested candidates' knowledge on lapse experience studies. Candidates received full credit for identifying all bullet points below. Most candidates discussed two to three bullet points.

Statement D tested candidates' understanding on UL's lapse behaviour.

Candidates generally did not do well on this statement. To receive full credit, candidates had to clearly state the approach was not appropriate and justify why.

Partial credit was received if candidates discussed secondary guarantee.

Statement E tested candidates' knowledge on term rider and anti-selection behaviour. Candidates received full credit by clearly stating the approach is not appropriate and providing reasonable explanation or additional modeling considerations. Candidates generally did well critiquing this statement.

(A)

- The stated mortality assumption of being differentiated by issue age, duration, gender, and smoking status is reasonable. It considers the core aspects from SoP.
 - Given Level COI has low-to-moderately credible experience, I recommend blending industry data with company's internal data. YRT can be calculated using internal data given YRT has fully credible experience.
 - Investigate the term riders which are not underwritten to understand whether material anti-selective behaviour (higher mortality) is occurring; would require judgment to reflect anti-selection if necessary.
 - Differentiate base mortality assumptions by more variables such as face amount, preferred class, etc
 - Although YRT has fully credible experience, there may be subsets that aren't credible. We can blend with industry data to add credibility in this case.
- <Candidates can also state the original rationale of combining both UL products and term rider is ok given the insurer's underwriting practice has been historically consistent and regarded as industry-leading. However, this need to be monitored and updated if internal experience warranted it>

4. Continued

(B)

- Yes: the stated assumptions are reasonable and in line with industry guidance.
- No: insurer can use other mortality improvement assumption (for example, from internal experience). However, CIA's prescribed assumption establish a minimum valuation basis, which suggests padded liability under other FMI should not be lower than liability under CIA MI2017.

(C)

- The stated lapse assumption is generally reasonable given it considers several core aspect required by SoP: age, duration, and policy plan.
- Lapse experience study can be enhanced by more variables: smoking status, face amount band, premium frequency, distribution/marketing, etc
- UL Level ultimate lapse rate is not appropriate based on most recent industry study. The industry study suggests it levels off at around duration 20 (we are using 10+) and the rate should be lower based on industry study, e.g. 1.0% (we are using 2.0%)
- Consider blending internal experience with industry data when necessary, for example, Level COI product.

(D)

- It is not appropriate to assume all policyholders would pay out of pocket to keep their policies inforce (i.e. to assume 0% lapse under this scenario).
- The lapse assumption should consider whether there is incentive to keep the policy inforce. Level COI generally has low lapse rate since policyholders over-pay premium in early duration and under-pay premium in late duration. YRT generally has high lapse rate especially at late duration given COI increase significantly.
- Whenever there is an UL secondary guarantee, the policy can be still inforce even the fund value are zero. It's also not appropriate to assume policyholders would pay additional premium in this case.

(E)

It is not appropriate to ignore term rider due to the minimal take up rate. Since no UW is required, it is reasonable to assume term riders would be added to policies for anti-selective behaviour. Since it is an option given to policyholders, it is more appropriate to model a non-zero take up rate, unless the valuation results showed that it is more conservative to model zero take up rate. Since this hasn't been modeled in valuation before, more investigation is needed to understand how the feature is utilized in practice (how often people use the feature). Caution should be given to not base the assumption entirely on historical experience (for example, if there is no evidence of take-up now, it could be due to durational patterns that haven't materialized yet).

4. Continued

- (b) Recommend margins for adverse deviations for the following assumptions for each of JKL Life's UL products:
- (i) Base mortality rates
 - (ii) Policy lapse rates

Commentary on Question:

This question tested candidates' knowledge of setting margins for adverse deviation. Candidates were expected to discuss significant considerations, and where significant considerations exist, the recommendation should be at least equal to the midpoint of the CIA's range. To receive full credit, candidates had to recommend appropriate margins and provide explanations to support the recommendation. Candidates generally did well on this part of the question. Common errors include not stating the direction of the MfAD and omitting the ex in mortality mfad (i.e., simply stating 3.75%-15%).

(i)

Base mortality rate MfAD is ± 3.75 to 15 divided by ex per 1000 face. The mid point is ± 9.375 divided by ex per 1000 face.

Level: there is a significant consideration exist that Level COI mortality experience are not credible. The margin need to be at least the midpoint of prescribed margin range. So I recommend ± 12 divided by ex per 1000. The direction of the margin will be the one which generates the more conservative liability.

YRT: no significant consideration exist as the company has fully credible data with strong underwriting. The margin can be lower than the midpoint of prescribed margin range. So I recommend ± 5 divided by ex per 1000. The direction of the margin will be the one which generates the more conservative liability.

(ii)

Lapse rate MfAD is $\pm 5\%$ to 20% of lapse rate. The mid point is $\pm 12.5\%$.

Level: there are significant considerations. Cancellation of the contract is clearly detrimental to policyholders especially at later durations. Level COI inforce block lacks credibility. The margin need to be at least the midpoint of prescribed margin range. So I recommend $\pm 20\%$. The direction of the margin will be the one which generates the more conservative liability.

YRT: no significant consideration exist as YRT COI inforce block is credible.

The margin can be lower than the midpoint of prescribed margin range. So I recommend $\pm 10\%$. The direction of the margin will be the one which generates the more conservative liability.

