ILA LFVC Model Solutions
Spring 2018

1. 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:

(4b) Apply methods and principles of embedded value.

Sources:

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

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

Commentary on Question:

This question tested candidates' knowledge of embedded value.

Solution:

(a)

(i) Calculate the total return on MCEV. Show all work.

(ii) Calculate the operating return on MCEV. Show all work.

Commentary on Question:

Generally, candidates spent minimal effort writing out the formulas for the items requested. Some candidates did not list any formula, and a few used non-standard abbreviations in the formulas making it difficult to assess understanding. Adding or subtracting a series of numbers without context does not convey understanding of the concept, especially if the candidate does not arrive at the correct numerical answer. Candidates should list the appropriate formula and substitute the correct values to demonstrate understanding of the connection of the terms and the values provided. In this way, if candidates make a substitution or conceptual mistake, partial credit may be received.

(i)

Total return on MCEV = (A) Total MCEV Earnings / (B) Opening MCEV
= 17 / 300
= 5.7%

1. Continued

(A) Total MCEV Earnings consist of the following components:

New Business Value =	1	(given)
+ Operating Variances =	8	(given)
+ Economic Variances =	-5	(given)
+ (C) Unwinding MCEV =	13	(calculated below)
Total MCEV Earnings =	17	

(B) Opening MCEV = 300 (given)

(C) Unwinding MCEV consists of the following components:

Expected existing business contribution using the reference rate =	7 (given)
+ Expected existing business contribution in excess of the reference rate =	2 (given)
+ Transfer or release of profits in the value of in-force business =	3 (given)
+ Release of required capital =	1 (given)
Total Unwinding MCEV =	13

(ii)

Operating return on MCEV = Operating MCEV Earnings / Opening MCEV
= 22 / 300
= 7.3%

Operating MCEV Earnings = Total MCEV Earnings – Economic variances
= 17 (from part (a)(i)) – (–5) (given)
= 22

Opening MCEV = 300 (given)

(b) Assess concerns with performing an actuarial appraisal of XYZ using its latest EV results.

Commentary on Question (b):
Generally, candidates recognized the importance of including future new business capacity in an actuarial appraisal and that there are differences in assumptions in calculating EV vs those used in an actuarial appraisal. Some candidates mentioned that the company being appraised can be a "going concern" and therefore include future new business whereas if it is not, then new business is not included. Some candidates discussed how EV could be modified (i.e., not used directly) and the value of new business added which is also an acceptable approach.

1. Continued

EV cannot be used directly as a basis for an actuarial appraisal because:

(1) An actuarial appraisal value should include both the value of in-force business and the value of future new business capacity if the company is a "going-concern" and it intends to write new business.
(2) The assumptions used in the calculation of EV are not the same as those used in an appraisal.

It may be possible to modify EV by changing assumptions, considering future growth, performing various sensitivity modeling and then selecting a multiple of modified value of new business to be added to modified EV.

(c) The following assumptions appear in XYZ's EV report:

A. Persistency, mortality, and expense assumptions are best-estimate with provisions for adverse deviation.
B. Mortality improvement is included in the mortality assumptions. This is common industry practice.
C. Expenses consist of acquisition expenses (to the extent associated with existing business) and maintenance expenses. Overhead and one-time expenses are excluded.
D. Since non-economic assumptions used to calculate EV should be "entity-specific", the company's experience data was exclusively used to develop persistency, mortality, and expense assumptions. No industry data was used.

Critique the appropriateness of each statement.

Commentary on Question (c):
Generally, candidates did well on this part of the question. Candidates demonstrated knowledge of what should or should not be included in EV calculations along with justification.

A. FALSE. Persistency, mortality and expense assumptions are non-economic assumptions and therefore should be best estimate. The use of provisions for adverse deviations for these assumptions is not appropriate for EV.

B. TRUE. Using mortality improvement in the EV projection is appropriate to the extent it can be supported and falls under a best estimate approach. It is common industry practice. Care should be taken in considering changes in the mix of business over time and possible anti-selection occurring at renewal periods.

1. Continued

C. FALSE. This is not appropriate. All expenses should be included in the EV calculation including overhead expenses. Although specific one-time expenses may not recur, new and/or unanticipated one-time expenses may arise and take the place of current one-time expenses.

D. Could be TRUE or FALSE. It is supportable to use company experience if it is credible. If not fully credible, the actuary should set an assumption based on a blend of company and industry experience. Expenses are typically company specific but mortality assumptions are typically a blend of company data and industry data due to lack of credibility of the company's own data. Persistency assumptions can be blended with industry data but due to product differences, most persistency assumptions are company specific.

2. 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 and Annuity Reinsurance, Tiller, 4th Edition, 2015, Ch. 5

Commentary on Question:

This question tested the candidates' knowledge of reinsurance, in particular coinsurance and mod-co, and their use on in-force business. Candidates had to demonstrate how coinsurance and mod-co affected the income statement.

Solution:

(a) Create LNT's projected 2018 term life income statements for each of the proposed reinsurance arrangements. Show all work.

Commentary on Question:

Candidates generally did poorly on this part of the question. Many candidates assumed all the premiums and claims were transferred to the reinsurer in 2018, which is not correct since the reinsurance transaction did not occur until the end of the year.

2. Continued

	Coinsurance	Mod-Co
Premium		
Gross	4000	4000
Ceded	9500	9500
Net	(5500)	(5500)
Investment Income	800	800
Reinsurance Allowance	950	950
Mod-co Adjustment	0	9500
Total Revenue	(3750)	5750
Claims and Surrenders		
Gross	1500	1500
Ceded	0	0
Net	1500	1500
Reserve Increase		
Gross	1000	1000
Ceded	9500	0
Net	(8500)	1000
Expenses	300	300
Total Benefits and Expenses	(6700)	2800
Net Income	2950	2950

(b) Calculate the projected 2019 net income for the block under each reinsurance arrangement. Show all work.

Commentary on Question:

Candidates generally demonstrated an understanding of premium, reinsurance allowance, benefits and expenses. Most candidates also demonstrated an understanding of the mod-co adjustment. Most candidates had difficulty with investment income, basing it upon something other than the year-end 2018 asset balance.

2. Continued

	Coinsurance	Mod-Co
Premium		
Gross	3500	3500
Ceded	3500	3500
Net	0	0
Investment Income	324	1084
Reinsurance Allowance	350	350
Mod-co Adjustment	0	335
Total Revenue	674	1769
Claims and Surrenders		
Gross	500	500
Ceded	500	500
Net	0	0
Reserve Increase		
Gross	1000	1000
Ceded	1000	0
Net	0	1000
Expenses	250	250
Total Benefits and Expenses	250	1250
Net Income	424	519

Supporting data and calculations

Year-end 2018 Balance Sheet			
	No Reinsurance	Coinsurance	Mod-co
Assets	12600	4050	13550
Liabilities	9500	0	9500
Surplus	3100	4050	4050

Coinsurance Investment Income =
Coinsurance Assets at Year-end 2018 x 8% =
4050 x 8% = 324

Mod-co Investment Income =
Mod-co Assets at Year-end 2018 x 8% =
13550 x 8% = 1084

2. Continued

Mod-co Adjustment =
Ending Reserve – Beginning Reserve – Interest on Beginning Reserve =
10500 – 9500 – 7% * 9500 = 335

3. 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.

