ILA LFMC Model Solutions
Spring 2022

1. 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:

Economic Capital for Life Insurance Companies, SOA Research Paper, Oct 2016 (excluding sections 5 & 7)

Economic Capital A Case Study to Analyze Longevity Risk, Risk & Rewards, Aug 2010

Commentary on Question:

This question tested candidates' understanding of the Economic Capital framework, and the impact of the mortality assumption on liability cash flow projections. For the EC framework portion of this question, while most candidates were able to describe the main difference of the two approaches and make the correct choice under each scenario, few candidates could demonstrate the in-depth understanding needed for some parts of this question. For the mortality assumption portion, most candidates showed the basic understanding, but failed to demonstrate full knowledge.

Solution:

(a) Compare and contrast the two approaches based on each of the following management considerations:

(i) We use buy-and-hold strategy for fixed interest investment and intend to closely match assets and liabilities.

(ii) We want to know how many assets are required to cover liabilities with some degree of security.

1. Continued

(iii) We closely monitor changes in market conditions and respond accordingly. We want to reflect these actions in the Economic Capital framework.

(iv) We believe that yield curves eventually go back to normal after extreme market events.

(v) We want to be consistent with the reality of capital management and regulatory reporting that requires capital to be calculated on an annual basis.

(vi) We hope to easily calibrate EC to a target security level.

Commentary on Question:
Most candidates were able to demonstrate an understanding of the two approaches when it comes to the basic concepts and generally did well on parts (i), (ii), (v), and (vi).

(i)

- Even a buy-and-hold strategy is regularly monitored and rebalanced.
- A runoff EC model is more appropriately aligned with its long term focus, which would emphasize risks such as defaults over the investment horizon.
- Finite risk horizon approach suggests a strong focus on the tradeable value of the insurance portfolio, suggesting market-based values cannot be ignored, even for buy-and-hold strategies.

(ii)

- Both approaches can achieve that goal
- Run off approach investigates a runoff of the business,
- While the finite risk horizon approach looks at transfers to a third party.

(iii)

- A one-year model using market consistent valuations is inherently more aligned with financial markets and therefore with market-based risk mitigation strategies that can be or are being undertaken, including financial derivatives, reinsurance or securitization transactions
- A runoff approach with no intermediate valuation metrics may become disconnected from financial market conditions. However, it is appropriate where the management action model used is realistic and explicitly tied to a formal business strategy.

1. Continued

(iv)

- Both the adjusted market-based and runoff cash flow methodologies embed strong assumptions about the mean reversion of asset returns after extreme market events.
- A runoff model will typically make an assumption about the expected level of yield curves based on historic experience that is different from the future level implied by the long end of the initial market yield curve. Whereas the Solvency II adjusted market-based model incorporates these effects by ignoring parts of the initial yield curve and extrapolating quickly to real world expectations.
- The effects of both are to introduce a type of mean reversion into the measurement of capital that diverge strict short term market pricing or market implied risk levels.
- The nature of this mean reversion assumption is highly subjective and difficult to reliably estimate. The evidence for these effects is also mixed and dependent on the particular time periods, asset types and economies included.

(v)

- When applied over a one-year time period, the finite risk horizon approach acknowledges this reality and better aligns itself with the actual management of the company.
- In contrast, the liability runoff approach attempts to find the amount of capital today that will provide sufficient protection for the lifetime of the portfolio, thus ignoring the reality that capital levels will be annually reevaluated.

(vi)

- It is generally viewed as easier to calibrate EC to a target security level under a finite risk horizon approach, and there is a significant body of statistics available regarding corporate bond defaults against which a reasonable calibration can be made.
- Calibration of a liability runoff approach to an external data source is more difficult as:
    - The block of business (and therefore the risk exposure) will typically be reducing over time.
    - The projection would typically not include all risks for all time periods; in particular, new business may be included for only a limited time period, if at all.

(b) Recommend changes to the current liability projection model in order to accomplish ABC's intended objective.

1. Continued

Commentary on Question:
Most candidates pointed out the assumptions based on historical experience may have deviated over time due to various reasons, and provided responses regarding how to fix/improve these assumptions. Some candidates recognized the need to use different discount rates, as well as taking into account of extreme scenarios such as a pandemic. But few candidates touched on other aspects discussed in the source material.

- Volatility can rise from a mismatch between the population used to generate the mortality table and the population of lives in ABC's customers.

- Recommend to review historical deviation of mortality from current table and incorporate volatility in based table projection.
    - May use combination of SS table and company data based on credibility.

- For mortality improvement:
    - Reflected historical levels of correlation by age and genders over time periods.
    - Then project volatility in future mortality improvement in manners consistent with how the factors were derived from the historical data.

- Reflect the possibilities of extreme mortality occurrences, such as a pandemic or earthquakes

- May use different discount rates depending on the asset portfolios, i.e. different asset portfolios may have different asset risk that would need to be reflected in Economic Capital

- Consider using formula based mortality rate depending on market condition for certain products, if historical data shows correlation between them.

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

Commentary on Question:

This question tested the candidates' knowledge of U.S. principle-based reserves and the rationale behind the regulations and other professional guidance.

Solution:

(a) Regarding starting assets and the use of a discount rate, describe 2 approaches that can be used to calculate deterministic reserve.

Commentary on Question:

To receive full credit, candidates had to include an accurate description of the scope of cash flows used in each approach, a description of the discount rate used for the PV of cash flows approach, and an indication that all projected benefits and expenses must be liquidated by the end of the projection horizon in the direct iteration method.

Most candidates received at least partial credit by correctly naming each approach. The model solution reflects the approach names used in LFM-143-20, but names from other source material were treated as equivalent such as "Gross Premium Valuation method" and "Prospective method" in lieu of "PV of cashflows," and "Retrospective method" in lieu of "Direct iteration."

Describing the discount rate for the PV of cash flows approach as the net asset earned rate (or NAER for short) was seen as equivalent to the description in the model solution.

Common errors for the PV of cash flows approach included describing the cash flows as either liability only or including inflows from investment income only (i.e., not including premium cash flows). Many candidates also mistakenly described the discount rate as prescribed. Most candidates failed to mention that all policy obligations must be liquidated by the end of the projection period for the direct iteration method, which is a fundamental component of the calculation.

2. Continued

Two approaches- PV of cashflows and direct iteration

PV of cashflows:
DR is APV of benefits, expenses - APV of premiums, less PIMR (pre-tax interest maintenance reserve). Cashflows should also include policy loan, separate accounts, reinsurance, etc. using the path of discount rates for the corresponding model segment.

Direct iteration:
Assigns an amount of starting assets which, when projected along with all premiums and investment income, results in the liquidation of all projected future benefits and expenses by the end of the projection horizon.

(b) Describe the purpose of the following exclusion tests:

(i) Deterministic Exclusion Test (DET)

(ii) Stochastic Exclusion Test (SET)

Commentary on Question:
Most candidates received partial credit by explaining that passing each test allows the insurer to avoid calculating the corresponding reserve. Few candidates explained the purpose of the tests, which is to identify cases where the deterministic/stochastic reserves are highly unlikely to exceed the net premium reserve.

Full credit responses also described the property that each test identifies – the sufficiency of premium revenue to fund liabilities in the case of the DET, and the lack of interest rate and asset return volatility sensitivity in the case of the SET. Another acceptable description of the DET is that it is used to demonstrate that the sum of valuation net premiums for all future years is less than the sum of the corresponding guaranteed gross premiums.

(i) The deterministic exclusion test (DET) is designed to identify those groups of policies that have anticipated premium revenue that is adequate to fund the future obligations of the policy group and likely to produce a deterministic reserve that, if calculated, would not provide the basis for the minimum reserve (i.e. would not exceed the net premium reserve).

(ii) The stochastic exclusion test (SET) is intended to identify those groups of policies that are insensitive to interest rate and asset return volatility risk and are likely to produce a stochastic reserve that, if calculated, would not provide the basis for the minimum reserve (i.e. would not be the greatest of the three reserve components).