5. Learning Objectives:

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

Learning Outcomes:

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

Sources:

CIA Final Communication of a Promulgation of Prescribed Mortality Improvement Rates, Jul 2017

Commentary on Question:

This question tested the candidates' knowledge of mortality improvement assumptions.

Solution:

- (a) Outline the process to determine the mortality improvement valuation assumption for both the life insurance and income annuity blocks.

Commentary on Question:

Candidates generally received partial credit for this part of the question. Most candidates:

- *Failed to describe the requirement that the increase or decrease in margins should increase liability*
- *Failed to note that life insurance could have death-supported or death-sensitive businesses*
- *Failed to mention diversification*
- *Failed to mention appropriate aggregation*
- *Skipped explaining how margins affected life insurance or the income annuity block (i.e. they seemed to miss this nuance of the question)*
- *Missed to mention the value of actuarial judgment*

To received full credit, candidates had to analyze the life insurance and income annuity block separately and recognize that the life insurance blocks can go either way in terms of improvement; recognize that the higher liability condition is important to choose the valuation assumption; and recognize the importance of appropriate aggregation and the effect of diversification.

There are a couple of steps to determining the mortality improvement valuation assumption for the life insurance and annuity blocks:

5. Continued

First step is to determine the prescribed mortality improvement rates using two scenarios. This involves:

- Getting a set of base mortality improvement rates, either from an industry study or a company-developed one, and doing the valuation using those rates
- Testing two scenarios and choosing which one would produce the higher liability:
 - Scenario 1: Using mortality improvement rates and reducing these by the MfADs, varying by attained age, then incorporating diversification
 - Scenario 2: Using mortality improvement rates and adding these by the MfADs, varying by attained age, then incorporating diversification
- Proper level of aggregation must be considered when grouping data; further, it would be inappropriate to aggregate annuities with life insurance business

Second step is to consider the diversification between all aggregated death-sensitive blocks of business and death-supported blocks of business

For this company's life insurance business, the liabilities could increase or decrease, depending on whether the life insurance business is death-supported or death-sensitive.

For this company's income annuity business, the liabilities could only increase.

Note that the actuary must exercise appropriate judgment in determining the best estimate assumption and margin for future mortality improvement, making sure that the liabilities are at least as high as the ones described above.

- (b) Identify the information you require to justify a maximum mortality improvement MfAD diversification factor for MCB's mortality assumptions.

Commentary on Question:

At least three considerations were required to receive full credit for this part of the question.

Some candidates identified one or two considerations followed by "etc".

Candidates who discussed "demographics" in general received partial credit.

"Age" was the most commonly identified consideration.

Candidates generally did not discuss the sensitivities to changes in mortality and how it affects both blocks of business similarly in magnitude but not in direction.

5. Continued

The range for mortality improvement diversification factor for MfAD is from 0%-50%. To justify the 50%, the blocks of business involved must have similar composition in terms of:

- Attained age
- Gender
- Country of issue and residence
- Access to emerging health care advances
- Durations
- Socioeconomic profiles of the underlying population

The actuary must also be able to ascertain that sensitivities to changes in mortality improvement affect the businesses in a similar magnitude, but opposite in direction.

(c) You are given:

Mortality Rates

Age	Male
65	0.01018
66	0.01129
67	0.01250
68	0.01384

Prescribed Mortality Improvement Rates

Age	Year		
	2020	2021	2022
65	.0154	.0147	.0141
66	.0151	.0144	.0137
67	.0152	.0145	.0139
68	.0157	.0150	.0143

Assume

- Valuation date is Dec 31, 2020
- Mortality MfAD is 6.5%
- Mortality Improvement MfAD rate for ages 60 to 90 is 0.5%

Calculate the projected valuation mortality rate for an annuity product of a 65 year old male in 2 years if the diversification factor is 25%. Show all work.

5. Continued

Commentary on Question:

Few candidates received full credit for this part of the question. The most common errors include:

- Using q_{65} instead of q_{67}
- Using the incorrect mortality improvement rates
- Missing the product of the two q_{66} and q_{67} factors in the formula and just using q_{67} , or overcompensating and using three (q_{65} , q_{66} , and q_{67})
- Instead of $(1 - (MImp_x^{VY+i} + MfAD_x(1 - DivF)))$, using $(1 - MImp_x^{VY+i} * (1 + MfAD_x(1 - DivF)))$
- Incorrect signs $(1 + Mort MfAD)$ or $(1 + DivF)$

Partial credit was received where an aspect of the formula was incorrect but the candidate used the correct attained age and mortality improvement factors.

The projected mortality valuation rate for a 65-year old male in 2 years (attained age 67) given that the diversification factor is 25% could be described using the formula below:

$$q_x^{VY+n} = q_x \times (1 - Mort MFAD) \times \prod_{i=1}^n (1 - (MImp_x^{VY+i} + MfAD_x \times (1 - DivF)))$$

where:

q_x is the best estimate mortality rate, at age x , at the valuation date,

q_x^{VY} is the mortality rate, which includes prescribed mortality improvement and margins, at age x , at the valuation date in calendar year VY ,

q_x^{VY+n} is the projected mortality rate, which includes prescribed mortality improvement and margins, at age x , at the valuation date in calendar year VY , for the calendar year $VY+n$,

$MImp_x^{VY+n}$ is the base mortality improvement rate at age x for the calendar year $VY+n$, where VY is the calendar year of the valuation date,