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

Learning Outcomes:

(4e) Explain Canadian regulatory capital framework and principles.

(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:

LFV-636-18: OSFI Draft Guideline A-4 Internal Target Capital Ratio for Insurance Companies, September 2017

LFV-645-18: OSFI Draft Guideline A – Life Insurance Capital Adequacy Test (LICAT), Chapters 1 - 3, 5 – 9, 11, September 2017

LFV-645-18: OSFI Draft Guideline A – Life Insurance Capital Adequacy Test (LICAT), Chapter 10, September 2017

Commentary on Question:

This question tested the candidates' knowledge of the Canadian capital framework, and the impact of reinsurance on it.

Solution:

(a) List the primary considerations for assessing the available capital elements of an insurer under the Life Insurance Capital Adequacy Test (LICAT).

Commentary on Question:

Candidates generally did well on this part of the question.

The primary considerations for assessing the available capital elements of an insurer under LICAT are:
- i) availability
- ii) permanence
- iii) absence of encumbrances and mandatory servicing costs
- iv) subordination

3. Continued

(b) Describe actions the Office of the Superintendent of Financial Institutions (OSFI) may take towards an insurer for not satisfying the Supervisory Target ratios.

Commentary on Question:
This part of the question tested the candidates' knowledge on actions OSFI may take when Supervisory Target ratios are breached. Common errors include simply listing regulatory capital levels and describing actions when dropping below the Minimum Capital level.

For an insurer who falls below the Supervisory Target ratios, OSFI mandates an early intervention approach as this is indicative of material safety and soundness concerns, and a vulnerability to adverse business and economic conditions, which require immediate attention.
Insurers will be subject to increased supervisory attention that would include an early warning intervention status (i.e. stage 1)
The intensity and nature of the supervisory intervention would depend on the circumstances of the particular insurer.

(c) Explain causes for the difference in the following components between the three arrangements:

(i) Surplus Allowance (B)

(ii) Diversified Risk Requirement (E)

(iii) Operational Risk (F)

Commentary on Question:
Candidates generally did well on parts (i) and (ii).
A common omission for part (iii) was listing the formula for operational risk but not specifically addressing why operational risk is different for these three arrangements based on the formula. Partial credit was given for this. Another common omission for part (iii) was arguing that Modco and YRT were more complicated, and as a result required a higher operational risk, without relating back to the operational risk calculation itself. No credit was given for this response.

(i) Surplus Allowance (SA) is lower for the two reinsurance arrangements due to the PfADs being ceded, which are part of the SA calculation.

(ii) Diversified Risk Requirement is lower for the two reinsurance arrangements due to risk requirements being net of registered reinsurance. Both YRT and Modco arrangements are providing the same amount of risk coverage so have the same impact on diversified risk requirement.

3. Continued

(iii) Required capital for operational risk is the sum of:
1) Business volume required capital;
2) Large increase in business volume required capital; and
3) General required capital.

Business volume required capital (component 1 above) is calculated based on gross premiums, which keeps that component the same for all three arrangements.

General required capital (component 3 above) consists of two separate sub-components : (a) 5.75% factor applied to total required capital for credit, insurance and market risk components net of reinsurance and all other credits, and (b) 2.5% factor applied to ceded reinsurance premiums.

Reinsurance arrangement has higher operational risk from sub-component (b) (Mod-co ceded premium higher than YRT) which is partially offset by lower requirement from sub-component (a).

(d) Describe considerations when recognizing ceded liabilities for unregistered reinsurers under LICAT.

Commentary on Question:
This part of the question required candidates to demonstrate knowledge of both the valuation basis for ceded liabilities and the deduction rules from available capital of unregistered reinsurance. Most candidates did not address the former. For the latter, most candidates did not describe deduction rules when the ceded liability is negative.

Policy liabilities that are ceded by an insurer under unregistered reinsurance must be valued, in accordance with CALM.
Assumptions about assets supporting liabilities must be consistent with assets used to collateralize reinsurer's obligations.
The assets backing the ceded liability should be assumed to consist of all or a portion of:

1) the assets held by the insurer or vested in trust that are used to support funds withheld from or other amounts due to the unregistered reinsurer;
2) the assets located in Canada for which the insurer has a valid and perfected first priority security interest under applicable law that are used to obtain credit in respect of the unregistered reinsurer
3) letters of credit held to secure payment to the insurer by the reinsurer that are used to obtain credit in respect of the unregistered reinsurer. These amounts should be treated as non-interest bearing cash equivalents for the purpose of valuation.

3. Continued

The total value of the policy liabilities ceded to the unregistered reinsurer, if positive, must be deducted from available capital.

Where an insurer cedes positive policy-by-policy liabilities and negative policy-by-policy liabilities to the same unregistered reinsurer, amount of offsetting liabilities is minimum (total positive liability ceded, total negative liability ceded)

Where the total value of the policy liabilities ceded is negative, the insurer should deduct from Tier 1 and include in Tier 2 the reported assets arising from transactions with the reinsurer unless the assets:
1) are unencumbered and held in Canada in custody of the insurer;
2) are not receivables;
3) do not bear any credit exposure to the unregistered reinsurer or any of its affiliates
4) have been transferred to the insurer permanently.

Deduction from tier 1 limited to value of aggregate negative policy liability ceded to reinsurer

4. 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:

(1c) Describe, apply and evaluate regulatory documentation and disclosure requirements.

Sources:

LFV-620-14: OSFI Guideline E15: Appointed Actuary – Legal Requirements, Qualifications and External Review (September 2012)

Commentary on Question:

This question tested the candidates' knowledge of the qualification requirements of an Appointed Actuary.

Solution:

(a) List the qualifications necessary to be an Appointed Actuary for a Canadian life insurance company.

Commentary on Question:

Candidates generally did well on this part of the question.

1. Has appropriate Canadian practical experience, which is defined as Work in Canada for at least three of the last six years, of which at least one year was performing valuation of Canadian actuarial liabilities of an insurance company;
2. Has experience with the CIA's Standards of Practice and relevant insurance legislation and regulation;
3. Is up to date with respect to the CIA's Continuing Professional Development requirement;
4. Has not been the subject of an adverse finding by a CIA Disciplinary Tribunal. Where there has been such a finding, the Superintendent may nevertheless conclude that the AA is a suitable person if the circumstances of the case and other information support such a conclusion.