2. Continued

(c) Critique the following statements:

A. Term products are eligible for DET while ULSG is not. While premiums are low during the level period, there will always be more than enough premium post level period to fund the policy so that there's no need to calculate a deterministic reserve.

B. ALF's term and ULSG products are eligible for SET.

Commentary on Question:
Most candidates correctly identified that both Term and ULSG products are eligible for DET. The key issue with the statement regarding the post level period is the impact of shock lapse in the post level period. Some candidates attempted to refute the statement by discussing prescribed assumptions and limits from actuarial guideline XXX and/or the net premium reserve rules for VM-20, neither of which are relevant to the accuracy of the statement or the calculation of the deterministic reserve.

No partial credit was received for suggesting that Term or ULSG policies are sometimes eligible for the DET.

Candidates generally struggled with statement B. Candidates generally did not recognize that there is no clearly defined hedging strategy.

A. Without the consideration of PLT shock lapses and adverse selection, term policies will be able to fund future obligations because the PLT (Post Level Term) premium is much higher than the level term premium. However, a lot of policyholders surrender their policies at renewal due to sharp increase in PLT premium rates, leaving a lot of term products underfunded in later years. In other words, the anticipated premium revenue is inadequate to fund the future obligations. Therefore, it is not eligible for the DET. It is also true that ULSG is ineligible for the DET.
B. True – both products are eligible for SET because there is no Clearly Defined Hedging Strategy.

(d) You are given one of the projected scenarios from ALF's cash flow model.

Projection period	**0**	**1**	**2**	**3**	**4**
Statement value of assets	2,000	400	-200	-650	1,000
One – Year Treasury Rate	N/A	1.00%	1.20%	1.50%	2.00%

Calculate the scenario reserve. Show all work.

2. Continued

Commentary on Question:
To receive full credit, the candidate must calculate the greatest present value of accumulated deficiency (GPVAD) and demonstrate understanding that the reserve is the sum of time 0 asset and the GPVAD. Most candidates failed to calculate the scenario reserve correctly. Some candidates ignored multiplying the treasury rate by the 1.05 factor. Many candidates added the present value of all future accumulated deficiencies to the reserve instead the greatest present value of accumulated deficiency.

	Period	0	1	2	3	4
1. Statement value of assets		2,000	400	-200	-650	1,000
2. One - Year Treasury Rate			1.00%	1.20%	1.50%	2.00%
3. Negative of the Statement of value of assets		-2,000	-400	200	650	-1,000
4. 105% of 1 year treasury			1.05%	1.26%	1.58%	2.10%
5. Accumulative Discount Factor		1	0.9896	0.977	0.962	0.942
6. Discounted negative accumulated deficiencies		-2,000	-395.84	195.46	625	-942
7. Greatest present value of accumulated deficiency (GPVAD)		625				
Starting Reserve (Time 0 Asset + GPVAD)		2,625.39				

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: Considerations in the Valuation of Segregated Fund Products, Nov 2007

CIA Report: Report of the Task Force on Segregated Fund Liability and Capital Methodologies (Aug 2010)

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

Commentary on Question:

This question tested the candidates' knowledge of current valuation principles.

Solution:

(a) You are given the following information for the most recent IFRS 4 valuation:

- The liability for the segregated fund guarantees is set at CTE(70).
- Recoverability testing has confirmed that the allowance for acquisition expenses (AAE) is fully recoverable.

(i) Compare the term of revenue recognition to the term of the AAE at the valuation date.

(ii) Explain why the term of the AAE may change at future valuation dates.

(iii) Describe the CIA Standards of Practice requirements for an appropriate method to write-down the AAE.

Commentary on Question:

This part of the question tested candidates' understanding of Allowance for Acquisition Expenses concepts and characteristics. Candidates generally did well on this part of the questions.

For part (i) few candidates provided a comparison of the terms at the valuation dates.

3. Continued

For part (ii) partial credit was received for indicating the term of AAE may change due to market movement but did not mention impact from changes in future cash flows.
For part (iii) partial credit was received for identifying some, but not all, elements of the appropriate method correctly.

(i) The question has stated the AAE is fully recoverable, which indicates the term length of revenue recognition is equivalent with the term of the AAE.

(ii) The extended term of AAE would change from period to period in reaction to the amount of AAE remaining and changes in future cash flow patterns as of result of market movement and other factors.

(iii) An appropriate method to write-down the AAE has the following characteristics:

1. Have a term consistent with the extended term established at inception; 2. Have a write-down pattern reasonably matched with the net cash flow available to offset these expenses at inception;
2. Be locked in, so the amount of write-down in each period will not fluctuate from the expected amount established at inception provided such balance is recoverable from the additional cash flow recognized at the balance sheet date, and where not fully recoverable at the balance sheet date;
3. Where not fully recoverable, is written down to the recoverable amount, with the expected amount of write-down in each future period proportionately reduced.

(b) Critique the following:

- *A CTE(0) level for recognizing future cashflows should be used for the purpose of annual AAE recoverability testing.*

Commentary on Question:
This part of the question tested candidates' understanding of CTE choice of AAE recoverability testing. Candidates generally did well on this part of the question and recommended an appropriate range. A few candidates recommended CTE (0) as a reasonable approach for AAE recoverability testing.

- CTE(0) is not a recommended approach since future cash flows are uncertain.
- Accepted actuarial practice in Canada requires some provision for adverse deviation in the recoverability testing exercise.
- CTE(60) – CTE(80) is a recommend range by Standards of Practice. Any CTE level within this range (e.g. CTE 70 to be consistent with the liability level) may be recommended.

3. Continued

(c) Compare and contrast the Bifurcated Approach and the Whole Contract Approach for segregated fund valuation.

Commentary on Question:
This part of the question tested candidates' understanding of the two approaches for segregated fund valuation.

Bifurcated Approach

- Revenue is allocated, or bifurcated, between recoverability testing of the allowance for acquisition expense and the liability for the guarantee.
- The portion allocated to the guarantee would generally be based on the additional charge priced into the product for that guarantee.
- The policy liability for the guarantee is calculated separately using the net cash flows available excluding those allocated to amortize the remaining unamortized AAE.
- The allocation of future revenues between amortization of the AAE and the guarantee does not change from period to period.

Pro: necessary for hedging because it is not possible to hedge a stream of revenue that varies from period to period.

Pro: Easier to understand and analyze results.

Con: Total liability is equal to or greater than the Whole Contract approach, since not all future revenue will always be considered.

Whole Contract

- Under this approach all net cash flows available are considered in determining the total liability.
- This total liability will change from period to period because of market movements and other factors and could, therefore, implicitly include a writing down of the AAE.

Pro: More comprehensive than bifurcated approach.

Pro: Total liability is equal to or less than the bifurcated approach since all future revenue will be considered in the calculation.

Pro: defer writing down AAE as long as possible since the calculation considers all future revenue

Con: Liability will be more volatile than bifurcated approach once it becomes positive. This is because the implicit allocation between AAE and the guarantees will change period to period.

3. Continued

(d) SEG Life is considering redesigning their segregated fund product for new sales. The options being considered are:

A. The surrender charge period will be extended from five years to seven years
B. The guaranteed benefits will decrease from 100% to 75% of the initial deposit
C. Fund options are limited to Fixed Income assets only

Assess the impact of each of the above proposed options on:

(i) the best estimate Surrender assumption

(ii) the best estimate Partial Withdrawal assumption

Commentary on Question:
This part of the question tested candidates' understanding of drivers of assumption movement for a segregated fund product. Candidates generally did well on this part of the question. Partial credit was received for assessing the impact to surrender assumption correctly but incorrectly assessing the impact to the partial withdrawal assumption, or vice versa.

