

ILA LFVC Model Solutions

Spring 2017

1. Learning Objectives:

3. The candidate will understand and apply emerging financial and valuation standards, principles and methodologies.

Learning Outcomes:

- (3a) Describe, evaluate and calculate the impact on reserves, income, capital, and processes of emerging developments in Statutory and U.S. GAAP reporting, International Financial Reporting Standards, and Solvency Modernization.

Sources:

IFRS 4 Phase II: Illustrative Example of Life Contract Without Participation Features, EY June 2015

LFV-132-14: Practical Guide to IFRS, PwC, exclude appendices 1, 2, and 4 (July 2013)

Analysis of Methods for Determining Margins for Uncertainty Under a Principle-Based Framework for Life Insurance and Annuity Products, Ch. 4

Investor Perspectives - Mind the Gap? December 2015

Commentary on Question:

This question tested the candidates' knowledge of international financial reporting standards.

Solution:

- (a) Management is concerned about potential financial statement volatility between the effective dates of IFRS 9 (effective January 1, 2018) and IFRS 4 (effective January 1, 2020 at the earliest). The IASB has developed proposals for dealing with this potential volatility.

Recommend a course of action for each subsidiary based upon these proposals. Justify your response.

Commentary on Question:

This question tested candidates' knowledge of two approaches proposed by the IASB. To receive full credit, a candidate had to describe the two approaches and recommend a course of action. Most candidates did not understand that neither of the approaches can be applied to Subsidiary B (the bank).

1. Continued

Since Subsidiary B does not conduct any insurance activities, it has to apply IFRS 9, effective January 1, 2018.

Subsidiary L predominantly conducts insurance activities. It can therefore apply either the deferral approach or the overlay approach, proposed by the IASB to deal with potential volatility. The choice of approach is a matter of company preference.

Under the deferral approach, the entity would defer the implementation of IFRS 9 and continue to apply IAS 39. This approach also requires disclosure of information about the fair values of financial assets that would be required to be measured at fair value under IFRS 9.

Under the overlay approach, the entity would apply IFRS 9, and then for those assets backing insurance contracts that are now measured at fair value under IFRS 9, the entity would adjust the profit and loss statement to revert back to an IAS 39 effect. The amount of the adjustment would be recognized in other comprehensive income. The entity may make the adjustment in a single line or on a line-by-line basis.

- (b) For Subsidiary L's variable annuity portfolio, a consultant suggests using the replicating portfolio technique to determine the fulfillment of cash flows under IFRS 4.
 - (i) Describe the replicating portfolio technique.
 - (ii) Assess the appropriateness of using the replicating portfolio technique for a variable annuity portfolio.

Commentary on Question:

This question tested candidates' knowledge of the replicating portfolio technique to determine the fulfillment of cash flows for a variable annuity portfolio under IFRS 4. A common error was to evaluate the technique as a hedging strategy rather than as an approach for determining the fulfillment of cash flows.

The replicating portfolio technique involves constructing a portfolio of assets whose cash flows exactly match the contractual cash flows of an insurance contract in amount, timing and uncertainty. The fair value of such portfolio can be used to measure the fulfillment cash flows of the insurance contract.

1. Continued

The replicating portfolio technique is not appropriate for a variable annuity portfolio, since it contains guarantees that make the cash flows difficult to match. These guarantees include guaranteed withdrawal and guaranteed accumulation benefits in variable deferred annuities, and guaranteed payment floors in variable immediate annuities.

- (c) Calculate the following:
- (i) Best estimate liability at inception
 - (ii) Risk adjustment (or margin for uncertainties) at inception
 - (iii) Contractual service margin at inception
 - (iv) Insurance contract revenue for year 1
 - (v) Underwriting result for year 1

Show all work.

Commentary on Question:

This question tested candidates' knowledge of the IFRS 4 building block measurement model for insurance contracts. Candidates generally did well on parts (i), (ii), (iii). Candidates generally did poorly on part (iv) and (v). Most candidates incorrectly calculated insurance contract revenue as premium less claims and underwriting result as actual claims less expected claims. In general, candidates failed to recognize that the income statement presentation under the building block approach is very different from the current income statement presentation.

- (i) Best estimate liability (BEL) is defined as the present value of cash outflows minus the present value of cash inflows.
PV of claims = $70 + 75 + 80 = 225$ (since 0% discount rate).
PV of premium = $100 + 100 + 100 = 300$.
BEL = PV of claims – PV of premium = -75 .
- (ii) Risk adjustment (RA) under the cost of capital methodology is the present value of cost of capital (6%) applied to future required capital.
RA = $6\% * (320 + 280 + 220) = 49.2$ (since 0% discount rate).

1. Continued

- (iii) Contractual service margin (CSM) is the unearned profit at inception and is amortized over the coverage period.

$$\text{BEL} + \text{RA} + \text{CSM} = 0.$$

$$-75 + 49.2 + \text{CSM} = 0.$$

$$\text{CSM} = 25.8.$$

- (iv) Insurance contract revenue is defined as the sum of release of CSM, release of RA related to past coverage, expected claims and expenses, and the part of the premium allocated to the recovery of acquisition costs.

Release of CSM for year 1 is the CSM amount amortized in year 1. Since CSM is amortized linearly over 3 years at 0% risk free rate, the amount amortized in year 1 = $25.8/3 = 8.6$.

Release of RA for year 1 is the release of cost of capital of year 1 required capital.

$$\text{Release of RA for year 1} = 6\% \times 320 = 19.2.$$

$$\text{Alternatively, RA at end of year 1} = 6\% \times (280 + 220) = 30.$$

$$\text{Release of RA for year 1} = \text{RA at inception} - \text{RA at end of year 1} = 49.2 - 30 = 19.2.$$

$$\text{Expected claims for year 1} = 70.$$

Since expense = 0, expected expense and premium allocated to the recovery of acquisition cost = 0.

Insurance contract revenue for year 1 = 8.6 release in CSM + 19.2 release in RA + 70 expected claims = 97.8.

- (v) Underwriting result = insurance contract revenue – actual claims incurred.
Underwriting result for year 1 = $97.8 - 80 = 17.8$

2. Learning Objectives:

4. The candidate will understand basic financial management, capital management and value creation principles and methods in a life insurance company context.

Learning Outcomes:

- (4a) Assess financial performance, including analyzing and interpreting the financial performance of a product line or company.
- (4b) Apply methods and principles of embedded value.

Sources:

LFV-137-16: EVARAROC vs. MCEV Earnings – A Unification Approach, Kraus, 2011

LFV-106-07: Chapter 4 of Insurance Industry Mergers & Acquisitions (Sections 4.1-4.6)

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

Commentary on Question:

This question tested the candidates' knowledge insurance management valuation techniques. Most candidates demonstrated a level of comprehension. However, only a few candidates were able to apply their knowledge when confronted with specific contexts and details.