(b) Arthur is the Appointed Actuary of ABC Company, a major Canadian life insurer. Below are his major actions as Appointed Actuary in 2018.

January 1: *Arthur is appointed as the Appointed Actuary by the board of directors. To help with the transition, Arthur chooses the previous Appointed Actuary, who is recently retired, to be his peer reviewer.*

4. Continued

February 28: *Arthur submits the Appointed Actuary Report to OSFI. He schedules a meeting for the following week with the peer reviewer to review the report.*

March 12: *Arthur is made aware that a 1 million dollar bond in the company's portfolio has a high probability of defaulting in the near future. He reports the matter immediately to senior management and sends a copy of the report to the board of directors. The report includes a recommendation to sell the bond with a one-month deadline.*

May 30: *Arthur's team completes a par block dividend review. The experience of the par block is worse than expected. The team recommends that the policyholder dividend be reduced by half in accordance with the dividend policy. Arthur opines that the recommendation is fair and approves the change. The new dividend comes into effect on June 15, 2018.*

August 1: *Arthur reports the second quarter's financial results and the dividend changes to the board of directors.*

August 30: *Arthur is notified about a lawsuit brought against the company by a class of non-participating policyholders. It is expected that the legal fees for the lawsuit will be significant. Arthur reduces the policyholder dividend to offset the legal fees and potential for lawsuit settlement. The changes come into effect on September 30, 2018.*

Critique the appropriateness of each of Arthur's actions.

Commentary on Question:
Candidates generally did not do well on this part of the question.
Common errors by candidates include:

- *February 28: Most candidates declared the action inappropriate*
- *March 12: Most candidates declared the action appropriate*
- *May 30: Most candidates did not justify why the action was inappropriate*
- *August 30: Most candidates did not fully justify why the action was inappropriate*

4. Continued

January 1: Inappropriate.

- A reviewer may not be an employee of the company or any affiliated companies, and may not have been employed by the company or served as AA of the company during the three years prior to the date of the work being reviewed.
- Retain the current reviewer if he/she hasn't completed his/her two cycles; or choose a new reviewer that fulfills the OSFI's criteria in determining objectivity of the reviewer.

February 28 : Nothing inappropriate

- the review of the AAR can be post-submission

March 12: Inappropriate/unnecessary

- There would be no such report to senior management/board of an adverse condition that does not threaten the insurer's financial condition. Informal notification and consultation would usually precede, and may obviate, that report to senior management.
- Communicate with the stakeholders in the company (e.g. investment department) on solving the issue.

May 30/August 1: Inappropriate

- The AA is required to report, in writing, to the directors on the fairness to participating policyholders of a proposed dividend, bonus or other benefit and whether it is in accordance with the dividend or bonus policy.
- Arthur should have reported to the board in writing on the proposed dividend and then the board can decide whether or not to adopt the new dividend.

August 30: It is inappropriate to allocate expense of non-participating policies to participating policies.

- It prevents the AA to issue fairness opinion on the participating account management policy.
- Arthur should not reduce the dividend to offset the litigation cost.

5. 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.

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.

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

Learning Outcomes:

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

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

(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:

CIA Educational Note on IFRS: Classification of Contracts under IFRS (IASP 3)

LFV-XXX-17: CIA Standards of Practice: Insurance Sections 2100, 2300, 2500, April 2017

LFV-141-18: IFRS 17 Insurance Contracts – IFRS Standards Effects Analysis, May 2017, IASB

Commentary on Question:

This question tested the candidates' knowledge of insurance contract under IFRS17. Candidates were required to classify a particular contract and identify the appropriate measurement approach.

Solution:

(a) Describe considerations for determining if a contract qualifies as an insurance contract for IFRS accounting purposes.

Commentary on Question:

Most candidates did not describe the first two points (a and b) sufficiently. Most candidates were able to describe the third point (c) sufficiently.

5. Continued

The considerations for determining if a contract qualifies as an insurance contract for IFRS accounting purposes consist of the following:

a. Whether an insured event is covered by the contract:
   - A contract must specify at least one insured event that could trigger a benefit payable to policyholder.
   - This benefit can be uncertain as to its occurrence, its amount, or its timing.
   - The risk transferred by the policyholder to the insurer must be non-financial risk, and policyholder needs to be exposed to the risk regardless of whether the contract exists or not.

b. Whether the occurrence of the insured event would result in an adverse effect on the policyholder:
   - The insured event must adversely affect the policyholder and a benefit be triggered as compensation.
   - In some cases, the adverse effect is presumed to occur and does not need to be proved.

c. Whether the insurance risk contained in the contract is significant:
   - The benefit that insurer payable to the policyholder must be significant, excluding scenarios that lack commercial substance.
   - The risk can be significant even when the insured event is extremely unlikely.
   - The risk can also be significant even when the expected present value of the contingent cash flows is small in proportion to the present value of all contractual cash flows.
   - The determination of significance is performed on an individual contract basis.

(b) Assess whether the following contracts would be classified as insurance contracts under IFRS. Justify your assessment.

(i) A contract that pays the accumulated value of a single premium deposit at the maturity of a contract, or at death if earlier. Payments at death are subject to a market value adjustment.

(ii) A Universal Life contract where the accumulation rate of the policyholder account is tied to the return of an external index.

(iii) A contract to provide administration and record keeping services for a block of life insurance policies.

(iv) A life contingent payout annuity with a guaranteed benefit period of 5 years.

5. Continued

(v) A contract that pays the contract purchaser if a particular bond defaults.

(vi) A contract a golfer purchases to offset some of the cost incurred if they hit a hole-in-one, as this requires purchasing expensive gifts for friends and colleagues.

Commentary on Question:
Candidates generally did well identifying the insurance contracts and classifying contracts as investment or service. Some candidates failed to identify (vi) as an insurance contract. Candidates who correctly assessed the contract without justification received partial credit.

(i) This contract is not an insurance contract and should be considered as an investment contract:
- The insured event that will lead to the uncertainty of the amount and timing of benefit payout is the death of the policyholder. However, the benefit only varies by the time value of money and therefore the risk is associated with financial risk, not insurance risk. Thus, there is no significant insurance risk and is not an insurance contract.

(ii) This contract is an insurance contract:
- The Universal Life contract meets all requirements for an insurance contract. The policyholder account would be considered as a deposit component which can be evaluated on a stand-alone basis. Unbundling the deposit component is permitted but not required. The deposit component could be measured separately, while the insurance component, which depends on the amount of account value, would be measured as a whole.

(iii) This contract is not an insurance contract but a stand-alone service contract:
- There is no insured event and no benefit payout under the contract.
- This contract does not create financial assets or liabilities and does not transfer insurance risk.