A
Best Estimate Surrender assumption

- Expect surrender assumption to spike after the surrender charge period expires, so move the spike from after five years to after seven years.

Partial Withdrawal assumption

- The partial withdrawal change could be similar with surrender assumption, with the spike moved out two years.
- Candidates who considered the relationship between full surrenders and partial withdrawals (e.g., there might be a lower partial withdrawal assumption near the end of the surrender charge period, as the full surrender assumption increases) received full marks.

B
Best Estimate Surrender assumption

- A lower guaranteed value is expected to increase the MV/GV ratio. Policies will generally be more out-of-the-money with the new product than the old product. In general, the more out-of-the-money a seg fund is, the higher the surrender rate should be since the client isn't benefitting from the insurance element.

3. Continued

Partial Withdrawal assumption

- The partial withdrawal assumption movement is similar with the surrender assumption.
- Candidates who mentioned that partial surrenders are more likely to occur frequently for other reasons than the in-the-moneyness of the policy, so would likely be less effected than surrenders rate, also receive full marks.

C

Best Estimate Surrender assumption

Examples of responses that received full marks include

- Fixed income option would produce lower returns than other types of investments (e.g., equity) which leads to lower segregated fund market values. A lower market value would decrease the MV/GV ratio which leads to a decrease in the surrender rate.
- The surrender assumption is expected to increase due to the limited option provided and general lower return from fixed income asset compare with other investment options. The policyholder is intended to lapse and look for other options provided by other companies for a higher return rate.
- The surrender ratio is related to the current market environment. If it's during volatile time, the policyholder is intended to stay, and the surrender ratio is expected to decrease. If it's during stable time, the policyholder is intended to lapse and seek for higher return options provided by other companies.

Partial Withdrawal assumption

Examples of responses that received full marks include:

- Fixed income option would produce lower returns than other types of investments (e.g. equity) which leads to lower segregated fund market values. A lower market value would decrease the MV/GV ratio which leads to a decrease in the partial withdrawal surrender rate.
- The partial surrender assumption is expected to increase due to the limited option provided and general lower return from fixed income asset compare with other investment options. The policyholder may move funds to higher return products offered other companies for a higher return rate without fully lapsing the policy.
- The partial surrender ratio is related to the current market environment. During market volatility, the policyholder is more likely to stay and the partial surrender ratio is expected to decrease. If markets are stable, the policyholder is more likely to seek other products with higher returns.

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:

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

CIA Educational Note: Margins for Adverse Deviations (MfAD), Nov 2006

CIA Educational Note: Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies, Jul 2002 (excluding Appendices)

Commentary on Question:

This question tested the candidates' knowledge of pre-IFRS 17 valuation principles.

Solution:

(a) Outline the requirements under the CIA Standards of Practice for the following when calculating IFRS 4 reserves for life insurance products:

(i) Reinsurance recoverables

(ii) Amount of assets required to support contract liabilities

(iii) Renewal benefits

(iv) Forecasting cashflows

(v) Adopting a scenario

Commentary on Question:

Candidates generally did well on parts (i) and (ii) of this part of the question. For part (iii), some candidates described the contract renewal and contract boundary under IFRS 17 but failed to provide any description for the requirement for renewal benefits under IFRS 4. For part (iv), candidates generally did not discuss policy owner reasonable expectations, and/or dividend treatment in cash flow forecasting. For part (v), a common mistake is that the actuary must adopt the CIA prescribed interest scenario that produces the largest insurance contract liabilities (vs. the insurance contract liabilities would not be <u>less than</u> those in the prescribed scenario with the largest insurance contract liabilities).

4. Continued

(i) The insurance contract liabilities need to be calculated net of reinsurance recoverables by the CALM.

(ii) The amount of insurance contract liabilities using CALM for a particular scenario is equal to the amount of supporting assets at the calculation date that are forecast to reduce to zero coincident with the last liability cash flow in that scenario.

(iii) The term of the liabilities should take account of any renewal, or any adjustment equivalent to renewal, after the calculation date if:

a. The insurer's discretion at that renewal or adjustment is contractually constrained; and
b. Insurance contract liabilities are larger as a result of taking account of that renewal or adjustment

(iv) In forecasting the cash flow expected to be generated by an insurance contract, the actuary should

c. Take account of policy owner reasonable expectations; and
d. Include policy dividends, other than the related transfers to the shareholders' account and other than ownership dividends, in the comprised cash flow from benefits

(v) The actuary should calculate insurance contract liabilities for multiple scenarios and adopt a scenario whose insurance contract liabilities make sufficient but not excessive provision for the insurer's obligations in respect of the relevant policies.

(b) The following statements summarize how a company determines its best estimate assumptions and margins for adverse deviation (MfAD). Critique the following statements.

A. *Considerations in properly estimating best estimate morbidity assumptions include operational risks, seasonal variations in experience, and contract wording to protect against the impact of medical advances.*

B. *Due to lack of credibility, an addition of 17.5% of the best estimate of morbidity termination rates is applied, and a subtraction of 17.5% of the best estimate morbidity incidence rates is applied. The MfAD would not reflect any expected correlation between incidence and termination rates.*

C. *Best estimate expense assumption in the valuation of insurance contracts considers overhead, marketing and premium taxes. Expenses are well understood and managed, so an MfAD of 2.5% is applied.*

4. Continued

D. Death supported products include an MfAD of $-5/e_x$. Death supported products include all 20-year Term and Term-to-100 policies that are reinsured on at least an 80% quota share basis.

E. The best estimate assumption for mortgage asset depreciation considers assets that are impaired at the valuation date and includes loss of interest, loss of principal, and expense of managing depreciation. The MfAD for mortgage asset depreciation considers assets that are impaired after the valuation date.

Commentary on Question:
Candidates generally did well in critiquing statements A, B and C. For statement D, candidates were generally able to comment on the appropriateness of the direction of the MfAD. Some candidates were able to critique the statement on the death supported/sensitive feature of T100 and T20, and the impact of QS reinsurance on the death supported/sensitive features. Candidates generally did not demonstrate knowledge in critiquing Statement E.

A. It is correct that the operational risk and seasonal variation are considered in best estimate morbidity assumptions. However, contract wording are considered for MfAD, not best estimate assumptions.

B. It is appropriate to set the MfAD margin at the higher end of the range due to lack of credibility. However, margin should be subtracted from the termination rates and added to incidence rates. The MfAD should reflect correlation between termination and incidence rates.

C. It is correct that the best estimate assumption includes overhead and premium taxes. However, best estimate does not include marketing. Provided that expenses are well understood, setting MfAD at 2.5% is appropriate.

D. Negative MfAD for death supported is appropriate as it will increase policy liabilities. T-100 is death supported; however, T20 is not death supported. Quota Share reinsurance will not change whether the policies are death supported or death sensitive.

E. The best estimate assumption for mortgage assets depreciation considers assets that are impaired both at and after valuation date. The MfAD considers assets that are impaired at the valuation date. The rest of the statement is correct.

4. Continued

(c) 10 years ago MCB Insurance entered into the annuity market in Canada.

You are given:

- There were 1,500 annuitant death claims over ten years
- A reliable administration process has been established and followed
- The business mix of the portfolio is predominantly a wide range of blue collar (i.e. manual labour) industries
- The COVID-19 pandemic has caused deaths in the portfolio; however, it is not clear if this will result in a permanent change in the expected assumption
- The current annuitant mortality Provision for Adverse Deviation (PfAD) is 5,000,000.
- The current annuitant mortality MfAD of 6.5% was set when MCB entered the annuity market 10 years ago.

(i) Provide a rationale for setting the initial MfAD at 6.5%.

(ii) Recommend an updated MfAD.

(iii) Calculate the impact on the annuity block's PfAD from the recommended MfAD.

Commentary on Question:
Candidates were generally able to provide rational for the initial MfAD in part (i). For part (ii), partial credit was received for discussing relevant considerations. Full credit was received for the final recommendation if the candidate provided appropriate considerations and justification. Candidates generally did well on part (iii); however, a common omission was calculating the new MfAD, but not providing the final "impact" of the change.