Solution:

- (a) Compare and contrast the following measures used to determine the value of a block of life insurance:
 - Embedded Value (EV);
 - Market Consistent Embedded Value (MCEV); and
 - Actuarial Appraisal Value (AAV)

Commentary on Question:

Candidates generally did well on this part of the question. Most candidates were able to elaborate on certain key differences, such as inclusion of new business, and discount rates. Many candidates failed to articulate similarities between the approaches clearly. Credit was awarded for recognizing the definitions for each measure. For each difference or similarity, it was critical for candidates to make comparisons, and not just state isolated facts

2. Continued

The three measures are defined as follows:

- $EV = \text{Value in Force} + \text{Free Surplus Required} + \text{Required Capital}$
- $AAV = \text{Value in Force} + \text{Free Surplus} + \text{Required Capital} + \text{Value of Future Business}$
- $MCEV = \text{PV of Future Profits} - \text{Frictional Costs of Required Capital} - \text{Costs of Residual Non Hedgeable Risks} - \text{Time Value of Options and Guarantees} + \text{Free Surplus} + \text{Required Capital}$

Several main similarities can be identified:

- Each of the measures broadly applies a discount cash flow, reflecting some form of cost of capital
- Each of the measures can be used consistently at a group level
- Each of the measures is ultimately intended for user purposes, and not strictly for regulatory requirements

Several main categories of differences are identified:

New Business

- EV and MCEV do not reflect the value of new business
- AAV does reflect new business

Discount Rate

- MCEV uses a risk free discount rate
- AAV and EV use risk adjusted discount rates
- AAV discount rates are typically higher
- MCEV uses an entire discount curve, rather than a single rate

Purpose

- EV is used for stock price evaluation, executive compensation, profit analysis by LOB, and capital allocation
- MCEV is used to analyze creation of value or change in MCEV over time, managerial performance, and consistent fair value analysis across companies by banks and financial institutions
- AAV is used to determine the acquisition value of a block of business

Capital

- EV is normally a regulatory capital or rating agency capital
- MCEV normally uses economic capital, Solvency II or other market based capital approach
- AAV normally uses regulatory or required capital

2. Continued

Expenses

- EV and MCEV expense assumptions are company-specific
- AAV expenses reflect the prevailing market levels
- Synergies and economies of scale can be applied in AAV

(b) Critique the following statements made by the CEO of ABC about valuing DEF's business:

- A. *The MCEV earnings for Fixed Deferred Annuities will look horrible, since a risk-free rate must be used for discounting and projecting investment income.*
- B. *Since our incentive compensation is based on operating MCEV earnings, we're taking a big gamble that interest rates will increase in the short term.*
- C. *MCEV doesn't do a great job incorporating cost of capital for the Term Insurance block.*
- D. *The AAV may overstate the value of the Variable Annuity block.*

Commentary on Question:

Candidates generally did not demonstrate the knowledge of MCEV required to critique statement A. Candidates generally critiqued the other statements well. Candidates received partial credit for identifying whether the statement was true or false. To receive full credit candidates were required explain why.

- A. This statement is false. Although the discount rate and projected investment income rate is at the risk free level (the reference rate) for VIF discounting purposes, the excess investment income (the spread) will be recognized in MCEV earnings when achieved (through the expected contribution of existing business line)
- B. This statement is false. Economic variance are included in Total MCEV earnings, but not Operating MCEV
- C. This statement is false. MCEV does include some form of cost of capital, through the cost of residual non-hedgeable risks, and the frictional costs of capital
- D. This statement is true. The AAV approach does not provide for an explicit approach to valuing options and guarantees, which are common and significant in VA blocks. Additionally, the fact that Value of New Business is included could inflate value since there are subjective assumptions required.

2. Continued

- (c) Calculate the Actuarial Appraisal Value on December 31, 2017. Show all work.

Commentary on Question:

Candidates generally struggled to capture all details of the calculation to receive full credit. Partial credit was awarded for addressing key concepts, such as the calculation of cost of capital, the discounting of several years of VNB, and the inclusion of Free Surplus and Required Capital

Main Formula for Valuation

AAV = NPV(Distributable Earnings) + Free Surplus = NPV(Profits on Business) – NPV(Required Capital x Cost of Capital) + NPV(Investment Income on Required Capital) + Initial Required Capital + Free Surplus

In Force Value Calculation

NPV(Profits on Business) – NPV(Cost of Capital x Required) + NPV(Inv Inc on Cap) + Initial Req Cap
= PV Prem + PV Inv Inc on Res – PV Ben – PVReqCap x CostofC + PV Inv Inc Cap + Initial Req Cap
=160 + 50 – 140 – 200 x 10% + 10 + 30 = 90

Value of One Year of New Business

Same formulas as for in-force, but for one hypothetical year of new business (excluding initial required capital since it is not in the entity)
20 + 10 – 15 – 40 x 10% + 4 = 15

Discount of Three Years of New Business

VNB + VNB/(1 + Cost of Capital) + VNB/ (1 + Cost of Capital)²
=15 + 15/1.1 + 15/1.1²
=41

Final Sum of AAV Value

In Force Value + Value New Business + Free Surplus
=90 + 41 + 25
=156

3. Learning Objectives:

1. The candidate will understand financial statements and reports of Canada life insurance companies as well as the professional standards addressing financial reporting and valuation.

Learning Outcomes:

- (1d) Describe, apply and evaluate the appropriate accounting treatments for insurance products, assets, derivatives and reinsurance.

Sources:

CIA Research Paper on IFRS: Embedded Derivatives and Derivatives under IFRS (IASP 10)

Commentary on Question:

This question tested the candidates' knowledge of embedded derivative treatment under IFRS. Candidates generally did not do well on this question.

Solution:

- (a) Describe the steps and considerations required for the identification of an embedded derivative within a life insurance contract according to IFRS 4, as per the CIA Research Paper on IFRS: Embedded Derivatives and Derivatives under IFRS.

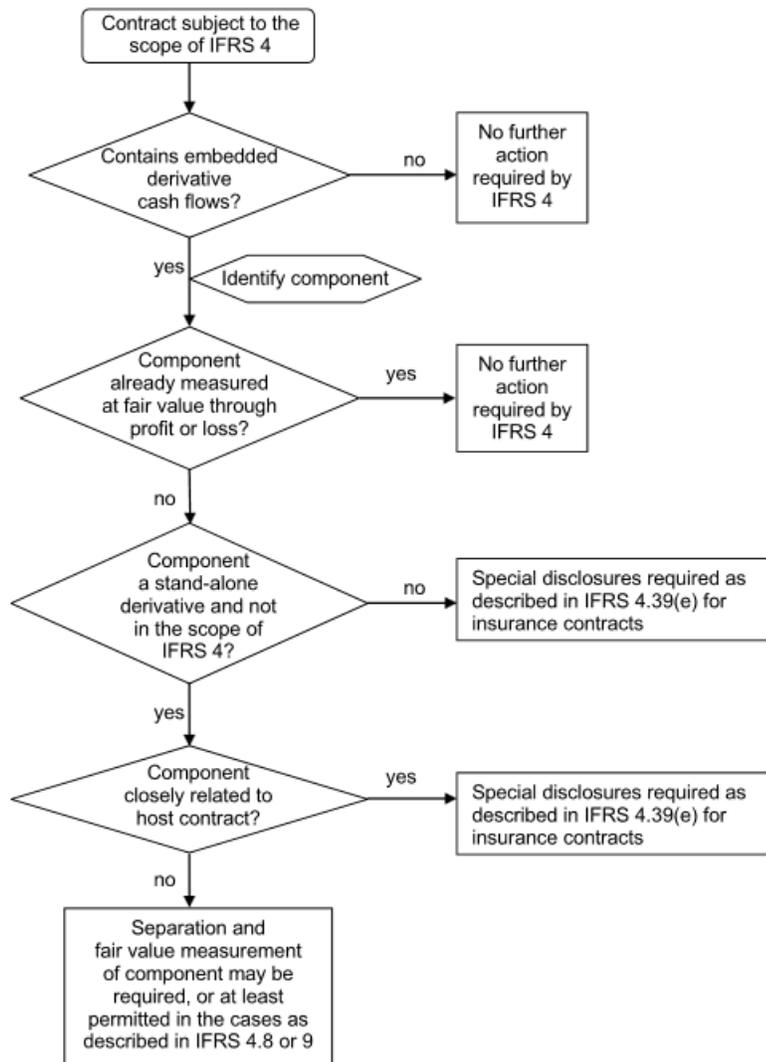
Commentary on Question:

Most candidates listed two or three of the four steps from the decision diamonds. Few candidates presented the steps in the correct order. Few candidates described proper treatment of the steps. Candidates generally did not identify the decision process applies to contracts in scope of IFRS-4.