(iv) This is an insurance contract:
- The life contingent payout annuity is classified as an insurance contract even with a 5-year guaranteed benefit, as the life contingent portion meets all requirements.

(v) This contract is not an insurance contract but rather an investment contract:
- The risk transferred from contract purchaser to insurer is financial risk and does not meet the insurance contract requirement.

5. Continued

(vi) This contract is an insurance contract:
- There is an insured event that results in a contractual benefit payable. The benefit is uncertain to its occurrence and is not due to financial risk. The policyholder is adversely impacted when the insured event occurred, as expensive gifts would have to be purchased.

(c) XYZ Insurance Company currently sells only 10-year term insurance and segregated funds products.

(i) Recommend the appropriate IFRS 17 measurement approach for each product.

(ii) Describe the effect of discount rate changes on the Contractual Service Margin (CSM) for each of the two products.

Commentary on Question:
Most candidates correctly identified the correct measurement for each product and analyzed the effect on CSM. To receive full credit, candidates had to provide justification. Candidates were given credit for referring to the General Accounting Model as a Building Block Approach or General Measurement Model.

(i) The General Accounting Model is recommended for the 10-year term insurance:
- The term insurance contract does not have direct participation features thus only general accounting model or premium allocation approach (PAA) could be considered. However, the optional simplified approach (PAA) can only measure some simpler insurance contracts where significant changes in estimates before the claims are incurred are not expected, or the coverage period is less than a year. Therefore, only general accounting model is appropriate for this contract.

The Variable Fee Approach is recommended for the segregated funds product:
- The segregated funds product contains direct participation features where the contract creates an obligation to pay policyholders an amount that is equal to the fair values of the underlaying items, less a variable fee for service. This means the insurer and the policyholder share the returns, which are affected by market driven changes in the underlying items. Thus, variable fee approach is appropriate for this contract.

5. Continued

(ii) Under the general accounting model, at subsequent measure, the contractual service margin at initial recognition is updated to reflect changes in fulfillment cash flows related to future coverage and the changes are discounted with interest rates locked in at initial recognition. In other words, change in interest rates will have no impact on CSM.

The effects of changes in discount rates will either present in profit or loss or disaggregated between profit or loss and other comprehensive income.

Under the variable fee approach, at subsequent measure, the contractual service margin at initial recognition is updated to reflect changes in the amount of the variable fee, including those related to changes in discount rates and other financial variables.

(d) Calculate the insurance contract liability at inception for each product under:

(i) CALM

(ii) IFRS 17

Show all work.

Commentary on Question:
Most candidates did well calculating CALM liabilities. Common errors include not backing out CALM margins from cash outflows properly, not assessing CSM for each product properly, and failure to apply the IFRS formula to get the final IFRS liability. Some candidates combined both products when doing the liability calculations, and partial credit was received. Candidates received partial credit for getting individual components correctly.

For the risk adjustment calculation, candidates who did not consider the time value (i.e., discounting effect) on cash flows were given full credit since the assumptions in the question did not specify whether the risk adjustment was defined as point in time assumption (i.e., to be applied at Year 1 and Year 2) or as valuation date assumption (i.e., to be applied at valuation date and no further discounting is necessary). Therefore, both interpretations were acceptable.

5. Continued

(i) CALM Liability at time 0:

CALM valuation interest rate 6% should be used to discount the cash outflows, and CALM margins are already included:

	Product A	Product B
T = 0	5000	2500
Yr 1 discounted to t = 0	1500/(1+6%)=1415	1200/(1+6%)=1132
Yr 2 discounted to t = 0	2000/(1++6%)^2=1780	1800/(1+6%)^2=1602
CALM Liability	-1805	234

(ii) IFRS 17 Liability at time 0:

Under IFRS 17, insurance contracts are measured as the total of:

- the fulfilment cash flows
- the contractual service margin. If at initial recognition, the contractual service margin is negative, the contract is onerous, and the contractual service margin needs to be floored to zero.

Thus, IFRS 17 Liability at time 0 = Fulfilment cash flows + CSM
= PV (best estimated cash outflows – best estimated cash inflows) + Risk Adjustment + CSM

- To calculate present value of cash flows, the best estimated claims and expenses cash flows need to be determined. 4% discount rate should be used as it is based on current observable interest rates, with adjustments using similar instruments whose characteristics are consistent with the contracts.

	Product A	Product B
T = 0	5000	2500
Yr 1 discounted to t = 0	1500/(1+15%)/(1+4%)=1254	1200/(1+15%)/(1+4%)=1003
Yr 2 discounted to t = 0	2000/(1+15%)/(1+4%)^2=1608	1800/(1+15%)/(1+4%)^2=1447
PV (cash outflows - cash inflows)	-2138	-50

- Risk adjustment is defined as 10% of undiscounted cash outflows. The BE cash outflows should be used as CALM margin needs to be removed:

	Product A	Product B
Yr 1 discounted to t = 0	1500/(1+15%)*10%/(1+4%)=125	1200/(1+15%)*10%/(1+4%)=100
Yr 2 discounted to t = 0	2000/(1+15%)*10%/(1+4%)^2=161	1800/(1+15%)*10%/(1+4%)^2=145
Risk Adjustments	286	245

***Note that candidates were also given full credit without discounting the risk adjustments back to time 0.*

- The fulfillment cash flow is the sum of the above two components:

5. Continued

	Product A	Product B
PV (cash outflows - cash inflows)	-2138	-50
Risk Adjustments	286	245
Fulfilment cash flows	-1852	196

- CSM is the negative of fulfilment cashflows to prevent the recognition of unearned profit. If contracts are onerous, no CSM is recognized on initial recognition. CSM = max (0, - fulfillment CFs).

	Product A	Product B
CSM	max (0,-(-1852))=1852	max (0, -(196))=0

- IFRS 17 liability is the sum of fulfilment cash flows and CSM:

	Product A	Product B
Fulfilment cash flows	-1852	196
CSM	1852	0
IFRS 17 Liability	0	196

6. 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.

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

Learning Outcomes:

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

(2c) Recommend and justify appropriate valuation assumptions.

(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:

ILA-D611-08: CIA Educational Note: Margins for Adverse Deviations (Mfad) – November 2006

ILA-D610-08: CIA Educational Note: Currency Risk in the Valuation of Policy Liabilities for Life and Health Insurers, December 2009

ILA-D114-09: CIA Educational Note: Approximations to the Canadian Asset Liability Method (CALM): November 2006

ILA-D105-07: Analysis of Methods for Determining Margins for Uncertainty Under a Principle-Based Framework for Life Insurance and Annuity Products, Ch. 3, 4, 5.1, 5.5-6, 6

LFV-XXX-17: IFRS 17 Insurance Contracts – IFRS Standards Effects Analysis, May 2017, IASB

LFV-XXX-17; CIA Standards of Practice: Insurance Sections 2100, 2300, 2500. April 2017

Commentary on Question:

This question tested the candidates' knowledge of Canadian valuation practices around interest rate risk, currency risk and assumption setting with respect to policyholder behavior.