(i) The current MfAD is greater than the average of the low and high margin (2% to 8%). The higher level of MfAD was appropriate provided that the insurer just entered the market 10 years ago and did not have sufficient credible data.

(ii) There are a few considerations:

- There is currently a significantly amount of internal company experience. The credibility is at $\sqrt{\frac{1500}{3007}} = 71\%$. Compared to 10 years ago, there is one less significant consideration.

4. Continued

- The company now is having a more robust admin process. Hence operational risk is less likely.
- Given the business mix of the portfolio is predominately a wide range of blue collar industries, the portfolio is not homogenous and lacks diversification.
- The current COVID situation introduces more uncertainty on the future experience.

Possible recommendation:

- Reduce MfAD to 5% to reflect internal experience, but still having existing significant considerations in place;
- No changes given the uncertainty and not being fully credible business
- Or any other recommendations with appropriate justification.

(iii) Answer depends on the recommendation provided in part (ii) above.

- If reduce to 5%, the impact is a reduction of $\$5m \times \left(1 - \frac{5\%}{6.5\%}\right) = \$1.15m$.

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- Evaluate, calculate, and interpret liabilities
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Sources:

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

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

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

Commentary on Question:

This question tested the candidates' knowledge of pre-IFRS 17 valuation principles. Candidates generally did not do well on this question.

Solution:

(a) Explain characteristics of the company's block of LCOI UL policies that will influence lapse experience.

Commentary on Question:

Candidates were generally able to provide some considerations that influence lapse experience for a UL product, but generally failed to provide considerations specific to the information provided about the company in the question. Most candidates were able to identify that those joint policies used for estate planning tend to have very low lapse rates, and many candidates understood that larger high net worth policies tended to have lower lapses. Many candidates pointed out that LCOI policies had low lapse rates but generally did explain why, receiving partial credit. Few candidates identified that the new business growth could result in a different business mix and lapse experience.

- Level LCOI policies generally have very low lapse rates due to the prepayment of mortality charges.
- Since policy owners for LCOI policies have a strong incentive to keep the policy inforce, it is generally assumed that the policy owner will add deposits to the policy to prevent it from lapsing due to insufficient funds.
- Joint policies for estate planning tend to have lower lapse rates as well as there are taxation benefits to the policy owners.

5. Continued

- Large policies also make up a significant portion of the block; large policies tend to have lower lapse rates than smaller policies.
- New business growth in the last 3 years could also be a sign of the company's competitiveness, implying a shift in mix of policy owners than the company has seen before. This could result in a different lapse experience.

(b) Propose a lapse assumption for the LCOI UL product. Justify your proposal.

Commentary on Question:
In general, candidates critiqued and compared/contrasted the internal lapse study against the CIA UL LCOI lapse study, and described the differences in magnitude and trend of the lapses. However, full credit was received if candidates proposed a lapse assumption that was reasonable (lower than industry rates, varying by duration) and justified the proposal. Some candidates did not recognize that the company's data was not credible. Many candidates were able to critique the CIA experience study results and compare/contrast it against the company's experience, but full credit was received if the candidate proposed a reasonable lapse table, as opposed to providing verbal considerations in its construction. Common errors were not proposing a lapse table, proposing a partial lapse table that stopped at year 10, or not proposing an ultimate rate. Partial credit was received for partial tables that were reasonable.

Candidates that proposed using blended credibility received credit if they suggested a low credibility weight to the company's data and also proposed a lapse assumption that was lower than the industry's with good justification.

Proposed lapse rates:

Year	Lapse Rate
1	3.00%
2	2.75%
3	2.50%
4	2.25%
5	2.00%
6-10	1.50%
11-15	1.00%
16+	0.50%

- The lapse rates are based on industry data for setting the assumption, since 10,000 in-force policies is a small sample size and not enough to be credible.
- Keeping the characteristics of the company's in-force block in mind, recommend using lapse rates by volume since it is more relevant to the large policies sold by the company. Lapse rates by volume are lower than lapse rates by count, so it will reflect lower lapse rates for the larger policies.

5. Continued

- Recommend reducing the lapse rates to reflect that most in-force policies are joint last to die policies. The industry study shows that joint policies have lower lapse rates.
- Industry experience starts to level out around year 16, at around 1%. There are some spikes in lapse rates around years 26+. Given the small exposure in those years it is not credible. Thus, recommend holding the ultimate lapse rates steady at 0.5% starting in year 16.

(c) Propose a margin for adverse deviations (MfAD) for the lapse assumptions. Justify your proposal.

Commentary on Question:
Candidates generally proposed an acceptable MfAD for this part of the question, but generally did not provide sufficient justification for the recommendation. Some students did not demonstrate understanding of whether the product was lapse supported or lapse sensitive, and provided MfAD recommendations for both cases. Full credit was received only if candidates provided a reasonable MfAD (at least the midpoint of 12.5%), and proper justifications. Most candidates recognized the need for a higher MfAD because of the lack of credible data. Several candidates recognized the need for a higher MfAD but recommended an MfAD outside of the range from the SOP.

Full credit was received for providing an acceptable MfAD, and three appropriate justifications.

Propose an MfAD of 20% for the lapse assumptions. The range of the margins based on the SOP is between 5%-20%. Recommend taking the higher end of the range for the following reasons:

- The credibility of the company's experience study is too low to be the primary source of data. Since this is a significant consideration, the MfAD needs to be at least the midpoint of the acceptable range.
- The industry study is based on average policies which are different from the company's policies so experience may differ.
- The company only has a small block of business and concentrated within the most recent 3 years so experience can be volatile.
- Since the recommended best estimate assumptions are low, a high margin is a reasonable provision to account for the uncertainty.

6. 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 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts, Jul 2019

Commentary on Question:

This question tested the candidates' knowledge of IFRS 17.

Solution:

You are working on the implementation of IFRS 17 for the UL product at Star Life, a Canadian life insurance company. The liabilities for the UL product will be measured using the general measurement model (GMM).

(a)

(i) Explain the purpose of the Risk Adjustment (RA) within the GMM.

(ii) List three risks to be included in the RA

(iii) List three risks to be excluded in the RA

Commentary on Question:

Candidates generally did well on this part of the question. The most common mistake was to not specify the Risk Adjustment is for non-financial risks. Another common mistake was to say that the Risk Adjustment is an additional buffer for unexpected experience instead of recognizing it is compensation required by the insurer for bearing the risk.

Full credit was received for listing a subtype of a risk instead of the risk. For example, Mortality Risk instead of Insurance Risk.

Candidates generally received full credit for part (ii) and part (iii).

(i) The Risk adjustment is the compensation to the insurer for bearing uncertainty of timing and amount of cashflow obligations. It is only applied to non-financial risks and is determined at the entity level perspective.

(ii) Risks to include: Insurance Risk, Lapse Risk, Expense Risk

(iii) Risks to exclude: Operational Risk, Market Risk, Financial Risk.

6. Continued

(b) Identify the considerations to use the current IFRS 4 MfADs as a starting point for calculating the IFRS 17 RA.

Commentary on Question:
Candidates generally realized that a confidence level is required for IFRS 17 and that diversification benefits are to be considered. Few candidates provided that the Risk Adjustment needed to reflect the entity's requirements for bearing the risk, that margins need to be split between gross and ceded, or that adjustments are required for pass-through features.

There are several considerations required when using the IFRS 4 MfADs as the starting point for the IFRS 17 Risk Adjustment including:

1) Ensure that the aggregate Risk Adjustment reflects the entity's requirements for bearing the risk uncertainty.
2) Ensure that diversification benefits are appropriately reflected.
3) IFRS 17 requires that the equivalent confidence level of the Risk Adjustment is disclosed. The IFRS 4 PfADs are converted into a confidence level.
4) Margins need to be split between gross and ceded contracts.
5) PfADs to be adjusted for pass-through features.