Candidates are expected to answer (with description or/and charts) whether a contract, determined to be subject to IFRS-4, has any special disclosure requirements or need separation and fair value measurement of component

Candidates also need to confirm that the decision process (illustrated with decision diamonds) only refers to cases in which the contracts is within IFRS-4, not to the decision whether the contract as a whole is a derivative outside the scope of IFRS-4

3. Continued



- (b) Recommend the appropriate IFRS treatment for a Canadian insurer with respect to derivatives and embedded derivatives. Justify your recommendations.

Commentary on Question:

Candidates generally did not perform well on this part of the question. Partial credit was awarded for identifying cases with embedded derivatives. Some candidates described the correct treatment.

3. Continued

Death Benefit Options:

- a. Level Death benefit: no embedded derivative
- b. Face amount plus account value: no embedded derivative, even though death benefit related to account value since NAAR remains unchanged
- c. Face amount indexed to CPI: embedded derivative, because it is tied to a commodity price, requires no initial net investment, and is settled at a future date. Based on the criteria from part a, the following applies:
 - Not stand-alone and closely related to host contract because increases are percent of original amount
 - So special disclosures required
- d. Special indexed option, with annual percentage adjustments to existing death benefit equal to 25% of total return on policyholder account value: embedded derivative and based on criteria the following applies:
 - Not stand-alone and closely related to host contract because increases are percent of original amount
 - So special disclosures required

Surrender Values

- Per IFRS 4.8, “as an exception to requirement in IAS 39, an insurer need not separate, and measure at fair value” such surrender rights.
- Policyholder incentive to surrender policy bears little relationship with changes in any market factor;
- Therefore, does not comply with the definition of an embedded derivative

Investment Options on Account Value

1. Return equal to TSX Composite less 2.5%
 - Initial net investment is same as in an alternative investment
 - No additional leverage
 - No further action required by IFRS 4
2. Return equal to S&P 500 less 2.75%, adjusted for currency exchange
 - Initial net investment is same as in an alternative investment
 - No additional leverage
 - No further action required by IFRS 4

3. Continued

3. Return equal to S&P 500 less 3.00%, unadjusted for currency exchange
 - Foreign currency derivatives. If a component of any contract contains a foreign currency derivative to be separated, that embedded derivative is also subject to IAS 39
 - Additional leverage because of possibility of currency movements
 - Hybrid (combined) instrument - combination of separable economic features
 - To qualify as an ED, effect of component on CFs in response to a market factor must be measurable.
 - CF denominated in foreign currency qualifies

4. Return equal to three times the return on 1. Return Equal to TSX Composite less 2.5%, above
 - Initial net investment is NOT the same as in an alternative investment
 - Additional leverage
 - Creates a derivative
 - Not already measured at fair value through profit or loss
 - Stand alone
 - Not closely related to host contract
 - Separation and fair value measurement of component may be required

5. Guaranteed: 1. 5-year GIC with min of 90% of Government of Canada 5-year bond yield
 - Initial net investment is same as in an alternative investment
 - No additional leverage
 - No further action required by IFRS 4
 - Policyholder can switch investment options three times during contract without market value adjustment
 - Unilateral right affecting cashflows are triggered by market factors which are not necessarily in contract
 - High interest rates are a market factor that will likely affect policyholder decision
 - So that right becomes a derivative
 - An embedded derivative is measured separately at its fair value with changes through profit or loss if and only if all three criteria of IAS 39.11 are satisfied:

3. Continued

- The first criteria fails: Economic characteristics and risks of embedded derivative are not closely related to characteristics of host contract
- So not measured separately
- And since component closely related to host contract, special disclosure required

4. Learning Objectives:

2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canadian life insurance companies.

Learning Outcomes:

- (2b) Evaluate, calculate, and interpret liabilities.

Sources:

CIA Ed Note – Margins for Adverse Deviation

CIA Ed Note – Investment Assumptions used in the Valuation of Life and Health Insurance Contracts

Actuarial Standard Board – Final Communication of Promulgations of the Maximum Net Credit Spread, Ultimate Reinvestment Rates and Calibration Criteria for Stochastic Risk-Free Interest Rates

Commentary on Question:

This question tested the candidates' understating of CALM and the structure of best estimate investment assumptions with and without margins for adverse deviation (MfAD).

Solution:

- (a) Recommend a margin for adverse deviation for the asset depreciation assumption.

Commentary on Question:

Candidates were generally able to provide the correct range of MfAD and an appropriate recommendation. However, few candidates were able to justify that recommendation by describing how potential considerations applied to this group of assets and investment strategy. Candidates who recommended a high MfAD and not 100% could still receive full credit if the appropriate justification was provided.

The low and high margins for Asset Depreciation are respectively 25% and 100% of the best estimate

Multiple Significant Considerations exist:

- Error of Estimation of the Best Estimate Assumption:
 - Future Experience is difficult to estimate, relatively high proportion of Junior Issue Bonds
- Deterioration of the best estimate assumption:
 - Concentration or lack of diversification
 - Portfolio concentration by number of issues, issuer or industry

Therefore, recommend an MfAD of 100%

4. Continued

- (b) Calculate the combined provision for adverse deviation for asset depreciation and credit spreads. Show all work.

Commentary on Question:

Candidates generally struggled on this part of the question, but were able to earn partial credit for selecting correct assumptions and applying the margins correctly.

A common error occurred in calculating the liability. Many candidates assumed they were calculating 1-year spot rates and discounted at one year intervals for 30 years (as if they were purchasing 1-year zero coupon bonds) instead of discounting at the 15-year spot rate for 15 years.

Assumptions

Risk Free Rate	2.00%
Asset Depreciation	0.10%
Asset Depreciation MfAD	100% (from a)
Current Credit Spread	1.00%
Historical Credit Spread	1.25%

Commentary on Question:

The best estimate historical average should be based on the longest available data period. Information from the Bank of Canada may be limited, but other public data sources are appropriate (ie, Bloomberg).

CALM Reserve

A CALM Liability is defined as the Statement Value of Assets required to support the future liability cashflows.

Liability CF = \$10 million at time 30

Available Assets = 15 year Bonds

I can support this liability by purchasing an \$x 15-year bond at time 0 (earning the time 0 15-year spot rate). Upon maturity at time 15, I can reinvest the proceeds (\$x + Interest) in a 15-year bond (earning the time 15 15-year spot rate) which will mature at time 30 for \$10 million.

- Reserve = 10 million / [(1 + i_0)¹⁵ * (1 + i_{15})¹⁵]

Where:

- i_t = risk free + credit spread_t - asset depreciation_t

4. Continued

Best Estimate Calculation

- Best estimate credit spread grades from current spread at time zero to historical spread at time 5
- Historical spread used after time 5
- Best estimate asset depreciation is 0.10% at all points in time

Time 0

$$i_0 = \text{Risk Free} + \text{Current Credit Spread} - \text{Asset Depreciation}$$
$$i_0 = 2.00\% + 1.00\% - 0.10\% = 2.90\%$$

Time 15

$$i_{15} = \text{Risk Free} + \text{Historical Credit Spread} - \text{Asset Depreciation}$$
$$i_{15} = 2.00\% + 1.25\% - 0.10\% = 3.15\%$$

$$\text{Reserve} = 10,000,000 / [1.029^{15} * 1.0315^{15}]$$
$$\text{Reserve} = \mathbf{4,090,071}$$

Padded Calculation

- Credit Spread with Margin grades from current spread at time zero to historical spread with a +/-10% margin at time 5
- Historical spread with a +/-10% margin used after time 5
- The margin should increase the liability so a -10% margin is required
- Net Credit Spread (including Asset Depreciation) is capped at 0.80% at time 30
- Asset Depreciation with margin is $0.10\% * (1+100\%) = 0.20\%$ at all points in time, unless the cap is exceeded

Time 0

$$i_0 = \text{Risk Free} + \text{Current Credit Spread} - \text{Asset Depreciation with Margin}$$
$$i_0 = 2.00\% + 1.00\% - 0.10\% * (1 + 100\%) = 2.80\%$$