$MfAD_x$ is the mortality improvement margin for adverse deviations at age x , and

Plugging in the given information:

$$x = 67$$

$$Mort MfAD = 6.5\%$$

$$MImp_{67}^{66} = .0145; MImp_{67}^{67} = .0139$$

$$MfAD = 0.01250$$

$$DivF = 25\%$$

5. Continued

$$\begin{aligned} & q_{67} \times (1 - 0.065) \times (1 - (0.0145 + 0.005 \times (1 - 0.25))) \times (1 - (0.0139 + 0.005 \times (1 - 0.25))) \\ &= 0.01250 \times (1 - 0.065) \times (1 - (0.0145 + 0.005 \times (1 - 0.25))) \times (1 - (0.0139 + 0.005 \times (1 - 0.25))) \\ &= 0.01127 \end{aligned}$$

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.
2. The candidate will understand the professional standards addressing IFRS 17 financial reporting and valuation.
5. The candidate will understand how to explain and apply the methods, approaches and tools of financial management in a life insurance company context.

Learning Outcomes:

- (1a) The Candidate will be able to:
- Compare and apply methods for life and annuity product reserves
 - Evaluate, calculate, and interpret liabilities
 - Recommend and justify appropriate valuation assumptions
- (2a) The Candidate will be able to describe, apply and evaluate the appropriate IFRS 17 accounting and valuation standards for life insurance products.
- (5a) The Candidate will be able to:
- Explain and apply methods in determining regulatory capital and economic capital
 - Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital
 - Explain Canadian regulatory capital framework and principles
 - Explain and apply methods in capital management

Sources:

CIA Educational Note: Transition from CALM to IFRS 17 Valuation of Canadian Participating Insurance Contracts, Mar 2019

Commentary on Question:

This question tested the candidates' knowledge and application of insurance contracts with direct participation features under IFRS17.

Solution:

- (a) Provide the definition of “insurance contract with direct participation features” under IFRS17.

Commentary on Question:

Candidates generally did well on this part of the question and described the three criteria for insurance contracts with direct participation features.

6. Continued

An insurance contract for which, at inception:

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

- (b) Identify two approaches for estimating future cash flows of participating contracts for items where the experience is shared with policyholders.

Commentary on Question:

This part of the question tested the candidates' knowledge and understanding of the two methods for evaluating par contracts' cash flows. Candidates generally did not do well on this part of the question. Partial credit was received for reasonable explanations.

Implicit approach – “Perfect pass-through” is measured assuming all experience can be absorbed by changes in dividend scales; plus the cost of guarantees, which measures the inability of the dividend scale to absorb changes.

Explicit approach – The total is measured by projecting explicit dividend scale changes corresponding to future experience changes; may require a supplement to reflect cost of guarantees depending on the experience changes considered.

- (c) Describe how you would model a change in expense cash flows for participating contracts, distinguishing between the cases where:
- (i) expense experience is shared with the policyholders.
 - (ii) expense experience is not shared with policyholders.

Commentary on Question:

This part of the question tested the candidates' knowledge on par expense valuation. Candidates generally did not do well on this part of the question. For part (i) full credit was received if the candidate demonstrated they understood that change in expenses are offset by dividend scale changes. For part (ii) candidates were generally not able to demonstrate that some expenses can still be offset by dividend scale change, and such expenses must be removed from the FCF to avoid double-counting. Partial credit was received for reasonable explanations.

6. Continued

(i)

When expense experience is shared with policyholders, such expenses are “charged” to policyholders via an adjustment to the dividend scale. Therefore, whether the implicit or explicit approach is used, projected expense cash flows included in the estimates of future cash flows would be consistent with the expenses shared with policyholders. Any change in the level of such expenses would be offset by an adjustment to policyholder dividends, with no impact on the estimates of future cash flows. However, the level of expenses may affect the cost of guarantees as it affects the amount of dividend room available.

(ii)

When expense experience is not shared with policyholders, some level of expenses (which could be nil) is “charged” to policyholders via reducing the policyholder dividend scales. Therefore, the FCF would be adjusted by the present value (at unlinked discount rates) of the difference between projected actual expenses and the expenses charged in the dividend scales. In this context, “actual” expense are directly attributable expenses without double-counting of the expenses attributed to other components of the liability.

- (d) Quadra Life demutualized 10 years ago. You are given the following information for the following three participating products:

Par Product A:

- Limited to existing policyholders at the time of demutualization.
- Policyholders are paid dividends based on interest, mortality and expense gains of the par policyholders with a minimum guaranteed interest return of 2%.
- Actual returns on the closed par fund are projected to be well above the guaranteed interest rate.
- Gains in the closed par fund are to be split evenly between the shareholders and policyholders.

Par Product B:

- Open to new participants after the time of demutualization.
- Dividends are based on a share of the Company’s earnings plus a flat 5% return on cash values.
- The Company is expected to remain profitable, and dividends are projected to increase over the next 5 years.

6. Continued

Par Product C:

- Open to new participants after the time of demutualization.
 - Dividends are based on the investment return of the open par fund subject to a 5% minimum return.
 - Investment returns on the open par fund have been negative, and dividend payments are projected to remain at the minimum level for the next 5 years.
- (i) Assess the eligibility of each product to be valued under the Variable Fee Approach (VFA).
- (ii) Propose changes to the products to meet the VFA criteria if they are not currently eligible.