(c) Describe two techniques which can be used to set the Risk Adjustment under an aggregate approach.

Commentary on Question:
Most candidates received partial credit on this part of the question. Most candidates were able to name the two approaches, and at least partially describe how they work.

The aggregated approach calculates the Risk Adjustment at the segment level and are reliant on the precision of the aggregate calculation. There are hybrid approach options that combine the unit of account and aggregate approach. MfADs will need to be recalibrated if aggregate Risk Adjustment is outside of the target range.

Two possible aggregate approaches are:

1) Cost of Capital Approach
    a. Project Required Capital for non-financial risks for the duration of the policies
    b. Multiply the required capital by the cost of capital rate to determine the compensation required in each future period.
    c. Discount these amounts back to the valuation date to calculate the risk adjustment.

6. Continued

2) Quantile Technique
   a. Generate a distribution for future cash flows
   b. Determine the target confidence level that corresponds to the compensation required by the company
   c. Risk adjustment is set to VaR or CTE at the selected target confidence level minus the mean of the PV of probability weighted cash-flows (CTE 0).

(d) You are given the following information from a LICAT exercise:

- Present value of probability-weighted cash flows: 40,000
- Components of Base Solvency Buffer from LICAT:

Credit Risks	3,000
Market Risks	
Interest Rates	5,500
Others	3,500
Insurance Risks	
Level	10,000
Trend	8,000
Volatility	2,500
Catastrophe	2,000
Operational Risks	500
Diversification Adjustment	20%

Percentile	75%	85%	95%
Standard Normal Value	0.67449	1.036433	1.644854

(i) Describe an approach for using LICAT results to quantify an equivalent confidence level for IFRS 17 reporting.

(ii) Calculate the minimum risk adjustment for non-financial risk required to get a confidence level corresponding to the 75th percentile given the data above. Show all work.

Commentary on Question:
Candidates generally struggled with describing an approach for using LICAT results to quantify an equivalent confidence level for IFRS 17 reporting. The calculation of minimum risk adjustment was generally done either very well or not at all well. A common error was to include the Volatility and Catastrophe risks even though they are one-year risks so should be excluded.

6. Continued

(i) LICAT results can be used to quantify an equivalent confidence level for IFRS 17 reporting using the following steps:

a. Assume that the probability distribution for the probability-weighted cash-flows follow the normal distribution.
b. Treat the best estimate (BE) liability as the mean of the normal distribution
c. LICAT + BE liability can be used as the second point of the distribution, representing the 85th percentile. For insurance risks, level and trend risk could reasonably be assumed to represent a lifetime 85th percentile shock.
d. Calculate the Confidence Level z, by using the formula z=(x-mean)/standarddeviation, where x = LICAT + BELiability

(ii) Mean = Mean of PV of probability weighted Cash-flows = 40,000
Level + Trend = 10,000 + 8,000 = 18,000
Adjust For Diversification = 18,000*(1-20%)=14,400
Then X = 14,400+40,000=54,400

Since LICAT is calibrated to the 85th percentile:
1.036433=(54,400-40,000)/StandardDeviation
Rearranging, we get:
StandardDeviation=14,400/1.036433=13,894

Now that we have the standard deviation we can solve for the Risk Adjustment equal to the 75th percentile by multiplying the standard deviation by the Standard Normal Value for 75%:
13,894*0.67449=9,371

The Risk adjustment reflecting the 75th percentile is 9,371.

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: Comparison of IFRS 17 to Current CIA Standard of Practice, Sept 2018

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

LFM-657-22: 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 IFRS 17.

Solution:

(a) Explain how the following IFRS 4 items would change under IFRS 17 for the T10 product

(i) Classification of contracts

(ii) Term of the Liability

(iii) Determination of contract cashflows, including items included or excluded

Commentary on Question:

Candidates had to distinguish the differences between classification, term of liability and setting assumptions for cashflows under IFRS4 vs IFRS17.

For part (i), candidates generally explained how the contracts are grouped instead of the classification.

Candidates generally did well on part (ii). Some candidates were able to explain the difference in general. However, they did not mention how the difference applied to the T10 product specifically.

7. Continued

For part (iii), candidates were generally able to point out IFRS17 restricts the expense to directly attributable portfolio, but not many candidates were able to point out the acquisition expense are required to be included. Some candidates were able to correctly list out whether IIT, premium taxes and income taxes need to be included. Few candidates mentioned that cashflows under IFRS17 should be estimated using probability weighted mean of the full range of possible outcomes whereas IFRS4 uses best estimate cashflows.

(i) The classification of these term products are not expected to change. These products are still expected to be insurance contracts under IFRS17 as there is significant mortality risk.

(ii) The contract boundary for T10 under IFRS-17 would extend for the full term of the contract including renewal periods since the option to renew and the renewal premiums are guaranteed. Under IFRS17, there is no bias towards conservatism; so in this case the contract boundary would take into account the right of the policyholder to extend the contract.

Under IFRS4, the current CIA standards require the actuary to be conservative, so future renewals would only be included if the resulting liability is larger. So the term of the liability could only be 10 years, or could be more depending on whether the renewals increase the reserves or not.

(iii) Cashflows under IFRS17 should be estimated using the probability weighted mean of the full range of possible outcomes whereas IFRS4 uses best estimate cashflows
Under IFRS4, estimates of cashflows should consider all policy related tax cashflows including income taxes. Under IFRS17, IIT and premium taxes are included in the cashflows, while income taxes are excluded
Policy maintenance expenses are included in both IFRS4 and IFRS17, although IFRS17 restricts the expense to those "directly attributable" to the portfolio
Acquisition expenses that are directly attributable to the portfolio are required to be included in the initial insurance contract valuation for IFRS17.

7. Continued

(b)

(i) Calculate the total opening CSM for the portfolio containing both the T10 and whole life products.

(ii) The insurance company updated the mortality assumption for years starting in year 2, which resulted in an increase in the best estimate liability of 1,000,000 for the T10 block, and a decrease in the best estimate liability of 1,100,000 for the whole life block.

Calculate the CSM at the end of years 1 and 2 assuming a 0% interest rate.

Commentary on Question:
For part (i), candidates were generally able to calculate the CSM/LC for T10 and whole life separately. Some candidates calculated the CSM/LC by combining T10 and whole life, receiving partial credit.
For part (ii), partial credit was received if candidates calculated T10 and whole life in one combined group.

(i) 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:
13,000,000 - 11,000,000 - 700,000 - 1,200,000 - 1,000,000 = (900,000)
As the CSM cannot be negative, the CSM at inception for the T10 block is 0.

Whole Life:
14,000,000 - 8,000,000 - 1,200,000 - 1,700,000 - 1,600,000 = 1,500,000.
The CSM at inception is 1,500,000

(ii) CSM Time 1 = MAX(CSM Time 0* (1 - (Year 1 CU / Remaining Lifetime CU)),0)
CSM Time 2 = MAX((CSM Time 1 + chg in b.e. liab) * (1 - (Year 2 CU / Remaining Lifetime CU)),0)

Term 10:
CSM Time 1 = -900,000* (1 - (20,000/250,000))= (828,000), floor at 0, CSM Time 1 = 0
CSM Time 2 = (-828,000 – 1,000,000)*(1 – 19,000/230,000) = -1,676,991, floor at 0, CSM Time 2 = 0

7. Continued

Whole Life:
CSM Time 1 = 1,500,000*(1 – (5,000/100,000)) = 1,425,000
CSM Time 2 = (1,425,000 + 1,100,000)*(1 – (4,8000/95,000)) = 2,397,421

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:

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

Commentary on Question:

This question tested the candidates' knowledge of IFRS 17 discount rates.

Solution:

(a) Critique the following statements with respect to IFRS 17 discount rates:

A. The IFRS 17 discount rate applied to the estimates of future cash flows includes the effect of all factors that influence observable market prices (if any).