6. Continued

Solution:

(a) Calculate the interest rate risk provision for adverse deviation (PfAD). Show all work.

Commentary on Question: *Candidates were generally able to calculate the net cash flows correctly. Only a few candidates calculated the PV of surplus and the time zero asset value by correctly adjusting the assets using the top-up/top down method.*

	2016/01	2019/12	2020/12	2021/12
CFs	0	1	2	3
GIC(Liability)		-100	-1200	-1200
Bond 1		100	1100	
Bond 2		100	100	1100
Net CF		100	0	-100
Time 3 Accumulated Asset Value under BE scenario		`=100*1.05^2-100		
		=10.25		
PV of surplus		=10.25/1.05^3		
		=8.85		
Time 3 Accumulated Asset Value under Worst scenario		=100*1.02^2-100		
		=4.04		
PV of surplus		=4.04/1.02^3		
		=3.81		
Alternative 1 - take PV of surplus as top up/top down of assets				
Total bonds plus/minus top up/down BE Scenario		=2300-8.85=2291.15		
Total bonds plus/minus top up/down Worst Scenario		=2300-3.81=2296.19		
C3 PfAD		=2296.19-2291.15=5.05		
Alternative 2 - take % of bonds based on PV surplus				
% under BE		=(2300-8.85)/2300= 0.99615		
% under Worst		=(2300-3.81)/2300=0.998343		
Time 0 Asset value under BE		=2300*0.99615=2291.15		
Time 0 Asset value under Worst		=2300*0.99834=2296.19		
C3 PfAD		=2296.19-2291.15=5.05		

(b) Describe how interest rate risk is reflected under the IFRS 17 framework.

Commentary on Question:
Candidates generally did not do well on this part of the question, focusing on how interest rate risk is reflected in the financial reporting not the valuation.

6. Continued

Under IFRS17, interest rate risk is reflected in the discount rates, not in the risk adjustment
IFRS requires a company to discount the cash flows from insurance contracts using discount rates that reflect the characteristics of the cash flows arising from the group of insurance contracts (such as the timing, currency and liquidity of the cash flows) rather than rates based on the characteristics of the assets backing that liability.
They are based on current observable interest rates, with adjustments being made to these observable rates to align them with the characteristics of the group of insurance contracts.
This will help to report economic mismatches between insurance contract liabilities and assets backing them which otherwise might remain obscured.

(c) Consider a Canadian dollar liability of 10,000 payable at the end of five years. The assets backing this liability are denominated in U.S. dollars. Currency forwards are not readily available. You are given:

- Current spot rate: 1.00 U.S. dollar buys 1.30 Canadian dollar
- Canadian risk-free rate = 2.50%
- U.S. risk-free rate = 2.75%
- Historical standard deviation = 0.030

Determine the Provision for Adverse Deviation for currency risk under CALM.

Commentary on Question:
Candidates generally calculated the base liability correctly. Candidates generally calculated the adverse and minimum scenarios incorrectly when projecting the exchange rate. The most common error was applying the margin incorrectly.

6. Continued

Base liability = CAD 10,000 / (1 + 2.5%)^5
= 8838.543
Adverse Scenario
Projected/Ultimate exchange rate = 1.3 * ((1 - 0.03)^(1/5))^5 = 1.3*0.97
= 1.261
Asset purchased in USD, valued at time 5 = USD 10,000 / 1.261
= USD 7930.214
USD Asset PV at time zero = USD 7930 / (1 + 2.75%)^5
= USD 6924.298
Valued in CAD = USD 6924 * 1.3
= CAD 9001.588 = Adverse scenario
A liability with a minimum provision needs to be calculated.
Use 5% margin

Projected/Ultimate f/x using risk free rates = 1.3 * [(1 + 2.5%) / (1 + 2.75%)]^5 * (1 - 5%)
= 1.220049
Asset purchased in USD, valued at time 5 = USD 10,000 / 1.22
= USD 8196.395
USD Asset PV at time zero = USD 8196 / (1 + 2.75%)^5
= USD 7156.715
Valued in CAD = 7157 * 1.3
= CAD 9303.729 = Minimum
Reserve = Maximum of Adverse and Minimum scenarios
Reserve = 9304

PfAD = 9304 - 8839
= 465.1865

(d) A Guaranteed Annuity Option gives a policyholder the right to purchase a payout annuity at a guaranteed price at a later date.

(i) Describe the key non-economic assumptions for the valuation of a Guaranteed Annuity Option.

(ii) Describe the considerations for determining the MfAD for each assumption.

Commentary on Question:
Candidates generally described the mortality and policyholder behavior assumptions, but did not provide proper justification. Few candidates described FMI assumptions.

6. Continued

Mortality assumption: the GAO provides policyholder the option to convert their accumulative value of GIC into a Life Contingent Payout annuity, the number of payments depends on the life status of the policy holder, the longer life expectancy, the higher cost of the GAO, so mortality is important assumption

Mortality improvement: the best estimate assumption would include mortality improvement.

Policy behavior assumption: option utilization and anti-selection, those who are healthier tends to utilize this option, as they see themselves more liable to receive more payments, plus it is a high face amount policy, according to the mortality study, higher face amount policy tends to have lower mortality rate

ii
For annuity mortality, the low and high margins for adverse deviations are respectively a subtraction of 5% and 15% of the best estimate
Considerations leading to a margin of at least the average of the high and low margins included:
• Low credibility: the credibility of the company's experience and studies on GAO is possibly low
• Exposure to back-to-back arrangements,
• Potential anti-selection: Policyholder who is healthier tends to utilize the GAO option
• Favorable medical developments may emerge.

SOP does not specifically discuss a standard range of margins for adverse deviations for policyholder options. It would be reasonable to assume a margin in the 5% to 20% range of the best estimate option utilization assumption.

Sensitivity testing could be helpful when multiple assumptions interact to achieve a reasonable level of margin in aggregate.

7. 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.

(2c) Recommend and justify appropriate valuation assumptions.

Sources:

LFV-634-18: CIA Standards of Practice: Insurance Sections 2100, 2300, 2500, April 2017

CIA Education Note, Investment Returns for Non-Fixed Income Returns for Assets, March 2011

Initial Communication of Updated Promulgations of the Ultimate Reinvestment Rates and Calibration Criteria for Stochastic Risk-Free Interest Rates in the Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2330), June 2017

Commentary on Question:

This question tested the candidates' knowledge of valuation standards of practice.