Commentary on Question:

This part of the question tested the candidates' understanding and application on three criteria of contracts with DPF. For part (i) candidates generally only discussed one or two criteria for each product. Full credit was received only if candidates assessed all criteria. For part (ii) most candidates recommended correct changes.

(i)

An insurance contract with DPF means a contract for which, at inception:

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

Product A:

- Underlying items: satisfied. The closed par fund constitutes clearly identified underlying items.
- Substantial share paid to policyholder: not met. Gains in the closed par fund are to be split evenly between the shareholders and policyholders, so 50% cannot be considered as substantial share.
- Amounts to be paid vary with change in underlying items: satisfied. The Criterion 3 is to exclude contracts with high minimum guarantees. Actual returns on the closed par fund are projected to be well above the guaranteed interest rate of 2%, which suggests the amounts to be paid to policyholders can vary in most scenarios.

6. Continued

Product B:

- Underlying items: not met. Company earnings are not an underlying item. Earnings would need to be based on a par fund or perhaps an external index to be qualified as a clearly identified pool of underlying items.
- Substantial share paid to policyholder: not met. The Criterion 2 requires insurer pay substantial share to policyholders and also charge a small portion as variable fees. Since investment income is based on a constant percentage, there is no variable fee associated with this contract.
- Amounts paid will vary with changes in underlying items: satisfied. The Criterion 3 would also be assessed by considering the amount of dividend room available to absorb adverse experience. As the dividends are projected to increase in the next 5 years, there is dividend room to absorb adverse experience.

Product C:

- Underlying items: satisfied. Par fund is an underlying item.
- Substantial share paid to policyholder: cannot be determined from information given.
- Amounts paid will vary with changes in underlying items: not met. The Criterion 3 is to exclude contracts with high minimum guarantees. Since returns have been below guaranteed minimum and dividend are projected to remain at minimum level, this is considered as contract with high minimum guarantees so it does not meet the criterion 3.

(ii)

Product A: change earnings split from 50%/50% to pay more to policyholders, for example, 90%/10%.

Product B: change company earnings to investment return based on a par fund or an external index. Also replace the constant percentage of return by paying investment income less a variable fee, such as 2.0%.

Product C: make sure split of gains is mostly paid to policyholder. Remove or reduce 5% minimum guarantee so changes in underlying items will result in changes in amounts paid to policyholders.

7. Learning Objectives:

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

Learning Outcomes:

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

Sources:

CIA Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts, Jun 2020

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

Commentary on Question:

This question tested the candidates' knowledge of IFRS 17.

Solution:

- (a) Identify the cash flows included for the UL product under the:
 - (i) Whole Contract view
 - (ii) Core Cash Flows view

Commentary on Question:

Candidates received full credit by providing a complete description of cash flows included in both views.

- (i) The whole contract view includes all cashflows transferred between the insurer and the policyholder. This view includes cash flows that do not vary such as premium, fixed death benefit costs and expenses; and cash flows that do vary such as account value payable on death.
- (ii) The core cash flows view includes just cash flows transferred between the insurer and the product's account value. Transfers in and out of the account value by the policyholder are excluded. The fees collected from the account value. This view includes cash flows that do not vary such as fixed death benefit, cost of insurance (COI rate x net amount at risk); and cash flows that do vary such as the annual management Fee charge (MER x account value).

7. Continued

(b) Calculate the Best Estimate Liability at issue using:

- (i) The Whole Contract view
- (ii) The Core Cash Flows view

Commentary on Question:

Candidates generally did well on this part of the question. Common errors for this part of the question include:

1. *In the Whole contract view, the COI charge is calculated based on (DB + Account Value) or (DB – Account Value);*
2. *The MER % or Credit rate is applied to Premium rather than (Premium – COI charge);*
3. *The survival benefit is not considered when calculating the Best Estimate Liability for the whole contract view.*

(i) The Whole Contract view

t =	0	1	2	3	4	5
Premium – (A)	3,000	3,000	3,000	3,000	3,000	3,000
Death Benefit – (B)	50,000	50,000	50,000	50,000	50,000	50,000
COI rate – (C)	4%	4%	4%	4%	4%	4%
COI charge = C x B	2,000	2,000	2,000	2,000	2,000	2,000
Account Value (EOP)		1,059	2,181	3,370	4,629	5,963

Where

$$AV_t = AV_{t-1} + (\text{Premium} - \text{COI charge}) \times (1 + \text{Credit rate}) \times (1 - \text{MER}\%)$$

t =	0	1	2	3	4	5
Mortality rate	0%	0%	0%	0%	0%	10%
Mortality costs	= (DB + AV ₅) x q ₅					5,596.30
Prob of Survival	100%	100%	100%	100%	100%	90%
Survival Benefit	= AV ₅ x tPx					5,366.73

7. Continued

Discount factors

t =	0	1	2	3	4	5
Discount rate		5%	5%	5%	5%	5%
Discount Factor	1	95%	91%	86%	82%	78%