B. The bottom-up approach is based on a yield curve that reflects the current market rates of return implicit in a fair value measurement of a reference portfolio of assets and adjusted with a liquidity premium.

C. In Canada, it's reasonable to set the last observable point for Government of Canada bonds at 30 years.

D. In setting the long-term risk-free rate, the 'historical real interest rate + inflation target' approach has the advantage of data being easily available.

E. Cash Surrender Value will increase the liquidity of a Universal Life insurance contract, and surrender charges do not affect the liquidity of a Universal Life insurance contract.

F. A company has a Universal Life insurance product with cash flows that vary with returns on underlying items. Under the General Measurement Model (GMM), the discount rate used must reflect that variability.

Commentary on Question:

Candidates generally critiqued statements A, B, D, and E well. To receive full credit on statement C, candidates had to explain why they believe it is True. Few candidates critiqued statement F well.

8. Continued

A. False
Per IFRS 17.36(c), the IFRS 17 discount rates applied to the estimates of the future cash flows shall exclude the effect of factors that influence such observable market prices but do not affect the future cash flows of the insurance contracts.

B. False
The bottom-up approach aims to explicitly derive a liquidity premium over risk-free rates. The liquidity premium reflects the differences between the liquidity characteristics of the financial instruments that underlie the risk-free rates observed in the market and the liquidity characteristics of the insurance contracts.

C. True
The last observable point for risk-free discount rates would correspond to the term of the asset with the longest maturity for which there is a quoted price form an active market. There is only 3% volume of outstanding Government of Canada debt securities outstanding having a term in excess of 30 years. In addition, due to the fact that the Government of Canada has only issued ultra-long bonds five times, there may not be a sufficient amount of bonds that trad in the over 30-year market to be considered an active and relevant market.

D. False
This approach is using real historical interest rate, it has the disadvantage that real rates are not publicly available for a long historical period, it must be derived using the difference between historical nominal rates and inflation rates.

E. True for the first part and false for the second part.
Cash Surrender Value creates an exit value, thus increases the liquidity of a Universal Life insurance contract.
Surrender Charges create an exit cost, thus decreases the liquidity of a Universal Life insurance contract.

F. False
Per IFRS 17.B74(b), cash flows that vary based on the returns on any financial underlying items shall be:
(i) discounted using rates that reflect that variability; or
(ii) adjusted for the effect of that variability and discounted at a rate that reflects the adjustment made.

8. Continued

(b) A company is developing a reference portfolio of assets to reflect the characteristics of its insurance contracts, and is considering either the Own Assets Portfolio approach or the Reference Portfolio approach.

For each of the two approaches being considered:

(i) Describe the approach

(ii) Outline two advantages of the approach

(iii) Outline two disadvantages of the approach

Commentary on Question:
Candidates generally did well on part (i) demonstrating knowledge of the two approaches. Most candidates were able to outline some advantages/disadvantages for the two approaches. To receive full credit, candidates need to properly explain two advantages and two disadvantages for each of the two approaches.

Own Assets Portfolio
(i) The portfolio would consist of own assets
(ii) Advantages
  (a) Enables partial linkage between the insurance contract discount rates and supporting asset returns
  (b) Reduce earnings and/or balance sheet volatility as assets/liabilities will move together for changes in risk-free rates and liquidity premium.
(iii) Disadvantages
  (a) Operationally more difficult to produce as the reference portfolio must be adjusted as the asset holdings change.
  (b) Actuary would need to demonstrate the portfolio reflects the characteristics of the liabilities
  (c) Trading activities in the asset portfolio can affect the insurance contract value and if the impact is significant, it would be disclosed.

Reference Portfolio
(i) The portfolio would be composed of assets that best reflect the characteristics of the insurance contracts.
(ii) Advantages
  (a) Operational simplicity
  (b) Separation between insurance contract reference portfolio and actual asset portfolios, easier to make adjustments to align liquidity characteristics, if needed
  (c) Actual trading activities will not affect the discount rates

8. Continued

(iii) Disadvantages
(a) Can increase earnings and/or balance sheet volatility if there are differences between underlying assets held and the custom reference portfolio.
(b) May be difficult to construct a reference portfolio for complex insurance contract portfolios

9. 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 10, The Taxation of Life Insurance Policies.

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

Commentary on Question:

This question tested the candidates' knowledge of taxation rules.

Solution:

(a)

(i) Describe the impact of paying cash dividends with respect to Maple Leaf Life's income tax payable.

(ii) Describe the impact of taking out policy loans with respect to the policyholders' income tax payable.

Commentary on Question:

Candidates generally did well on part (i), identifying that Maple Leaf Life's income tax would decrease due to decrease in taxable earnings. In part (ii) most candidates did not identify the full effect of taking out policy loans on policyholder taxation.

Policyholder dividends on Par policies are deductible from an insurer's taxable income to the extent that the amount was not deducted in a previous year. Since the company's taxable income is lowered, tax payable will be reduced.

When a policyholder receives a policy loan, it is considered as a partial disposition of the policy for tax purpose. The proceeds of the partial disposition is the lesser of: the amount of the loan (less insurance premium paid) and the remaining cash value of the policy (after subtract the balance of any prior policy loans). If the proceeds are less than the Adjusted Cost Basis (ACB) of the policy, then no income will be included in taxable income. In this case the ACB will be reduced by the amount of the proceeds. Although there are no immediate tax consequences, the lower ACB will result in higher taxable gains from future dispositions of the policy. If the proceeds are greater than the ACB of the policy, then the excess will be included in taxable income of the policyholder.

9. Continued

The excess amount would then be added to the policy's ACB so that it will not be subject to tax again in the future.

(b) Maple Leaf Life is exploring a new product to be launched in 2022 where the death benefit in any given year is indexed to the company's stock price. For a policy issued to a 50-year-old, you are given the following in the Excel file:

- The expected stock price over the projection period, which is projected to increase every five years
- The Exemption Test Policy accumulating fund rate issued at age n: ETP AF(n)
- The policy cash value rate: Pol CV
- The policy net premium reserve rate: Pol NPR

The ETP AF(n), Pol CV, and Pol NPR are expressed as rates per thousand of coverage. In addition, for tax-testing purposes, death benefit growth should be assigned to the ETP with the earliest issue date, where possible.

(i) Describe the difference in tax treatment of an exempt policy verses a non-exempt policy.

(ii) Demonstrate that the policy is projected to pass tax exempt testing in year 15, but not in year 19.

(iii) Determine a new Pol CV pattern to ensure the policy passes tax exempt testing in year 19.

(iv) Critique the product design of indexing the death benefit to the company's stock price, and the potential impact on the tax-exempt test.

Commentary on Question:
For part (i) candidates generally did well in identifying the difference between exempt and non-exempt policies but failed to mention that the amount of accrued income that is taxable is based on year of issue.
For part (ii) candidates generally did not do well. Most candidates failed to realize that in year 5 and year 10 the policy DB increased by more than 8%, therefore a new ETP would be issued in those years. Most candidates also did not complete the 250% anti-avoidance rule. Partial credit was received for listing out correct formulas and describing anti-avoidance rules.
For part (iii) most candidates simply listed a lower DV rate that would result in Pol AF ≥ ETP AF but did not show calculations on how to achieve the DV rate.
For part (iv) candidates generally did well in identifying that death benefit would be volatile and might result in policy failing tax exempt tests.

9. Continued

Part (i)
For exempt life insurance policies, they are allowed to build tax-deferred cash values. Income earned on life insurance policies was not taxable until it was received. For non-exempt life insurance policies, the accumulating income within the policy will generally be subjected to taxation on a full accrual basis. The determination of whether and how much of the accrued income is taxable depends on the date of issue of the policy and the type of policyholder.

Part (ii)

This is for a new product, so it would follow the New Exempt Policy Rules (apply to policies issued after 2017).