Solution:

(a) Calculate the following items:

(i) Insurance contract liability

(ii) Interest Rate Risk Provision for Adverse Deviation (PfAD)

Show all work.

Commentary on Question:

To receive full credit, candidates had to calculate the insurance contract liability and the interest rate risk provision for adverse deviation. For this, candidates needed to use the correct methodology to calculate and apply the risk-free rates.

The insurance contract liability is the best estimate scenario under CALM. The liability is calculated using the present value of the liability cash flows using the risk-free rate 4.55%.

For part (i), calculate the liability for the prescribed scenario with the largest insurance contract liability, which is Scenario 1 (given).

7. Continued

For part (ii), calculate risk free rates based on the CIA Standards of Practice applicable to Scenario 1. The key is to linearly interpolate between the risk-free rate at time 0 (calculation date) and the Promulgated Ultimate Rate of Return – Low (URR-Low) at time 20 to calculate the risk-free rate at time 2.

Part (i)

$PV_0 = -1{,}000$

$PV_1 = 500 / (1.0455) = 478.24$

$PV_2 = 500 / (1.0455 \times 1.0455) = 457.43$

$PV_3 = 700 / (1.0455 \times 1.0455 \times 1.0455) = 612.53$

Insurance contract liability = -1,000 + 478.24 + 457.43 + 612.53 = 548.20

Part (ii)

$RFR_0 = 4.55\%$

$RFR_1 = 90\% \times RFR_0$

$= 90\% \times 4.55\%$

$= 4.095\%$

$RFR_{20} = 10\% \times RFR_0 + 90\% \times \text{URR-Low}$

$= 0.10 \times 4.55\% + 0.90 \times 1.30\%$

$= 1.625\%$

Calculate risk-free rates between time 1 and 20 using uniform transition:

$RFR_2 = 3.965\%$

$PV_0 = -1{,}000$

$PV_1 = 500 / (1.0455) = 478.24$

$PV_2 = 500 / (1.0455 \times 1.04095) = 459.43$

$PV_3 = 700 / (1.0455 \times 1.04095 \times 1.03965) = 618.67$

Liability = -1,000 + 478.24 + 459.43 + 618.67 = 556.33

PfAD = 556.33 – 548.20 = 8.13

(b)

(i) Explain the approach proposed by the Actuarial Standards Board for assessing the criteria shown in Table I

(ii) Determine whether the output from the model satisfies each criteria. Show all work.

7. Continued

Commentary on Question:
This question tested the candidates' knowledge and application of Actuarial Standards. Full credit was received by correct interest rate calculations at the needed percentile and applying the criteria to model output. Partial credit was received if the market value correction and MfAD were omitted or improperly applied.

The first step is to calculate the slope using the duration 60 results. Next identify the 25th and 75th percentiles. Finally determine whether each percentile passes or fails the criteria.

In calculating the CALM liability, candidates had to state the MfAD percentage for equities and the market value correction.

Part (i)
Criteria satisfied, for each of the initial risk-free rates, if the model produces results that are less than or equal to each of the left-tail calibration criteria and greater than or equal to each of the right-tail calibration criteria.

Part (ii)

Slope = long term risk free rate – short term risk free rate

Run	Long Term	Short term	Slope
1	3.50%	3.25%	0.25%
2	2.50%	2.75%	-0.25%
3	8.75%	7.50%	1.25%
4	9.00%	8.00%	1.00%
5	4.75%	5.00%	-0.25%

Identify the percentiles:

Percentile	Long Term	Short term	Slope
25%	3.50%	3.25%	-0.25%
75%	8.75%	7.50%	1.00%

Finally, test each percentile against the criteria to determine whether the model output satisfies each criteria.

25th percentile	5.00%	3.00%	0.00%
75th percentile	8.00%	7.25%	1.50%

7. Continued

25th percentile	Pass	Fail	Pass
75th percentile	Pass	Pass	Fail

(c) The Chief Actuary feels there is too much interest rate risk in the product, so she decides to change the investment strategy to 90% 1-year risk-free zero-coupon bonds and 10% Canadian equity. She states that a return of 6% per annum is appropriate for Canadian Equity.

(i) Describe the considerations the Chief Actuary would have used in setting this rate of return.

(ii) Calculate the CALM Liability using the new reinvestment strategy. Show all work.

Commentary on Question:
Candidates generally performed well on this part of the question by correctly stating the considerations, determining the Margin for Adverse Deviations (MfAD) and applying it to the CALM liability calculation.

Most candidates provided the percentages and received credit. Partial credit was received if the market value change or MfAD were omitted in the calculation.

In calculating the new CALM liability, first determine the margin for adverse deviation in determining the interest rate assumption. This includes justification for the margin including the 30% market correction.

Part (i)

- Select a benchmark return based on a broad-based market index, such as the S&P 500 and TSX for North American equities
- When selecting the benchmark, consider the investment objectives and the benchmark's historic returns;
- The equity return will vary depending on the class and characteristics of the investments;
- The selected best estimate return should not be more favourable than the historic benchmark return.

Part (ii)

- The MfAD for equities is 20% of the best estimate assumption plus an assumption for change in asset value under adverse conditions.
- That time usually would be the time when their book value is largest.
- The assumed change in value as a percentage of market value of North American common shares would be 30%
- This should be a capital loss (negative margin), i.e. to produce higher liability

7. Continued

Equity growth rate = 6% per annum.

Apply 20% margin to growth rate, resulting in 4.8% per annum. Additional market correction of 30% applies at time 0.

Calculate blended discount rate with MfAD based on 90% fixed income and 10% equity.

Net return at time 0 = $0.9 \times 4.55\% + 0.1 \times (4.8\% - 30\%) = 1.575\%$
Net return at time 1 = $0.9 \times 4.095\% + 0.1 \times 4.8\% = 4.1655\%$
Net return at time 2 = $0.9 \times 3.965\% = 0.1 \times 4.8\% = 4.0485\%$

PV_0 = -1,000
PV_1 = $500 / (1.01575) = 492.25$
PV_2 = $500 / (1.01575 \times 1.041655) = 472.56$
PV_3 = $700 / (1.01575 \times 1.041655 \times 1.040485) = 635.85$
Liability = -1,000 + 492.25 + 472.56 + 635.85 = 600.66

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:

(2c) Recommend and justify appropriate valuation assumptions.

Sources:

CIA Educational Note: Valuation of Universal Life Policy Liabilities

CIA Educational Note: Best Estimates Assumptions for Expenses

CIA Use of Actuarial Judgment in Setting Assumptions and Margins for Adverse Deviations

CIA Educational Note: Margins for Adverse Deviations (MfAD) – November 2006

Commentary on Question:

This question tested the candidates' knowledge in determining expense assumptions. Candidates generally did not do well on this question.

Solution:

(a) Explain differences in the unit expense valuation assumptions for Universal Life (UL) Insurance products versus Whole Life Insurance products.