Therefore,

$$\text{PV (Premiums)} = \$13,637.85$$

$$\text{PV (Death Benefits)} = \$4,384.85$$

$$\text{PV (Survival Benefits)} = \$4,204.97$$

Best Estimate Liability

$$= \text{PV (Survival Benefits)} + \text{PV (Death Benefits)} - \text{PV (Premiums)}$$

$$= \$4,204.97$$

(ii) The Core Cash Flows view

The core cash flow view includes just cash flows transferred between the insurer and the product's account value

t =	0	1	2	3	4	5
COI charge = C x B	2,000	2,000	2,000	2,000	2,000	2,000
Death Benefit – (B)	50,000	50,000	50,000	50,000	50,000	50,000
Account Value (EOP)		1,059	2,181	3,370	4,629	5,963
MER %	1%	1%	1%	1%	1%	1%
MER charge		10.6	21.8	33.7	46.3	59.6

Discount factors

t =	0	1	2	3	4	5
Discount rate		5%	5%	5%	5%	5%
Discount Factor	1	95%	91%	86%	82%	78%

Therefore,

$$\text{PV (COI charge)} = \$9,091.90$$

$$\text{PV (Death Benefits)} = \$3,917.63$$

$$\text{PV (MER charge)} = \$145.25$$

Best Estimate Liability

$$= \text{PV (Death Benefits)} - \text{PV (COI charge)} - \text{PV (MER charge)}$$

$$= -\$5,319.52$$

7. Continued

- (c) Describe the approach for deriving the discount rates applied to cash flows that do not vary with returns on underlying items using the following two approaches:
- (i) Top down approach
 - (ii) Bottom up approach

Commentary on Question:

Most candidates provided general descriptions for top-down and bottom-up approaches. For the top-down approach, candidates received full credit if they identified and describe the approaches to derive the credit risk adjustment. For the bottom-up question, candidates received full credit if they described:

1. *the approach to derive the risk-free risk from the observable market*
2. *examples for the approach(s) used to calculate the illiquidity premium*

- (i) In the top-down approach, a reference portfolio of assets is selected with characteristics that are similar to those of the insurance contract liability. The yield on the reference portfolio would be adjusted to remove the portion of the yield attributed to credit and market risks on the assets.

There are two approaches to derive the credit risk adjustment:

1. a credit loss model can be used to calculate credit losses which are then deducted from the yield or
 2. a market-based approach where the credit default swap is used to determine the adjustment.
- (ii) In the bottom-up approach, a risk-free discount curve is adjusted by adding an illiquidity premium that reflects the characteristics of the insurance contract liabilities.

The risk free discount curve is typically based on government bonds or swaps, and the actuary would have to use an ultimate reinvestment rate if there is a need to extend the yield curve beyond the observable period

The liquidity premium can be calculated using the difference between an asset reference portfolio spread and the risk-free rate, while adjusting for credit risk and the difference between the liquidity characteristics of the insurance contract and the asset reference portfolio.

The liquidity premium can also be calculated using market-based techniques, which quantify the liquidity premium using the spread difference between covered bonds (where there is no credit risk) and the risk-free rates.

8. Learning Objectives:

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

Learning Outcomes:

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

Sources:

LFM-XXX-21: The IFRS 17 Contractual Service Margin: A Life Insurance Perspective (Sections 1-4.7 & 5)

Commentary on Question:

This question tested the candidates' knowledge of contractual service margins under IFRS 17

Solution:

- (a) Determine each of the following for Group B at initial recognition:
 - (i) The profitability classification of the group (with respect to Level of Aggregation).
 - (ii) The impact to the Insurance Service Result.

Commentary on Question:

Candidates generally calculated the CSM correctly. Few candidates identified the three groups of contracts. Candidates that did not identify the classification of the group received partial credit.

(i) Paragraph 16 requires entities to divide a portfolio of insurance contracts issued into a minimum of three groups of contracts:

- Loss-making contracts (if any).
- Contracts without significant risk of becoming onerous subsequently (if any).
- all remaining contracts (if any).

CSM at initial recognition is the best estimate present value of all cashflows less risk adjustment, floored at 0.

CSM = MAX (PV(premiums) - PV(benefits) - PV(maintenance) - acquisition expenses - risk adjustment, 0)

T10: $1,300,000 - 1,100,000 - 70,000 - 120,000 - 100,000 = (90,000)$

As the CSM cannot be negative, the CSM at inception for the T10 block is 0.

(ii) This group of contracts is loss-making (onerous). The CSM at initial recognition is not allowed to be negative; this loss must be recognized in the P&L (Insurance Service Results) immediately.

8. Continued

- (b) Explain possible reasons why the CSM at initial recognition for Group B is not proportional to the CSM at Transition for Group A.

Commentary on Question:

Some candidates explained that past experience variances and changes in assumptions may have affected the CSM roll-forward under the full retrospective method. Few candidates explained that the company may choose to use the Fair Value Method.

Where full retrospective method was used for Group A, past experience variances and changes in assumptions may have affected the CSM roll-forward.

If full retrospective method is not practicable, company may choose to use Fair Value Method; methodology is different than calculation of CSM at initial recognition.

It is uncommon for Fair Value method to produce a loss component at transition. Same product can have a positive CSM at transition even if it is generally loss making.

- (c) Explain the impact on the CSM or loss component at the end of year 1 and the Insurance Service Result in year 1 of each of the following separately:
- (i) Actual death claims are increased by 1,000,000 in Group A.
 - (ii) Actual attributable maintenance expenses are increased by 100,000 in Group A.
 - (iii) Additional premium-related expenses of 100,000 in Group A.
 - (iv) A favorable change in non-financial assumptions of 1,000,000 in Group A.
 - (v) A favorable change in non-financial assumptions of 150,000 in Group B.