Time 15

$$\text{Uncapped Net Spread} = 1.25\% * (1 - 10\%) - 0.10\% * (1 + 100\%) = 0.925\%$$

Uncapped Net Spread > 0.80% therefor cap applies

4. Continued

$$\begin{aligned}\text{Capped Spread} &= \text{Uncapped Net Spread} * (t / 25) + \text{Cap} * (25 - t) / 25 \\ \text{Capped Spread} &= 0.925\% * (15/25) + 0.80\% * (10/25) = 0.875\%\end{aligned}$$

$$\begin{aligned}i_{15} &= \text{Risk Free} + \text{Capped Credit Spread} \\ i_{15} &= 2.00\% + 0.875\% = 2.875\%\end{aligned}$$

$$\begin{aligned}\text{Reserve} &= 10,000,000 / [1.028^{15} * 1.02875^{15}] \\ \text{Reserve} &= \mathbf{4,319,720}\end{aligned}$$

Asset Depreciation & Credit Spread PfAD

$$\begin{aligned}\text{PfAD} &= \text{Padded Reserve} - \text{Best Estimate Reserve} \\ \text{PfAD} &= 4,319,720 - 4,090,071 = \mathbf{229,649}\end{aligned}$$

- (c) Critique the following statement:

“The best estimate annual growth assumption for diversified U.S. equities is 8%. The reserve can be reduced to approximately one million if the liability is backed with equities instead of corporate A bonds.”

Commentary on Question:

Candidates generally stated which MfAD was applicable (ie, MfAD for Equity Growth & Income) or the value of that MfAD (ie, 20%). To receive full credit, candidates were required to provide both.

The statement is incorrect as it ignores the impact of PfADs

- An MfAD is required for equity growth and income
 - Non-Fixed Income (NFI) capital gains would be 20% of the Best Estimate
- There is a Market Shift/Market Correction PfAD
 - Assets change in value at the time when the change is most adverse
 - The assumed changes as a % of market value for a diversified portfolio of North American common shares would be 30%

4. Continued

- There is a limit on the amount of NFI allowed
 - If NFI is used to support liability cashflows that are not substantially linked to returns on NFI assets, the actuary would include an additional PfAD by modifying the assumed investment strategy
 - The maximum amount of NFI is calculated by discounting 20% of cash outflows for the first 20 years and 75% thereafter, where cash outflows are the greater of the annual liability cashflows and zero in each forecast period
 - Ie, the company can only back 75% of the liability with Equity at time zero
- There is a foreign exchange margin
 - A PfAD would be developed from a scenario using adverse movements in the exchange rate

5. Learning Objectives:

3. The candidate will be able to understand and apply emerging financial and valuation standards, principles and methodologies.

Learning Outcomes:

- (3a) Describe emerging developments impacting Canadian valuation and International Financial Reporting frameworks, and assess their impact on the valuation of reserves and financial statements.

Sources:

LFV-642-16: OSFI: Life Insurance Capital Framework Standard Approach – Jan 2015

Economic Capital for Life Insurance Companies, SOA Research Paper, Feb 2008, Ch. 1 and 3-6

LFV-606-17: OSFI Guideline – Minimum Continuing Capital and Surplus Requirements (MCCSR) For Life Insurance Companies, Sections 1-5, 8-9 (2015)

Commentary on Question:

This question tested the candidates knowledge of regulatory capital, including future capital frameworks, and economic capital.

Solution:

- (a) With respect to the SOA Research Paper on Economic Capital for Life Insurance companies and OSFI's Life Insurance Capital Framework (LICF) Standard Approach:
 - (i) Describe the two common approaches to economic capital.
 - (ii) Identify the approach prescribed by the revised LICF.
 - (iii) Describe the five core concepts of the revised LICF.

Commentary on Question:

- (i) *Most candidates correctly identified the liability run-off and the one year mark-to-market approach. Full credit was given if candidates included the deduction of current liabilities.*
- (ii) *Most candidates correctly identified the prescribed LICF approach as one year mark-to-market at CTE(99).*
- (iii) *Most candidates listed the core concepts.*

5. Continued

- (i) A) Liability Run-off approach. Economic Capital is defined as the market value of assets required to cover future liability cash flow and associated expenses (at a selected confidence level or conditional tail expectation level), minus the current value of liabilities.

B) One-Year Mark-to-Market Approach. Required Capital is defined as the market of assets required to cover the market consistent value of liabilities and associated expenses over the one year horizon, minus the current value of liabilities at the end of the one year time horizon.
- (ii) The revised LICF prescribes the one year Mark-to-Market approach at CTE(99).
- (iii) The five core concepts of the revised LICF are:
 - 1. All insurers can apply the standardized approach objectively and consistently.
 - 2. Reflect all relevant cash flows from both on-balance sheet asset and liabilities and off-balance sheet activities.
 - 3. Include individual quantification of credit risk, market risk, operational risk and insurance risk.
 - 4. Reflect all risk mitigation strategies (hedging and reinsurance).
 - 5. Consider interaction and dependencies within and between risks when calculated aggregate capital.
- (b) Contrast the difference in approach to interest rate risk between MCCSR and LICF.

Commentary on Question:

Candidates generally understood the interest rate risk for MCCSR used a factor-based approach. Candidates generally did not understand the LICF interest rate risk. Many candidates incorrectly describing it as a stochastic method to shock the interest rates.

MCCSR: Interest rate risk is calculated using a factor approach, where the reserve is multiplied by a factor to determine the interest rate risk.

LICF: Uses multiple interest rate scenarios from deterministic shock calculations. The interest rate risk is calculated by choosing the most adverse scenario and taking the difference of the best estimate (base scenario).

5. Continued

- (c) Describe credits available within LICF to a life insurance company.

Commentary on Question:

Most candidates knew the three main credits available but few candidates provided a description.

1. Diversification: credit is allowed for diversification within risk categories and between risk categories. An insurance company is usually subject to many different risks. For example, companies that offer life and annuity business will have diversification between mortality and longevity. Diversification is calculated using a correlation matrix.

2. Credit for Participating and Adjustable Products: products with pass-through features can have reduction in required capital. Must be able to demonstrate the adjustability included in the product through dividends or contract.

3. Reinsurance and Hedging: risk mitigation, where the risk can be reduced to the insurer will provide credit. Credit for reinsurance is calculated implicitly using net cashflows in the solvency buffer calculations.

- (d) Describe the Base Solvency Buffer introduced under the Life Insurance Capital Adequacy Test (LICAT).

Commentary on Question:

Most candidates defined the solvency buffer correctly. Candidates received more credit for describing what risks were covered and how the calculation was done. Few candidates discussed the multiplication of the scalar.

The Solvency Buffer (SB) is the amount of assets required to meet regulatory requirements over and above the assets required to back the best estimate liabilities.

The Solvency Buffer is the sum of assets required for credit, market, insurance and operational risks less credit for diversification, less credit for risk mitigation (reinsurance/hedging) and less credit for par and adjustable products.

SB is multiplied by a scalar to calibrate levels of capital across the system.

6. Learning Objectives:

5. The candidate will understand the nature and uses of basic reinsurance arrangements used by life insurance companies.

Learning Outcomes:

- (5a) The candidate will understand the various forms of reinsurance, and be able to, with respect to both the ceding and assuming parties, analyze and evaluate:
- (i) Risk transfer considerations
 - (ii) Cash flow mechanics
 - (iii) Accounting and financial statement impacts
 - (iv) Reserve credit considerations

Sources:

Life, Health & Annuity Reinsurance, Tiller, 3rd Edition, Ch 4 and Ch 12
Accounting for Reinsurance Contracts under International Financial Reporting Standards (IASP 9)

Commentary on Question:

This question tested the candidates' understanding of reinsurance.