Commentary on Question:

Most candidates acknowledged that there would be added complexities. Candidates generally discussed policy options, policyholder reporting/statements, and loading to recover acquisition expenses. However, few candidates discussed the other key differences. No credit was given to references to investment income tax, MERs, or other non-unit expenses.

Compared to Whole Life products, UL products have additional complexities resulted from the following:

- With the additional items to consider:
  - Policyholder options, and the rate at which options are exercised
  - Exempt testing
  - Costs for policy-owner reporting / annual statements
  - Automatic policy modifications (e.g. fund bonuses, COIs varying by duration…)
  - Additional expenses if COIs are adjustable
- Investment expenses need to be allocated
- Loadings to recover acquisition expenses may be higher
- If expense charges adjustable, the company would need to quantify how any change in admin expenses are passed along

8. Continued

- MfADs may be different/higher due to changes in policyowner behavior, options, and anti-selection
- Also need to account for explicit expense charges
- Acquisition, administration, and claim expenses usually vary by line of business and within a line of business by product type. Therefore, unit measures usually are established at the product line level.

(b) Recommend changes, if any, to the valuation expense assumptions used for the new enhanced UL product given the information above, with respect to the following:

(i) Best estimate assumptions

(ii) Margins for adverse deviation

Justify your recommendations.

Commentary on Question:
For best estimate assumptions, candidates generally identified factors such as investment expenses, expense from segregated funds, and decreasing unit expenses. Few candidates people identified the other considerations.

Candidates generally provided the correct range of margins, and justified their choice.

(i) To get credit for this part, candidates would need to provide recommendations for the expense of the relevant policies - marketing campaign is irrelevant (for example, option that doubles return may increase the investment expenses on required capital - but still irrelevant)

Given the information on historical growth and projected future growth
- The huge success on traditional block is a good indicator of future growth (and productivity gains) for UL
- Assess how prior experience can guide future experience
- May expect to see decrease in unit expenses from growth, but will need to see expense study that bears this out
- May project improvements in economies of scale beyond the valuation date

8. Continued

Since BDC management has successfully reduced unit expenses over the past few years:

- Need management to have a clear plan to reduce expenses and a prior history of successfully reducing
- Future productivity gains are assumed for only a temporary period
- Look at productivity improvements in different LOBs to ensure net productivity assumption is reasonable in aggregate

With regard to BDC plans to market the new UL product aggressively:

- Need to determine whether the expenses from the marketing campaign are non-recurring

With the information given on the new features of the UL product:

- For the option to go reduced paid-up - need to estimate usage rates and change unit expenses after election
- Investment expenses will be higher because of new investment options
- Might need different type of annual statement to cover all options
- Seg funds:
    - expenses and revenue from related management expense charges are included in valuation CFS
    - Regulatory expense increase because of seg fund investment option

Marketing and product development expenses should be excluded

For the option to switch COI schedules: it may be influenced by the investment or mortality outcomes but the impact is little for expenses

ii) The range of margin is between 2.5% and 10% - with the following considerations, it should be set to be higher or than, or at least the average of 2.5% and 10%

- Since this is a new product, there has not been any expense study yet, therefore there is higher risk in the estimation of future
- The new product is doubling the return on the index, and the best estimate assumption from the original product may not be a good representation of the new product in the future
- The new design of this product may affect the distribution of inforce, and the estimation based on existing distribution (of the UL product to be replaced) may be affected

Another factor to consider is whether the insurer is slow to protect itself against changes, which is not the case for BDC Company, since it was able to successfully handle the changes in the traditional block in recent years.

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:

(4c) Explain and apply methods in determining regulatory capital and economic capital.

(4e) Explain Canadian regulatory capital framework and principles.

Sources:

CIA Draft Educational Note: Life Insurance Capital Adequacy Test (LICAT) and Capital Adequacy Requirements for Life and Health Insurance (CARLI), June 2017

LFV-646-18: OSFI Draft Guideline – Life Insurance Capital Adequacy Test (LICAT), Chapters 1 – 3, 5 – 9, 11, Sept 2017

Commentary on Question:

This question tested the candidates' knowledge of LICAT.

Solution:

(a)

(i) Identify the types of provisions for adverse deviations (PfADs) that can be included in the Surplus Allowance under LICAT.

(ii) Explain the reasons for the exclusion of certain types of PfADs in the Surplus Allowance.

Commentary on Question:

Candidates generally identified the PfADs that can be included in Surplus Allowance. However, most candidates failed to explain the reasons why certain PfADs was excluded.

Solution:

(i) Only PfADs associated with insurance contracts other than segregated fund contracts are allowed in Surplus Allowance.

- Economic PfADs: PfADs relating to scenario assumptions for risk-free interest rates associated with insurance contracts other than segregated fund contracts
- Non-economic PfADs: Mortality risk on life insurance, longevity risk on annuities, morbidity risk, lapse, policyholder behavior risk, and expense risk

9. Continued

(ii) In general, economic PfADs would be included in the surplus allowance only when the corresponding required capital component in the base solvency buffer (BSB) reflects a terminal provision (versus only a one-year shock).

(b)

(i) Determine the shock level for the mortality level risk component. Show all work.

(ii) Determine the overall risk requirement for mortality risk. Show all work.

(iii) Explain the difference between the Life Insurance Capital Adequacy Test (LICAT) Total Ratio and LICAT Core Ratio.

(iv) Determine the LICAT Total and Core Ratios and assess whether they meet the minimum and supervisory levels.

Commentary on Question:
Candidates generally did well on this part of the question. Most candidates correctly calculated the trend and catastrophe components. Fewer candidates correctly calculated the mortality level risk. The most common error was applying the incorrect formula in the calculation of the shock level factor (candidates used the standard deviation of projected death claim instead of volatility RC in the formula).

Candidates were generally able to calculate the LICAT capital and understand the difference between the total LICAT ratio and the core LICAT ratio.