The basic principle is that a policy will qualify as an exempt policy if its accumulating fund does not exceed the accumulating fund of a hypothetical "Exemption Test Policy" (ETP). The anti-avoidance rules limit the allowable increase in death benefit (DB) to 8% each year. If the death benefit increases by more than 8%, a separate ETP is deemed to be issued at that date for the coverage in excess of 8%. In this question, the DB increased by 10% and 10.9% in year 5 and year 10 corresponding. Thus, the coverage in excess of 8% is deemed to be issued as a new ETP at those years. Another anti-avoidance rule applied if 3/20 of the total accumulating fund of ETP issued for a coverage under the policy exceeds the accumulating fund of the policy, on the 10th or any subsequent policy anniversary of the policy. The policy becomes non-exempt if the accumulating fund of the policy exceeds 250% of the accumulating fund of the policy on its third preceding policy anniversary.

Calculations
DB should be indexed to the stock price. The solution showed an initial DB of $1,000 but any value would work as long as the DB is indexed correctly to the stock price.
The DB Growth in any year must be assigned to an ETP(n) Growth up to 8%: assign to ETP(50) - as indicated in the question
Growth in excess of 8%: Assign to ETP(n) in year of the growth
The ETP AF in any year = SumProduct of all the ETP DBs and the ETP Rates provided.
The Pol AF in any year = Max(CV*DB/1000, NPR*DB/1000)

The tax-exempt test is passed at any given anniversary if the Policy AF <= ETP AF for that anniversary, and the next. So for the test to pass at year 15, the Policy AF <= ETP AF in years 15 and 16. Similarly, the test is passed at year 19 if the Policy AF <= ETP AF in years 19 and 20.

9. Continued

The Pol AF < ETP AF in years 15, 16, and 19. But in year 20, Pol AF>ETP AF. Therefore, the policy is projected to fail at the year 19 test.

For the 250% Test: The test is passed in all duration in this question, so no further action needed.

Attained Age	Policy Year	Death Benefit (DB)	Percentage Growth	Dollar Growth	DB Growth for ETP AF(50)	DB Growth for ETP AF(55)	DB Growth for ETP AF(60)
50	0	1,000		1,000	1,000	-	-
51	1	1,000	0.00%	-	0	-	-
52	2	1,000	0.00%	-	0	-	-
53	3	1,000	0.00%	-	0	-	-
54	4	1,000	0.00%	-	0	-	-
55	5	1,100	10.00%	100	80	20	-
56	6	1,100	0.00%	-	0	-	-
57	7	1,100	0.00%	-	0	-	-
58	8	1,100	0.00%	-	0	-	-
59	9	1,100	0.00%	-	0	-	-
60	10	1,220	10.91%	120	88	-	32
61	11	1,220	0.00%	-	0	-	-
62	12	1,220	0.00%	-	0	-	-
63	13	1,220	0.00%	-	0	-	-
64	14	1,220	0.00%	-	0	-	-
65	15	1,260	3.28%	40	40	-	-
66	16	1,260	0.00%	-	0	-	-
67	17	1,260	0.00%	-	0	-	-
68	18	1,260	0.00%	-	0	-	-
69	19	1,260	0.00%	-	0	-	-
70	20	1,280	1.59%	20	20	-	-

9. **Continued**

Attained Age	Policy Year	DB for ETP AF(50)	DB for ETP AF(55)	DB for ETP AF(60)	ETP AF	Pol AF	Tax Exempt?	250% Test
50	0	1,000	-	-				
51	1	1,000	-	-	60.00	10.00	Yes	Does not Apply
52	2	1,000	0	0	120.00	20.00	Yes	Does not Apply
53	3	1,000	0	0	180.00	30.00	Yes	Does not Apply
54	4	1,000	0	0	240.00	40.00	Yes	Does not Apply
55	5	1,080	20	0	324.00	55.00	Yes	Does not Apply
56	6	1,080	20	0	390.20	82.50	Yes	Does not Apply
57	7	1,080	20	0	456.40	110.00	Yes	Does not Apply
58	8	1,080	20	0	522.60	137.50	Yes	Does not Apply
59	9	1,080	20	0	540.20	165.00	Yes	Does not Apply
60	10	1,168	20	32	602.68	213.50	Yes	Does not Apply
61	11	1,168	20	32	624.00	244.00	Yes	177%
62	12	1,168	20	32	645.32	305.00	Yes	185%
63	13	1,168	20	32	666.64	366.00	Yes	171%
64	14	1,168	20	32	686.76	427.00	Yes	175%
65	15	1,208	20	32	730.28	504.00	Yes	165%
66	16	1,208	20	32	751.20	567.00	Yes	155%
67	17	1,208	20	32	772.02	630.00	Yes	148%
68	18	1,208	20	32	792.84	693.00	Yes	138%
69	19	1,208	20	32	812.54	787.50	Yes	139%
70	20	1,228	20	32	844.64	896.00	No	142%

9. Continued

Part (iii)
Only the CV rate in year 20 needs to be lowered, since that was the only year where the Pol AF > ETP AF. We can solve for the CV rate that sets the Pol AF = ETP AF.
Pol AF = Max(CV*DB/1000, NPR*DB/1000) = 844.64
= Max(CV*1280/1000, 500*1280/1000) = Max(CV*1.28, 640)
CV = 844.64/1.28 = 659.875
Therefore, lowering the Year 20 CV rate from 700 to 659.875 or less would be appropriate.

Part (iv)
An uncertain death benefit pattern could cause frequent and uncertain 8% and 250% test failures. While this wouldn't necessarily mean the policy would fail tax testing, if the stock price rises significantly, the policy would almost certainly fail.

10. 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:

Embedded Value: Practice and Theory, SOA, Actuarial Practice Forum, March 2009

Commentary on Question:

This question tested the candidates' knowledge of embedded value. Candidate generally did will on this question.

Solution:

Critique each statement. Justify your answer.

A. The traditional, formula-based approaches of US statutory reserving provide a commonly used basis for assessing company solvency, but they fail to distinguish movements in reserve margins from economic earnings in a reporting period.

B. Embedded Value is a more effective accounting basis that addresses the criticisms of current accounting methods.

C. Embedded Value is the same as the actuarial appraisal value of a company when used for mergers and acquisitions.

D. When calculating the Adjusted Net Worth, both the Required Capital and Free Surplus are assumed to earn market rates of return.

E. It is common to use a Risk Discount Rate that is consistent with the reporting entity's cost of equity capital, provided that the rate reflects the risks inherent in the business.

F. It is essential to have a clearly defined process for the selection of assumptions in the calculation of the Embedded Value.

10. Continued

G. All non-economic assumptions used in the Embedded Value calculation should be based on industry data plus a provision for adverse deviations.

H. When calculating the Time Value of Financial Options and Guarantees (TVFOG) using stochastic scenarios, it is recommended to use "real-world" scenarios.

I. The accurate calculation of the final Embedded Value is more important to investors than adequate disclosure of the movement.

J. There is substantial subjectivity on the part of the company for the disclosure of sensitivity tests for assumptions used in their Embedded Value calculations.

(A)

Commentary on Question:
Many candidates commented that RBC would be more commonly used to assess solvency than US Stat and received partial credit. Discussing transition to PBR and VM-20 also received partial credit if statements were true and relevant.

This statement is true.

US Stat reserving focuses on cost-based approaches to measuring earnings and does not directly reflect changes in the economic environment (i.e. changes in prevailing interest rates) as economic assumptions are locked in.

(B)

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

This statement is partially true. While EV addresses some of the criticisms of current accounting methods/standards, it also has shortcomings. For example, EV may be difficult to compare between companies or subject to manipulation. EV is not technically an accounting basis but has evolved to embody a codified collection of rules and practices that are almost universally recognized.

(C)

Commentary on Question:
Candidates generally recognized the EV excludes the value of future NB. Some candidates also identified other differences.