Solution:

- (a) Prior to reporting under IFRS 4, Roma Life included prudence in its reported insurance liabilities on a net basis.

Describe two possible approaches that can be used under IFRS 4 for Roma Life to retain the same level of prudence.

Commentary on Question:

Candidates generally demonstrated knowledge on this part of the question. Some candidates described the approach for setting prudence / margins (e.g.: top down / bottom up) rather than the approaches for ensuring the margin remains the same. To receive full credit, candidates had to include a description of the approach and the implications of choosing the particular approach..

Approach A: Include net margin in gross liabilities and report reinsurance asset without margins.

Results in level of prudence being different for contracts with reinsurance and without reinsurance. May be considered to be conflict with IFRS 4, as accounting policy should be consistent for all contracts.

Approach B: Include gross margins with the gross insurance liabilities and calculate the ceded asset using the same assumptions. Net position remains unchanged.

This results in a consistent accounting policy between contracts with and without reinsurance. However, it also results in an inflated reinsurance asset, which is not consistent with the general concept of prudence, but is not in conflict with IFRS 4.

6. Continued

- (b) Summarize the categories of practices and procedures laid out in OSFI Guideline B-3 with regards to reinsurance agreements.

Commentary on Question:

Candidates generally did well on this part of the question.

Reinsurance Risk Management Plan (RRMP)

Must be part of ERM plan. The RRMP should include certain elements, such as:

- Approach to using reinsurance to manage risks;
- Purpose and objectives for seeking reinsurance;
- Risk diversification objectives;
- Risk concentration limits;
- Ceding limits; and,
- Practices and procedures for managing reinsurance.

Evaluate counterparty risks

- Evaluate ability of reinsurance counterparties to meet their obligations
- Insurer to complete due diligence on reinsurer, not rely solely on rating agencies and broker recommendations
- Assess ability of reinsurers to pay under stress scenarios
- Review regulatory system of companies not supervised by OSFI

Terms and Conditions of Contract

- Target to have contract to be signed prior to effective date
- Ensure contract is complete
- If contract is not complete by effective date, a contractually binding summary document must set out particulars such as premium, risks covered, exclusions, etc.

Ceding Company not to be adversely affected by Terms and Conditions of Agreement

- Contract to include insolvency clause which requires reinsurers to make full payments to insolvent ceding companies.
- Contract cannot limit ceding ability of impaired or insolvent ceding company to enforce the terms and conditions of contract
- Funds withheld must remain part of ceding company's estate

6. Continued

- (c)
- (i) Build the following financial statements for the policy above on an IFRS basis assuming you have entered into the reinsurance agreement:
- Balance sheet at the end of year 1
 - Income statement for year 2
- Show all work.
- (ii) Recommend changes to the reinsurance offer that would reduce new business strain. Justify your recommendation.

Commentary on Question:

Some candidates struggled with the concept of a balance sheet, having balance sheets that did not have balanced assets and liabilities (including surplus). In this case, the balancing item is invested assets. Several showed the net reserve rather than the gross reserve and the ceded asset. Some candidates adjusted the surplus based on the change in reserves, ignoring the other components of income. Common errors included not appropriately accounting for reinsurance, such as assuming that the reinsurance premium was based on the gross amount and not the ceded amount, and adjusting the ceded face amount in the first year based on the net-amount at risk. This adjustment only applies in the second year.

Income statement – Year 1

		Gross	Ceded	Invested assets	Total
Volume		500,000	300,000	25,000	
YRT rate / 1000			0.70		
Reserve factor / 1000		9	2		
Premium		3,000.00	210.00		2,790.00
inv income	5%			1,250.00	1,250.00
commission	90%	2,700.00			2,700.00
acquisition		5,000.00			5,000.00
maintenance		30.00			30.00
premium tax	2%	60.00	4.20		55.80
Change in reserves		4,500.00	600.00		3,900.00
Total expenses		12,290.00	604.20		11,685.80
Net income		(9,290.00)	(394.20)	1,250.00	(7,645.80)

6. Continued

Balance sheet – End of Year 1

	Assets	Liabilities and Surplus
Actuarial liabilities / ceded assets	600	4,500
Invested assets	21,254	
Surplus		
Retained earnings		(7,646)
Initial surplus		25,000
Total	21,854	21,854

Income Statement – Year 2

Cash value rate (end of year 1) = $4 / 1000 = 500 * 4 = 2,000$

Ceded volume = $(300 / 500) * (500 - 2) * 1000 = 298,800$

Gross reserves = $500 * 15 = 7,500$

Ceded reserves = $298.8 * 5 = 1,494$

Change in gross reserves = $7,500 - 4,500 = 3,000$

Change in ceded reserves = $1,494 - 600 = 894$

Investment income = $5\% * 21,254 = 1,063$

	Gross	Ceded	Invested assets	Total
Volume	498,000	298,800	21,254	
YRT rate / 1000		0.85		
Premium	3,000	254		2,746
Investment income			1,063	1,063
Total Revenue	3,000	254	1,063	3,809
Commission	150			150
Maintenance	30			30
Premium tax	2% 60	5		55
Increase in reserves	3,000	894		2,106
Total expenses	3,240	899		2,341
Net income	(240)	(645)	1,063	1,468

ii) Recommend changes to the reinsurance offer that would reduce new business strain. Justify your recommendation

6. Continued

Commentary on Question:

Candidates generally did well on this part of the question, describing possible changes and explaining why or why not the changes would be effective in helping to meet the objective.

Change to the YRT contract:

- Increase the ceded amount
- Propose a zero first year ceded premium (i.e. a 100% first year allowance)

In this case, these approaches would only have limited success, as most of the strain is due to the acquisition and commission expenses, which are much larger than the first year reinsurance premium.

Change reinsurance method:

- Propose using coinsurance
- Propose using modified coinsurance

Under coinsurance, reinsurer assumes a share of all risks under the policy, and receives a proportionate amount of premium and holds a proportionate reserve. Reinsurer will pay expense allowance to ceding company, which may cover up to 100% of first year premium.

Under mod-co, the ceding company, rather than the reinsurer, holds the statutory reserve and supporting assets on the ceded portion of the policy. The reinsurer is responsible for funding the increase in reserve less an investment income credit. Effectively transfers the surplus strain on the reinsured portion of new issues to the reinsurer.

7. Learning Objectives:

1. The candidate will understand financial statements and reports of Canada life insurance companies as well as the professional standards addressing financial reporting and valuation.
4. The candidate will be able to explain and apply the methods, approaches and tools of financial management and value creation in a life insurance company context.

Learning Outcomes:

- (1a) Construct the basic financial statement or its components for a life insurance company.
- (1d) Describe, apply and evaluate the appropriate accounting treatments for insurance products, assets, derivatives and reinsurance.
- (4e) Explain Canadian regulatory capital framework and principles.

Sources:

CIA Educational Note CALM Implication of AcSB Section 3855 Financial Instruments – Recognition and Measurement

LFV-606-17: OSFI: Guideline Minimum Continuing Capital and Surplus Requirements for Life Insurance Companies 1-5, 8-9 (2015)

Solution:

- (a) Construct the income statement for the 4th quarter of 2016. Show all work.

Commentary on Question:

This part of the question tested the candidates' understanding of the income statement. Most candidates received partial credit for calculating investment income, and change in insurance contract liabilities. Few candidates received full credit by considering OCI.

7. Continued

Net Investment income = coupon payment from bonds regardless of designation + change in fair value of HFT asset + amortization of discount/premium of HTM asset + change in fair value of hedge =11+100+25+50
=186.00

Net income before tax = Net Investment income - change in insurance contract liabilities - change in investment contract liabilities = 186-100-0
=86.00

Income tax = tax rate x Net income before tax =86*27%
=23.22

Net income after tax = Net income before tax - Income tax =86-23.22
=62.78

Change in Other Comprehensive Income (OCI) = change in fair value of AFS asset =-\$10.00
=62.78-10

Total Comprehensive Income = Net income after tax + Change in OCI =52.78

- (b) Calculate the Gross Tier 1 available capital and Asset Default risk (C-1) component as at December 31, 2016. Show all work.