Commentary on Question:

Many candidates explained the impact on parts (i), (ii) and (iv) correctly. For part (iii), some candidates identified the CSM impact correctly. Few candidates explained that there is no impact on P&L. For part (v), few candidates explained that there was no impact on P&L. Most candidates explained that the CSM will be established and loss component is fully reversed.

8. Continued

- (i) Additional claims would impact P&L (insurance service expenses), profit decreases by 1,000,000.
No direct impact to CSM for claim payment. CSM would change slightly because coverage units would change and additional deaths affect future cash flow projections.
 - (ii) No impact to CSM
Additional expenses would impact P&L (Insurance Service Expenses)
 - (iii) Experience variance would increase by \$100,000 and reduce CSM by that amount. CSM amount is sufficient to absorb this; group remains in profitable status
No impact to P&L
 - (iv) Favorable change in NFS; CSM increases by 1,000,000
No direct impact to P&L from 1,000,000 assumption change itself. P&L changes slightly due to amortization of additional CSM
 - (v) 150000 does not impact P&L directly. 150000 impact of assumption change will first be applied to the loss component roll forward. Reversal of loss component will impact P&L. If loss component is fully reversed, the group will become profitable and a CSM will be established. In this case, the impact of the change in assumptions exceeds the amount of the loss component at initial recognition.
- (d) Explain how the calculation of the IFRS 17 liabilities would change for new business if the renewal premium rates after 10 years were no longer guaranteed and could be repriced at that time.

Commentary on Question:

Candidates generally explained that the contract boundary will end when the insurer has the right to reprice. However, few candidates explained that the risk adjustment will likely be reduced.

The Best Estimate Liability and CSM can only take into account cash flows that fall within the IFRS 17 contract boundary. The contract boundary will now end when the insurer has the right to reprice.

8. Continued

A substantive obligation to provide insurance contract services ends when:

- a) The entity has the practical ability to reassess the risks of the particular policyholder and, as a result, can set a price or level of benefits that fully reflects those risks; or
- b) Both of the following criteria are satisfied:
 - (i) the entity has the practical ability to reassess the risks of the portfolio of insurance contracts that contains the contract and, as a result, can set a price or level of benefits that fully reflects the risk of that portfolio; and
 - (ii) the pricing of the premiums up to the date when the risks are reassessed does not take into account the risks that relate to periods after the reassessment date.

The risk adjustment will likely be reduced to reflect the reduced risk given the insurer's right to reprice

- (e) Explain why the Risk Adjustment for Group A at transition may be different from the current Margins for Adverse Deviation (MfAD) under IFRS 4.

Commentary on Question:

Most candidates explained RA is for non-financial risk only. Few candidates explained other differences.

Risk adjustment is for non-financial risk only. C-3 margins should be excluded.

Margin approach may not be used to determine risk adjustment. A variety of methods are acceptable.

Reflection of diversification benefits may differ from IFRS-17 approach.

Entity's Confidence level for Risk Adjustment may not be consistent with that inherent in IFRS-4 margins.

9. Learning Objectives:

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

Learning Outcomes:

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

Sources:

CIA Educational Note: Contractual Service Margins – Coverage Units for Canadian Products under IFRS17

Commentary on Question:

This question tested the candidates' knowledge of IFRS 17 coverage units and ability to calculate the CSM run off.

Solution:

- (a) Explain the difference between an investment-return service and an investment-related service under IFRS 17.

Commentary on Question:

Few candidates received full credit for this part of the question. Candidates generally explained the difference between insurance service and investment service instead.

An investment-return service refers to generating an investment return for policies without direct participating features.

An investment-related service refers to management of underlying items on behalf of the policyholder for contracts with direct participating features.

- (b) Discuss considerations in determining coverage units under IFRS 17 for the following products:
 - (i) A Whole Life insurance contract with:
 - Guaranteed Cash Surrender values; and
 - An Accidental Death Benefit equal to two times the basic coverage
 - (ii) An Individual Participating Life contract which qualifies as an insurance contract with direct participating features. Policyholders have the option of applying dividends to purchase Term additions or Paid-Up additions.
 - (iii) An Immediate Annuity

9. Continued

Commentary on Question:

Few candidates discussed the type of service for each contract. For part (i) most candidates discussed that the Accidental Death Benefit shall be included in coverage but failed to discuss that it's inappropriate to simply add to the base coverage. Candidates generally did not do well on part(ii). Candidates generally did well on part (iii).

(i) Whole life contract

This contract has both insurance services and investment return services. Coverage for insurance service consider both the insured benefit and accidental death benefit. Net amount at risk (face amount less the cash surrender value) could be used as the coverage unit for the insured benefit. It is not appropriate to simply sum the accidental death benefit to the basic coverage, a measure which normalizes the to coverages such as premium paid shall be used. The cash surrender value could be used as the coverage unit for investment return service.

(ii) Individual Par

Coverage is related to investment related services. There would be additional considerations with respect to the projected underlying item or future face amount. Use of the fair value of the underlying item as the coverage unit would be appropriate. Additional insurance coverage that could be provided under various dividend options. Additional investment component amounts (and investment-related services) that could result from exercising the dividend options.

(iii) Immediate Annuity

Coverage is related to investment return service. Service is represented by the periodic benefit payable or the present value of all future payments under the contract.