10. Continued

This statement is false. EV and AAV differ in three key ways: (1) AAV includes the value of future NB while EV does not; (2) AAV generally uses a higher discount rate; (3) EV and AAV generally use different assumptions. Particularly for expenses, EV assumptions tend to be company-specific while AAV assumption tend to reflect market sentiments.

(D)

Commentary on Question:
Few candidates described the reason for treating FS and RC differently.

This statement is partially true. Two approaches have emerged in practice. Since the entire ANW is not distributable, the literal approach is to use tax-effected marked-to-market only for Free Surplus and use book value for Required Capital (since only FS is distributable). A more practical approach is to use market returns for both.

(E)

Commentary on Question:
Candidates generally did well on this part of the question. Many candidates discussed CAPM or cost of debt capital, which also received credit.

This statement is true. The RDR is often assumed to be consistent with the reporting entity's cost of equity capital. Sometimes the RDR is defined as the Weighted Average Cost of Capital (WACC) as opposed to the equity cost of capital. Sometimes the RDR varies by term and sometimes it is kept constant. It is usual to use different RDRs for each country for multinational companies. RDRs may also vary by product line or inforce/new business.

(F)

Commentary on Question:
Most candidate recognized that the statement is true, but many candidates struggled to explain why.

This statement is true. Selecting appropriate assumptions is one of the most important elements of EV calculation. Because the process involves considerable judgement and subjectivity, a clearly defined process for selecting assumptions is critical to ensure EV remains a reliable measure of performance over time. EV can be very sensitive to key assumption, so even a small shift can have a large impact. Care must be taken to set assumptions properly and consistently.

10. Continued

(G)

Commentary on Question:
Candidate generally did well on this part of the question. The most common error was stating that EV assumptions should include a margin or PfAD.

This statement is false. EV assumptions should be best-estimate (no PfAD) and company-specific. This means that they should reflect management's unbiased estimate of future experience based on the specific circumstances of the company. The assumptions need not be consistent with the market's perception of what such assumptions should be. Observed trends (such as mortality improvement) may be extrapolated, though it is not typically considered appropriate to assume unit expense improvement beyond the valuation date, except for start-up operations.

(H)

Commentary on Question:
Candidates did not need to discuss the CFO Forum's EEV principles to receive full credit. Full credit was received for recommending risk-neutral scenarios to produce market consistent results, relying on the evolution of practice in that direction.

The CFO Forum's EEV principles from 2004 suggest using real-world scenarios. However, actuarial practice has evolved towards valuing TVFOG on a market-consistent basis, using risk-neutral scenarios

(I)

Commentary on Question:
Most candidates recognized that understanding the movement was more important, but many candidates did not explain why. Many candidates did not demonstrate they understood that EV is used externally.

This statement is false. Using EV to assess the performance of an entity requires the observer to have access to the analysis of movement, and that changes to methodology and assumptions are included in such analysis. A single point-in-time value of EV is not usually as useful as understanding how EV emerges over time when evaluating an entity's performance.

(J)

Commentary on Question:
Most candidates understood the important of disclosures, but many candidates did not discuss the subjectivity involved in choosing what to disclose.

10. Continued

This statement is partially true. Different observers will find different disclosures more or less helpful in understanding EV. This is partially down to personal preference. However, in general, items that have the most material impact are most important to disclose. This means that when an assumption is particularly critical, companies should disclose sensitivity testing to enable outside users to draw their own conclusions.

Understanding the sources of these items will lend insight into the comparability of results across companies and across time periods and may provide an indication of how likely a company is to be able to maintain or improve its financial performance, as measured by the change in EV, in the future.

The CFO Forum provides some guidance on sensitivities, however these are not binding. EV is not subject to regulatory requirements.

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)

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

Commentary on Question:

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

Solution:

(a) Describe the calculation of the components of the aggregate capital requirements in the Base Solvency Buffer used in the LICAT Total Ratio for company AWH.

Commentary on Question:

This part of the question focused on aggregating the Base Solvency Buffer components specific to AWH, which is a company that sells annuities. However, most candidates answered this question by providing all of the LICAT BSB components for a life insurance company. Full credit was received if candidates described the key characteristics of longevity risk, expense risk, Interest Rate risk and Credit risk

Interest risk:
The insurance risk on annuities is longevity risk and expense risk.
The longevity risk component = level risk component + trend risk component.
The level risk component is calculated as the difference between the present value of the shocked cash flows and the present value of the best estimate cashflows.
The required shock is a permanent decrease in best estimate assumptions for mortality rate based on geography at each age.

11. Continued

The Trend risk component is calculated as the difference between the present value of the shocked cash flows and the present value of the best estimate cashflows. For the trend risk component, the required shock is a 75% increase in best estimate assumption for mortality improvement.
The discount rates are level rates and are prescribed by geography.

Expense risk required capital is calculated in aggregate for level, trend and volatility. The combined shock is an increase of 20% in the first year followed by a permanent increase of 10% in all subsequent policy years applied to maintenance expenses. The required capital for expense risk is the difference between the present value of best estimate cashflows and the shocked cashflows.

Interest rate risk:
The most significant aspect of the interest rate risk is the net effect of potential changes in interest rates on the values of assets and liabilities whose cashflows may be mismatched. The required capital for interest rate risk is calculated as the maximum loss under the four different prescribed stress scenarios. The net position used to measure the loss in each scenario is equal to the difference between the present value of asset cashflow and liability cashflows. The discount rate is changed from those of the initial scenario to those of the 4 stress scenarios; where the discount rates are defined in term of risk-free interest rates plus a spread. The stress scenarios test out changes in short term, long term, and ultimate reinvestment rates.

Credit risk:
For credit risk, credit risk factors that differ by bond rating and effective maturity are applied to the balance sheet carrying amounts.

(b) Describe the calculation of the capital requirements for company AWH under the International Capital Standard (ICS).

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

The capital requirement for ICS is based on the impact of adverse changes to the company's qualifying capital resources. The target criterion is 99.5% value at risk over a one year time horizon of adverse changes in the company's net assets calculated by taking the difference between the current balance sheet and the post-stress balance sheet.

Longevity risks will be stress tested using unexpected changes in the level, trend or volatility of mortality rates. Expense risk should be tested using changes in the incidences of expenses incurred. The interest rate risk should be tested using unexpected changes in the level or volatility of interest rates.

11. Continued

The changes are tested using current estimates only. Current estimates are calculated using probability weighted average of the present values of future cashflows. An adjusted risk-free yield curve is used to discount the current estimates.

(c) Discuss why the level of the following required capital components may change if the company were to move from LICAT to ICS:

(i) Insurance risk component

(ii) Interest rate risk component

(iii) Credit risk component

Commentary on Question:
Candidates generally did not do well on this part of the question, especially part (ii). Full credit was received if candidates provided the key differences / similarities with reasonable explanations.

Insurance Risk:
For the insurance risks (longevity and expense risks) that the insurer is exposed to, stress tests are used under both LICAT and ICS. The LICAT capital required could be more or less than the ICS capital required depending on how close the LICAT factors align to the CTE 99 level for the block of business that the company sells.

Interest Rate risk:
The ICS interest rate risk is based on the change in balance sheet net value (ie value of both the payout liability and bonds) stemming from the changes in level or volatility of interest rates from the stress test. The current estimate of insurance liabilities will change as the adjusted risk-free yield curve changes from the stress test. The bond market values will change as well due to the interest rate shocks from the stress test.

The change in net balance sheet position from the interest rate change approach is therefore similar to the LICAT discounting approach using risk-free rates. ICS and LICAT should produce similar interest rate impacts, if the highest of the 4 prescribed scenarios under LICAT aligns to the CTE 99 level for this particular block of business.

Credit risk component
Both LICAT and ICS use factors for credit risk. The difference between LICAT and ICS will stem from the difference in factors.