Commentary on Question:

This part of the question tested the candidates' knowledge of MCCSR. Candidates generally understood what components were required to calculate the available and required capital components.

Gross tier 1 capital is the sum of the following:

Common shareholders' equity, defined to include common shares, contributed surplus	\$100
And retained earnings	\$600
Accumulated net unrealized loss on available-for-sale equity securities reported in OCI	-\$10
Total	\$690

Asset Default Risk (C1)	Amount	C1 Factor	C1
HTM	\$525	16%	\$84
AFS	\$100	16%	\$16
HFT	\$1,100	16%	\$176
Total			\$276

7. Continued

- (c) The company decides to sell the assets backing surplus on December 31, 2016. Determine the impact of the sale on the balance sheet and income statement.

Commentary on Question:

Candidates generally did poorly on this part of the question. Common errors include not quantifying the impacts to bonds and cash as a result of the sale. Few candidates calculated the correct change to the income statement.

Balance sheet impact: Decrease bond balance sheet value by \$100

Balance sheet impact: Increase Accumulated OCI by \$10

Balance sheet impact: Increase Cash by \$90

Income statement: Investment income and NIBT increases by \$90 or income tax increases by \$24.3 or NIAT increases by \$65.7.

Income statement impact: Change in OCI decreases by \$90

Balance Sheet at Q4 2016	Before Selling	After Selling	Impact
Cash	\$0	\$90	\$90
Bonds	\$100	\$0	(\$100)
Accumulated OCI	\$0	\$10	\$10

Income Statement at Q4 2016	Before Selling	After Selling	Impact
Net Income Before tax	\$0	\$90.00	\$90.00
Income tax	\$0	\$24.30	\$24.30
Net Income After tax	\$0	\$65.70	\$65.70
OCI	\$90	\$0.00	(\$90.00)

8. Learning Objectives:

2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canadian life insurance companies.

Learning Outcomes:

- (2b) Evaluate, calculate, and interpret liabilities.

Sources:

CIA Ed Note – Future Income and Alternate Taxes

LFV-634-16: CIA Standards of Practice: Insurance Sections 2100, 2300, 2500, March 2015 2016

Commentary on Question:

This question tests the candidates' understanding of future taxes and the how they apply to Canadian standards of practice.

Solution:

- (a) Critique the following statements:
 - A. *The emergence of provisions for adverse deviation will impact the difference in an insurer's income according to tax rules and generally accepted accounting principles.*
 - B. *Changes to tax legislation effective in 2019 should be accounted for in the determination of the future tax asset/liability.*
 - C. *CALM scenario testing will have an explicit impact on the difference in an insurer's income according to tax rules and generally accepted accounting principles.*
 - D. *Expected release of provisions for adverse deviation should be taken into account when forecasting taxable income.*
 - E. *When considering cash flows from alternative taxes, the taxes on investment income from assets supporting the insurer's capital should not be included.*

Commentary on Question:

To earn full credit, candidates were required to state whether the statement was correct or incorrect, and provide a reasonable justification. Most candidates were able to achieve one or the other. Most candidates gave a vague description as opposed to providing a critique of the statement.

8. Continued

A. This statement is incorrect

- The realization of negative tax depends on the simultaneous availability of income that is otherwise taxable. In forecasting such income, the actuary would make provisions for adverse deviation and not take account of the expected release of provisions for adverse deviations in the insurance contract liabilities because, as noted above, their calculation implicitly assumes that those adverse deviations occur

B. This statement is correct

- the Standards of Practice requires that the best estimate scenario would consider continuation of the tax regime existing at the balance sheet date
- except that the best estimate would anticipate any “definitive” or “virtually definitive” decision by the relevant tax authority to change that regime
- Section 3465 of the CICA handbook states that income tax rates would be “enacted” or “substantively enacted” to be considered in the calculation of income tax assets or income tax liabilities
- The actuary would have to apply judgement to determine if the future tax scenario would need to be changed

C. This statement is correct

- the provision for adverse deviations in interest rate risk is determined by scenario testing, rather than by application of a margin for adverse deviations to the projected rates of return
- Each CALM scenario would result in different Permanent/Temporary differences for items such as real estate, derivatives, etc
- Theoretically, the tax cash flows would vary within each scenario
- However, this is often not done in practice which is acceptable provided the actuary can demonstrate that ignoring the variability in tax cash flows does not materially alter valuation results

D. This statement is incorrect

- the calculation implicitly assumes that those deviations occur

E. This statement is correct

- The exception is recoverability of future tax loss

8. Continued

- (b) Compare the treatment of projected tax cash flows resulting from the reversal of underclaims if they are:
- (i) associated with insurance contracts
 - (ii) not associated with insurance contracts

Commentary on Question:

Most candidates did not offer enough detail in their comparison to earn full credit

- (i) If the underclaim is assumed to be related to insurance contracts:
 - If the underclaim arose because of an insurance contract-related item, then the projected reversal of the underclaim is considered insurance contract-related
 - The underclaim would need to be allocated to the correct line of business
 - This methodology may be complicated to apply in a consistent and appropriate manner, particularly when underclaims are not managed at the segment level
 - This methodology requires the actuary's understanding of the company's tax position and tax management strategies to model the prospective impact of the underclaim and Loss Carry Forward position
- (ii) If the underclaim is assumed not to be related to insurance contracts:
 - It is effectively ignored in valuation
 - This is consistent with the view that MTAR = GAAP liability and there would be no temporary difference
 - This method is simple, practical, and easy to disclose
 - It treats the underclaim as a past event
 - The GAAP insurance contract liability is calculated prospectively, not retrospectively
 - The future tax asset associated with the underclaim is deemed to belong to surplus

Regardless of approach, it must be applied consistently across the organization. I.e., it would not be appropriate to apply the methodology differently across different lines of business

8. Continued

- (c)
- (i) Calculate the prevailing tax rate.
 - (ii) Calculate net income in 2017.

Show all work.

Commentary on Question:

Candidates generally were not able to identify all the necessary components of the calculation. Most candidates were able to identify the correct FTCO formula as a starting point for the unknown tax variable, but few candidates were able to work backwards and identify the underlying pieces of the FTCO (DFTP, Temporary Differences, etc).

For part (ii), few candidates were able to identify the correct earnings formula, confusing Net Income and Net Income before tax.

Partial credit was awarded for intermediate calculations.

Definitions

ICLIFT_t = Insurance Contract Liability Ignoring Future Tax

DFTP_t = Discounted Future Tax Provision

ICLBCO_t = Insurance Contract Liability Before Carve-Out

- (i) We need to work backwards from the FTCO to determine a solvable equation for the tax rate. By definition:

$$FTCO = T_x * [MTAR - (ICLIFT + DFTP) + (GAAP_A - Tax_A)] / (1 - T_x)$$

We are given:

$$(GAAP_A - Tax_A) = 0$$

$$FTCO_{2016} = 20$$

Therefore:

$$FTCO_{2016} = T_x * [MTAR_{2016} - (ICLIFT_{2016} + DFTP_{2016})] / (1 - T_x)$$

$$20 = T_x * [1000 - (1100 + DFTP_{2016})] / (1 - T_x)$$

$$20 = - T_x * (100 + DFTP_{2016}) / (1 - T_x)$$

8. Continued

Thus, we need to solve for $DFTP_{2016}$:

$$DFTP = PV (\text{Temporary Differences} * \text{Tax})$$

Where:

$$\text{Temporary Difference} = \text{Taxable Income} - \text{GAAP Income}$$

$$\text{Taxable Income} = \text{Change in MTAR}$$

$$\text{GAAP Income} = \text{Change in ICLIFT}$$

$$\text{ICLIFT} = \text{PV Benefit Cashflows}$$

Solve for the necessary pieces:

$$\text{Taxable Income}_{2017} = 1000 - 500 = 500$$

$$\text{Taxable Income}_{2018} = 500 - 0 = 500$$

$$\text{ICLIFT}_{2016} = -(-700 - 400) = 1100$$

$$\text{ICLIFT}_{2017} = -(-700) = 700$$

$$\text{GAAP Income}_{2017} = 1100 - 700 = 400$$

$$\text{GAAP Income}_{2018} = 700 - 0 = 700$$

$$\text{Temporary Difference}_{2017} = 500 - 400 = 100$$

$$\text{Temporary Difference}_{2018} = 500 - 700 = -200$$

$$DFTP_{2016} = 100 * T_x + -200 * T_x = -100 * T_x$$

Returning to the original equation:

$$20 = - T_x * (100 + DFTP_{2016}) / (1 - T_x)$$

Becomes:

$$20 = - T_x * (100 - 100 * T_x) / (1 - T_x)$$

$$20 = -100 * T_x * (1 - T_x) / (1 - T_x)$$

$$T_x = \mathbf{-20\%}$$

8. Continued

(ii) By definition:

$$\text{Net Income} = \text{Net Income before Tax} - \text{Tax Payable} + \text{Change in FTCO}$$

Where:

$$\text{Net Income before Tax} = \text{Liability CF} + \text{Change in ICLBCO}$$

$$\text{ICLBCO} = \text{ICLIFT} + \text{DFTP}$$

$$\text{DFTP}_{2016} = 100 * T_x + -200 * T_x = -100 * T_x = 20$$

$$\text{ICLBCO}_{2016} = 1100 + 20 = 1120$$

$$\text{DFTP}_{2017} = -200 * T_x = 40$$

$$\text{ICLBCO}_{2017} = 700 + 40 = 740$$

$$\text{NI before Tax}_{2016} = -400 + (1120 - 740) = -20$$

$$\text{Tax Payable} = \text{Taxable Income} * T_x = 50 * -20\% = -10$$

$$\text{FTCO}_{2016} = 20$$

$$\text{FTCO}_{2017} = T_x * [\text{MTAR}_{2017} - (\text{ICLIFT}_{2017} + \text{DFTP}_{2017})] / (1 - T_x)$$

$$\text{FTCO}_{2017} = -20\% * [500 - (700 + 40)] / (1 - -20\%) = 40$$

Therefore:

$$\text{Net Income} = -20 - -10 + (20 - 40) = \mathbf{-30}$$

9. Learning Objectives:

4. The candidate will be able to explain and apply the methods, approaches and tools of financial management and value creation in a life insurance company context.

Learning Outcomes:

- (4a) Assess financial performance, including analyzing and interpreting the financial performance of a product line or company.
- (4c) Explain and apply methods in determining regulatory capital and economic capital.
- (4f) Explain and apply methods in earnings management and capital management.

Sources:

Strategic Management of Life Insurance Company Surplus

OSFI Guideline – Minimum Continuing Capital and Surplus Requirements (MCCSR) for Life Insurance Companies (January 1, 2015)

OSFI: Own Risk and Solvency Assessment (E-19) (January 2014)

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

CIA Education Note: Margins for Adverse Deviations

Commentary on Question:

This question tested the candidates' knowledge of regulatory capital and understanding how to create value. Most candidates did not demonstrate an understanding of ORSA concepts.

Solution:

- (a) You are given the following for a non-participating and lapse supported life insurance product:

Best estimate liability assuming y% lapse rate	$100,000 * [1+(1-y\%)/2]$
Best estimate lapse rate	5%

- (i) Recommend a lapse margin for adverse deviation (MfAD).
- (ii) Calculate the lapse risk capital under MCCSR. Show all work.

Commentary on Question:

Most candidates calculated the lapse component under MCCSR correctly. Common omissions by candidates: (1) using the best estimate lapse rate 5% in the valuation lapse rate calculation and excluding the MfAD, (2) excluding the 13% magnitude of lapse margin when recalculating the liability.

9. Continued

- (i) Candidates could use a PfAD between [5%, 20%], providing reasonable justification. Since it is a lapse supported product, the PfAD should be negative. Calculations below assume 10% chosen.
- (ii) Valuation lapse rate = $5\% * (1 - 10\%) = 4.5\%$.

Lapse assumption used to recalculate liabilities for lapse capital is $5\% * (1 - 10\% - 13\%) = 3.85\%$. The magnitude of lapse margin should increase by 13% for non-par products.

Total liability under the valuation lapse rate: $100,000 * \left[1 + \frac{1 - 4.5\%}{2}\right] = 147,750$

Total liability under the recalculated lapse rate: $100,000 * \left[1 + \frac{1 - 3.85\%}{2}\right] = 148,075$

The lapse risk capital under MCCR = $148,075 - 147,750 = 325$

- (b)
 - (i) Describe the differences between the supervisory target ratio according to the MCCR guideline and the internal target ratio calculated using ORSA.
 - (ii) Critique the proposed equity allocation among profit centres with respect to the WACC and ROE.
 - (iii) Critique the proposed equity allocations among profit centres with respect to the Internal Capital Targets and Supervisory Capital Targets.

Commentary on Question:

Most candidates explained the relationship between ROE & WACC and ROE & Equity Growth Rate.

For part (i) few candidates received properly described differences between the MCCR and ORSA, instead focusing on the definitions and requirements of MCCR. For part (ii), most candidates correctly described the impact of ROE. For part (iii), candidates generally failed to identify the issue under ORSA; several candidates described the appropriateness of the three centers but did not provide further details or a recommendation for solutions.

9. Continued

(i)

- All risks specific to an individual insurer cannot be explicitly addressed by industry-wide Capital Guidelines (i.e. MCCSR guideline) alone.
- The Minimums and Supervisory Targets according to the MCCSR guideline are based upon simplifying assumptions applicable on an industry-wide basis, and are not tailored to individual insurers' risk profiles.
- Accordingly, an insurer should not unduly rely on these regulatory capital measures but should conduct its Own Risk and Solvency Assessment (ORSA) and, based on this process, determine its own capital needs and establish Internal Capital Targets (Internal Targets).
- When conducting its ORSA, an insurer should determine its own capital needs and establish its Internal Targets based on an internal assessment of all material risks. The Internal Targets should vary by each company, depending on its capital needs and risk profile.

(ii)

- ROE < cost of capital --> destroying economic value(EV)
- ROE > Equity Growth Rate --> Generating Free cash flows.

Profit Center	ROE	WACC	Equity Growth Rate
X	7%	12%	$7.7\% = \left(\frac{58}{50}\right)^{0.5} - 1$
Y	12%	12%	$14.0\% = \left(\frac{52}{40}\right)^{0.5} - 1$
Z	15%	12%	$11.8\% = \left(\frac{25}{20}\right)^{0.5} - 1$
Total Company	11%	12%	$10.8\% = \left(\frac{135}{110}\right)^{0.5} - 1$

○ Profit Center X:

- ROE < Cost of Capital, therefore destroying EV
- ROE < Equity Growth Rate, therefore destroying Free Cash Flows
- Growth in this business unit is undesirable. Make changes to improve ROE or minimize capital flowing into this profit center.