(c) You are given the following information for a 10-year Universal Life (UL) product:

- The death benefit is the face amount plus the account value
- The contract qualifies as a contract without direct participating features
- Coverage units are not discounted

9. Continued

You are given the following assumptions:

Assumptions	
Annual decrement (lapse and death combined, all at year end)	4% each year
Locked-in rate at initial recognition	3% flat for all years
Face amount	1,000
Account Value	Initial value of 400, expected annual growth rate of 5%
CSM at initial recognition	300

Calculate the Contractual Service Margin balance over the 10-year period.

Commentary on Question:

Candidates generally did well on this part of the question. Most candidates were able to calculate the CSM run off. Common mistakes including not decrementing properly and not including CSM interest accretion in CSM amortization.

See calculation in Excel.

10. 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: Chapter 3, Liability for Income Tax

Canadian Insurance Taxation, 4th Ed: Chapter 4, Income for Tax Purposes - General Rules

Canadian Insurance Taxation, 4th Ed: Chapter 5, Investment Income

Canadian Insurance Taxation, 4th Ed: Chapter 6, Reserves

Canadian Insurance Taxation, 4th Ed: Chapter 24, Provincial Premium Tax

Commentary on Question:

This question tested the candidates' understanding of how different provincial tax rules can impact business decisions, and how different forces (internal and external) can impact an insurer's taxable income. Candidates generally did well on this question.

Solution:

- (a)
 - (i) Discuss the circumstances under which a Canadian Life Insurance company is subject to premium taxes.
 - (ii) Explain the impact of paying premium taxes on the company's net income for tax purposes.

Commentary on Question:

Most candidates did well on this part of the question.

- (i) Premium taxes are assessed on premium paid on life insurance products, net of premium refunds and the cash value of policy dividends, and gross of reinsurance. Premiums taxes are not charged on annuity contracts. The definition of premium can vary by province.
- (ii) Paying premium taxes will decrease the company's net income. Any taxes paid are deducted from net income for both federal and provincial tax purposes.

10. Continued

- (b) Oakville Life is a Canadian-resident life insurer which sells business in Canada and the United States.

Discuss the potential impact on the Canadian taxable income of Oakville Life for each of the following events:

- A. *Incurring But Not Reported (IBNR) claims on Canadian life insurance policies for the following year are expected to increase.*
- B. *A Canadian group insurance policyholder uses their experience rating refunds to reduce upcoming premium payments.*
- C. *The cost to Oakville Life of mandatory underwriting for Canadian life annuities increases.*
- D. *Universal Life sales increase for Oakville Life's United States-based insurance business.*
- E. *Oakville Life reduces premium rates on their Canadian Term Life products in the hopes of selling more policies.*
- F. *Oakville Life increases interest rates charged on policy loans for their Canadian policies.*

Commentary on Question:

Most candidates did well on this part of the question. A few candidates discussed concepts for premium taxes instead of corporate income taxes.

A:

Current year's taxable income will decrease, because the expected reserve will increase due to the expected claims increase.

However, because IBNR reserve has an MTAR, the increase may cause the MTAR to be positive, and the deducted reserve in that year may have to be added to next year's taxable income. As a result, the following year's taxable income may increase.

B:

The taxable income may decrease. This is because the insurer is permitted a deduction for the portion of the experience rating refund for experience tied to the past year.

10. Continued

However, if the portion of ERR is not for experience tied to the past year, the insurer may not be eligible to claim a deduction. The insurer may be able to set up a reserve instead.

C:

Increase in underwriting will decrease taxable income because underwriting is a policy acquisition expense and deducted from taxable income.

D:

There is no impact to taxable income, because the foreign-earned insurance income is not subject to Canadian income tax for Canadian-resident insurers.

E:

Net impact depends on whether the premium reduction strategy is successful or not. Sales premiums are included in taxable income so a decrease in premium rate will decrease the taxable income. But if the strategy works and more policies are sold that more than fully offset the decrease in premium rates, taxable income will increase.

F:

Increase in interest payments or policy loan repayments will increase taxable income for the insurer, because policy loan interest and repayments are included in taxable income.

11. Learning Objectives:

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

Learning Outcomes:

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

Sources:

LFM-645-21: OSFI Guideline – Life Insurance Capital Adequacy Test (LICAT), Oct 2018, Ch. 1-11 (excluding Sections 4.2-4.4 & 7.3-7.11)

CIA Educational Note: LICAT and CARLI, March 2018

Commentary on Question:

This question tested the candidates' knowledge and application of LICAT.

Solution:

- (a)
- (i) Calculate the mortality risk solvency buffer for the company, without diversification credit between life-supported and death-supported business.
 - (ii) Calculate the diversification credit between life-supported and death-supported business
 - (iii) For the company:
 - Calculate the lapse risk solvency buffer
 - Calculate the expense risk solvency buffer

Commentary on Question:

Candidates generally did well on this part of the question. Candidates generally demonstrated understanding of the concepts of required capital and were able to apply the appropriate shocks to calculate the solvency buffer. However, many candidates were not able to calculate the individual volatility component correctly and determine the correct the level risk shock for Business B as it was a Life-supported business.

11. Continued

	Business A	Business B
(i) Mortality risk	Death-supported	Life-supported
Calculate the individual volatility component for Business A & B:	Required capital for volatility risk (RC_vol) = 2.7 * Standard deviation of the upcoming year's projected net death claims * NAAR/net face amount	
	=2.7*1.5*(1100-1500)/1100 = -1.4727	=2.7*1.2*(10,600-(-90))/10,600 = 3.2675
Shock on base mortality for level risk	-15%	Min (25%, 11%+20% x RC_vol /The following year's net expected claims)
		=Min (25%, 11%+20%*3.2675/17)=14.84%
Required capital for level risk	= 1115-1070 = 45	= -184 - (-210) = 26
Shock on mortality improvement for trend risk	+75% at all policy durations	- 75% for 25 years, followed by -100% (i.e. no mortality improvement) thereafter.
Required capital for trend risk	= 1095 - 1070 = 25	= -196 - (-210) = 14
Catastrophe Shock	0% + 1 additional death per thousand	
Required capital for catastrophe risk for A&B	= 1069 -1070 = -1	=-200-(-210) = 10
Mortality risk solvency buffer for A & B	Mortality risk RC = sqrt(RCcat^2+RCvol^2)+RClevel+RCtrend	
	=sqrt((-1+10)^2+(-1.4727+3.2675)^2)+(45+26)+(25+14) = 119	

(ii)	Business A	Business B
Calculate the Required Capital	Required capital for level risk + Required Capital for trend risk	
	= 45+25 = 70	= 26+14 = 40
Calculate RC _{Aggregate}	sqrt(Life Supp RC ^2 + Death Supp RC ^2 - 1.5*LifeRC*DeathRC)	
	=sqrt(40^2+70^2-1.5*40*70) = 48	
Diversification Credit	=70+40-48 = 62	

(iii)

	Business A	Business B
Lapse risk	Lapse-supported	Lapse-sensitive
Shock on lapse for level risk and trend risk	$\pm 30\%$ in all policy years	
Required capital for level risk and trend risk	$= 1085 - 1070 = 15$	$= 15 - (-210) = 225$
Shock on lapse for volatility risk	$\pm 60\%$ in the first year - $\pm 30\%$ in the first year	
Required capital for volatility risk	$= 1072 - 1071 = 1$	$= -160 - (-180) = 20$
Shock on lapse for catastrophe risk	-40% in the first year	An absolute addition of 20% to the lapse rate in the first year only
Required capital for catastrophe risk	$= 1080 - 1070 = 10$	$= -185 - (-210) = 25$
Lapse risk solvency buffer	$= \sqrt{RC\ vol^2 + RC\ cata^2} + RC\ level\ \&\ trend$	
	$= \sqrt{1^2 + 10^2} + 15 = 25$	$= \sqrt{20^2 + 25^2} + 225 = 257$
Lapse risk solvency buffer for the company	$= 25 + 257 = 282$	

Shock on expense	$+20\%$ in the first year followed by a permanent $+10\%$ in all subsequent policy years	
Expense risk solvency buffer	$= 1075 - 1070 = 5$	$= -200 - (-210) = 10$
Expense risk solvency buffer for the company	$= 5 + 10 = 15$	

(b) Assume that:

- All policies are individually underwritten Canadian life business
- Tax rate = 20%
- No change in negative reserve reduction limit

You are given the three following independent events:

- Event 1: Negative reserve changed from 1000 to 1200. No change in net reserve.
- Event 2: Credit spread PfAD increased by 20.
- Event 3: Interest rate PfAD increased by 30.

11. Continued

Describe the impact on the following for each independent event:

- (i) Total LICAT ratio
- (ii) Tier 1 capital ratio

Commentary on Question:

Candidates were generally able to quantify the impact under Event 1. Few candidates demonstrated enough knowledge on Events 2 and 3. A common error was not considering the tax impacts. One of the key concepts was to identify which PfAD should be included in the Surplus Allowance, but few candidates were able to make the correct decisions.

Total LICAT Ratio:

- Event 1:
No impact on Total LICAT ratio as negative reserve is subtracted from Tier 1 available capital and added back to Tier 2 available capital. Hence, there is no impact to total available capital.
- Event 2:
Increase in credit spread PfAD results in an after-tax loss of $\$20M \times (1-20\%) = \$16M$. Credit spread PfAD is not included in the surplus allowance. Hence, no offsetting impact to the after-tax loss. This causes total LICAT ratio to decrease.
- Event 3:
Increase in risk-free PfAD results in an after-tax loss of $\$30M \times (1-20\%) = \$24M$, but 100% Risk-free rate PfAD is included in the surplus allowance for the total LICAT ratio calculation. Hence, the numerator in the LICAT formula is going to change by $-\$24M + 100\% \times 30M = \$6M$. Therefore, the Total LICAT ratio will increase.

Tier 1 Capital Ratio:

- Event 1:
Tier 1 ratio should decrease as negative reserves are deducted from Tier 1 available capital.
- Event 2:
Increase in credit spread PfAD results in an after-tax loss of $\$20M \times (1-20\%) = \$16M$. Credit spread PfAD is not included in the surplus allowance. Hence, no offsetting impact to the after-tax loss. This causes Tier 1 ratio to decrease.

11. Continued

- Event 3:
Increase in risk-free PfAD results in an after-tax loss of $\$30M \times (1-20\%) = \$24M$, but only 70% Risk-free rate PfAD is included in the surplus allowance for the Tier 1 ratio calculation. Hence, the numerator in the Tier 1 formula is going to change by $-\$24M + 70\% \times 30M = (\$3M)$. Therefore, the Tier 1 ratio will decrease.