○ Profit Center Y:

- ROE = Cost of Capital
- ROE < Equity Growth Rate, therefore destroying Free Cash Flows

9. Continued

- This situation is acceptable as this profit center is destroying free cash flows but creating EV.
 - Profit Center Z:
 - $ROE > \text{Cost of Capital}$, therefore creating EV
 - $ROE > \text{Equity Growth Rate}$, therefore generating Free Cash Flows
 - Profit Centre Z is a small business unit with the highest rate of return, yet it is receiving only a small % of capital allocation. Opportunity to increase economic value by allocating more capital
 - Total company:
 - $ROE < \text{Cost of Capital}$, therefore destroying EV
 - $ROE > \text{Equity Growth Rate}$, therefore generating Free Cash Flows
 - Total company should be creating EV and generating free cashflows. Increase ROE or lower cost of capital to remain viable over the long term.
- (iii)
- As part of ORSA, insurers are expected to set Internal Targets. Internal Targets are set without undue reliance on regulatory capital measures. It is appropriate that Internal Targets do not equal regulatory capital (Supervisory Targets).
 - The Total Company and Profit Centers X & Y have Internal Capital amounts higher than Supervisory Targets. This is appropriate.
 - Profit Center Z has Internal Capital amounts lower than Supervisory Targets. This is not appropriate; Internal Capital should be higher than Supervisory Targets.
 - ORSA should be consistent with an insurer's strategic and business planning process and should contemplate adverse scenarios over the insurer's planning cycle. It is appropriate to include ORSA in the capital allocation exercise.
 - Stress and scenario testing should be an integral part of determining Internal Targets. It is appropriate that ABC calculated capital using different assumptions.
 - An insurer may add explicit buffers to complement its initial assessment when considering scenario and stress testing results. Consider increasing Internal Targets to reflect stress testing results.
 - Approaches and tools should be calibrated to determine the total amount of capital needed to cover severe losses.

10. Learning Objectives:

2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canadian life insurance companies.

Learning Outcomes:

- (2a) Compare and apply methods for life and annuity product liabilities.
- (2c) Recommend and justify appropriate valuation assumptions.

Sources:

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

CIA Final Communication of a Promulgation of Prescribed Mortality Improvement Rates Referenced in the Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2350), July 2011

CIA Educational Note: Margins for Adverse Deviations – November 2006

Commentary on Question:

This question tested candidates' understanding of Canadian standards of practices.

Solution:

- (a) Recommend modifications to the T100 valuation assumptions to be used for the new UL product. Justify your answer.

Commentary on Question:

Candidates generally did well on this part of the question. Most candidates recommended reasonable modifications to lapse and expense assumptions. Few candidates recommended reasonable modifications for mortality.

Mortality

Recommendation: 82% of CIA 97-04 (see above comments for other possible recommendations)

- Similar product to T100, especially if Level COI is minimum funded
- Potential for implied ETI if stop paying premium, ETI exhibits higher mortality in Trad products
- Potential for higher mortality if allow partial withdrawals without decrease in NAAR (anti-selection)

10. Continued

Commentary on Question:

Candidates could receive full credit on changes to the mortality assumption by recommending (1) no change to expected mortality but increase the MfAD; this assumes the same underwriting requirements but a new UL product will introduce uncertain experience, or (2) lower mortality under the assumption that more rigorous underwriting will be performed on UL compared to T100.

Lapses

Recommendation: 5%, 4%, 3%, 2%, 1% yrs 5-8, 0.5% yr 9, 0% yr 10, 5% yr 11, 1% yrs 12-25, 0.5% t/a

(see above comments for other possible recommendations)

- Lower lapse rates in the first 10 years due to the high surrender charges
- Lapse cliff at year 11 due to end of large surrender charges
- Persistency bonus may result in ultimate lapse rates similar to T-100 product

Commentary on Question:

Candidates could receive full credit on changes to the lapse assumption by recognizing the impact of surrender charges and persistency bonus on the expected lapse pattern.

Maintenance Expenses

Recommendation: \$45 per policy, inflated at 2% per year (see above comments for other possible recommendations)

- Higher unit cost due to additional product flexibility (deposits, withdrawals, fund changes)
- Also requires exempt testing, regular policyholder reporting (statements)
- Inflation is not dependent on the product type, use the same assumption

- (b) Describe additional non-economic assumptions that will be needed for the new UL product.

Commentary on Question:

Candidates generally did not do well on this part of the question. Many candidates did not identify all the assumptions and did provide a proper description of the identified assumptions.

10. Continued

Expected Premiums

As premiums are flexible, need an assumption for expected future premiums (premium persistency)
Expected premiums depend on purpose of policy, how the product is marketed and product features
Policies are often grouped for this assumption based on expected patterns (e.g. min vs high funded)
Initial premium should be consistent with the actual premium from the admin system
Assume more premiums will be paid if the policy runs out of funds as increases liability
Premium persistency likely to increase when minimum guaranteed rates are above market rates
Could have a material effect on the liability

Partial Withdrawal

Need an assumption regarding future partial withdrawals made from the fund
Tied to the premium persistency assumption as they both affect the size of the fund
Consider the impact of tax on amount withdrawn and the impact on the death benefit (reducing NAAR)
May be more likely to make partial withdrawals than surrender the policy with Level COI
Could be reflected as an addition to the lapse assumption
Could have a material effect on the liability
Most of the considerations that apply to premium persistency also apply to partial withdrawals

Deposit Allocation

Need an assumption regarding the allocation of future premiums between funds
Could have a material effect on the liability if assume material differences in spreads between funds
Minimum guarantees are also a consideration, especially when market rates are low
Would be appropriate to use current premium allocation selected by policyholder
Use of current fund mix could lead to assumption quite different from expected behavior
Assumption is tied to the economic environment

Transfer Between Funds

Need an assumption regarding the transfers between funds
Could have a material effect on the liability if assume material differences in spreads between funds
Fund transfer fees would be taken into account as would affect number of transfers in a year
Generally assume that policyholders act in their best interest, to the detriment of the insurer
Most of the considerations that apply to deposit allocation also apply to fund transfers

10. Continued

- (c) Calculate the padded mortality rate to apply during the 5th policy year.

Show all work.

Commentary on Question:

Candidates generally did well on this part of the question with many receiving full credit.

In policy year 5, the insured will be age 54

Mortality improvement rate at age 54 needs to be interpolated between 2% at age 40 and 1% at age 60

Mortality improvement rate at age 54 = $2\% - (2\% - 1\%) * 14 / 20 = 1.3\%$

Use 50% of the base mortality improvement rate for insurance

Unpadded mortality rate for age 54 = $qx @ 54 * (1 - \text{mort impr rate} @ 54 * 50\%) ^ 4$

Unpadded mortality rate for age 54 = $2.4 * (1 - 1.3\% * 50\%) ^ 4 = 2.34$

Padded mortality rate for age 54 = $\text{Unpadded mortality rate} @ 54 + ((3.75+15)/2) / ex @ 54$

Padded mortality rate for age 54 = $2.34 + 9.375 / 43 = 2.558$

- (d)
- (i) List the advantages of using population data when developing mortality improvement rates.
 - (ii) List the advantages of using insurance data when developing mortality improvement rates.
 - (iii) Describe any specific considerations for setting margins on mortality improvement rates for the T100 and UL products above.

Commentary on Question:

Candidates generally did well on parts (i) (ii). Most candidates could identify the credibility of using population data, the differences in underwriting, self-selection, and socio-economic classes between insured and general population when using insurance data.

Candidates generally did not do well on part (iii). Most candidates could not provide valid considerations

10. Continued

(i) Advantages of using population data are:

Mortality trends are not affected by changes in underwriting

Population data has more years of data available compared to insured data

Population data is not specific to life insurance or annuities, and therefore can be used for both or either

(ii) Advantages of using insurance data are:

Reflects differences in socio-economic classes between insured and general population

Reflects differences in underwriting and self selection between insured and general population

Insurance data shows different AIDS rates, target markets different, genetic testing leading to self-selection

Mortality improvement based on population data higher than that under scale AA

(iii)

T100 and UI (LCOI) tend to be death supported when combined with high quota share YRT reinsurance

Mortality improvement would lead to lower liabilities

Actuary must ensure that mortality PAD is appropriate

If negative mortality MAD produces positive mortality PAD, actuary would not reverse future mortality improvement

CIA prescribes only a minimum valuation assumption and leaves it to actuary to determine own best estimate assumption and related margin