Solution:

(i) The formula for volatility risk component (RC) is following:

$$2.7 * A * {}^{E}/_{F}$$

Where:

- A = Standard deviation of the upcoming year's projected net death claims
- E = Total net amount at risk for all policies
- F = Total net face amount for all policies

$$= 2.7 * 3{,}889 * \frac{1{,}000{,}000}{3{,}500{,}000} = 3{,}000$$

The shock level factor for the mortality level risk
= Min (25%, 11%+ 20%* Volatility RC/Next year's expected claims)
$= \text{Min}\left(25\%, 11\% + 20\% * \frac{3{,}000}{30{,}000} \right)$
= 13%

9. Continued

(ii) Mortality Level Risk:

- Difference in PV of CFs using the extra percentage applied to best estimate
- The shock factor is 13% from part (i)
- Given 2,000 increase in PV CFs for each 10% increase in best estimate
- Mortality Level Risk Component = 13% / 10% * 2,000 = 2,600

Mortality Trend Risk:

- A permanent 75% decrease in future mortality improvement (FMI) for 25 years, followed by no mortality improvement (i.e., a 100% decrease) after that.
- Given a change in PV of CFs for each 10% reduction in FMI in the first 25 years is 400.
- Mortality Trend Risk Component = 75% / 10% x 400 = 3,000

Mortality Catastrophe Risk:

- Shock is an absolute increase in a number of deaths per 1,000 in year following reporting date.
- For Canada, the number of deaths per 1,000 is 1
- Mortality Catastrophe Risk Component = PV Shocked CFs (1 per 1000) - PV Best Estimate Liabilities CF = 17,500 – 16,000 = 1,500

Mortality Volatility Risk = 3,000 (Calculated in Part (i))

Total Mortality Risk Requirement:

$$RC_{Mort} = \sqrt{RC_{Vol}^2 + RC_{Cat}^2} + RC_{Level} + RC_{Trend}$$
$$= \sqrt{3{,}000^2 + 1{,}500^2} + 2{,}600 + 3{,}000 = 8{,}954$$

(iii) $Total\ LICAT\ Ratio = \frac{Available\ Capital + Surplus\ Allowance + Eligible\ Deposits}{Base\ Solvency\ Buffer}$

The Total Ratio focuses on policyholder and creditor protection.

$Core\ LICAT\ Ratio = \frac{Tier\ 1\ Capital + 70\% * (Surplus\ Allowance + Eligible\ Deposits)}{Base\ Solvency\ Buffer}$

The Core Ratio focuses on financial strength.

(iv) Base Solvency Buffer = 1.05 * Total of Capital Requirements
= 1.05*(Credit RC+ Market RC + Lapse RC + Mortality RC + Operational RC)
= 1.05 * (1,000 + 2,000 + 3,000 + 8,954 + 3,000) = 18,852

9. Continued

Available capital is total of Net Tier 1 and Net Tier 2
= 12,000 + 7,000 = 19,000

$$Total\ LICAT\ Ratio = \frac{19{,}000 + 1{,}000 + 500}{18{,}852} = 109\%$$

$$Core\ LICAT\ Ratio = \frac{12{,}000 + 70\% * (1{,}000 + 500)}{18{,}852} = 69\%$$

- The Total LICAT Ratio is above its Supervisory Target of 100% and Minimum level of 90%.
- The Core LICAT Ratio is below its Supervisory Target of 70%, but above its Minimum Core level of 55%.

10. 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.

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:

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

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

Sources:

Can 2-44: CIA Educational Note: Future Income and Alternative Taxes

Commentary on Question:

This question tested candidates' understanding and treatment of taxes within the valuation process. Candidates that demonstrated understanding of the reasoning behind permanent and temporary tax differences, source of recovery for tax losses and calculation of future tax provision arise from temporary difference generally performed well.

Solution:

(a) Determine whether the given situations create a 'permanent' or 'temporary' tax difference for Canadian insurers. Justify your response.

(i) Income from Canadian subsidiaries

(ii) Real estate re-valuation

(iii) Net capital gains on real estate

(iv) Differences between GAAP and tax reserves

Commentary on Question:

To receive full credit, candidates needed to demonstrate the correct classification of permanent and temporary tax difference for each given situation.

10. Continued

(i) This is a permanent difference. Income in reporting periods between tax and GAAP are not fully offset or reversed over the lifetime.
(ii) This is a temporary difference. GAAP uses market value or amortized cost for real estate; while it is valued at depreciated cost for tax purpose
(iii) This is a permanent difference. Only a portion of net capital gains on real estate is included in taxable income
(iv) This is temporary difference. Period to period differences in GAAP and tax income are fully offset (or reversed) over the lifetime of the item.

(b) Determine whether the following are considered sources of recovery for tax losses which can be used in the valuation of policy liabilities. Justify your response.

(i) Expected releases of provisions for adverse deviation (PfAD) in the insurance contracts

(ii) Taxable investment income on current surplus

(iii) Taxable income arising from annuity contracts

(iv) Future new business arising from the sale of new insurance contracts

(v) Renewals of group life and health business

(vi) Expected gains from future mortality improvements on insurance contracts

Commentary on Question:
This part of the question required candidates to correctly identify the source of recovery for tax losses and to justify the response for each item. Candidates who did not justify the response generally did not do well on this part of the question.

(i) This is not considered a source of recoverability. Income is expected to be zero and PfADs are not released.
(ii) This is considered a source of recoverability for income earned from current surplus (net of MfADs). This item does not include planned future capital injections.
(iii) This is considered a source of recoverability. Income emerges as annuity business runs off.
(iv) This is not considered a source of recoverability. Uncertainty of future profits and management decisions associated with future new business.
(v) This is not considered a source of recoverability. Cashflows for group and health business is beyond the term of liabilities
(vi) This is not considered a source of recoverability. Income is expected to zero from future mortality improvement

10. Continued

(c) Calculate the insurance contract liability after carve-out as at year-end 2018.

Show all work.

Commentary on Question:
To receive full credit for this part of the question, candidates had to apply the correct formulas for Discounted Future Tax Provision (DFTP), Insurance Contract Liability Before Carve-Out (ICLBCO), Future Tax Carve-Out (FTCO) and Insurance Contract Liabiilty After Carve-Out (ICLACO).

Candidates did not receive full credit by using pre-tax elements in the calculation.

Difference in reserve = Statutory Reserve – Minimum Tax Actuary reserves
Difference in reserve$_{2018}$ = 1200 -1000 =200
Difference in reserve$_{2019}$ = 1100 -950 =150

Reversal of temporary differences = Difference in reserve in current year – difference in reserve in prior year
Reversal of temporary differences$_{2019}$ = 150-200 = -50
Reversal of temporary differences$_{2020}$ = 0-150 = -150

After tax future tax cashflow of temporary differences = tax rate * temporary differences
After tax future tax cashflow$_{2019}$ = 40% × (-50) = -20
After tax future tax cashflow$_{2020}$ = 40% × (-150) = -60

After tax discount rates = discount rate × (1-tax rates) = 5% × (1-40%) = 3%

DFTP$_{2018}$ = discounted after tax future tax cashflows

$$= \frac{-20}{1.03} + \frac{-60}{1.03^2} = -75.97$$

ICLBCO$_{2018}$ = Statutory reserve$_{2018}$ + DFTP$_{2018}$ =1200 + (-75.97) = 1124.03

FTCO 2018

$$= -\frac{tax\ rate\ \times (Minimum\ Tax\ Actuarial\ Reserve_{2018} - ICLBCO_{2018})}{1 - tax\ rate}$$

$$= -\frac{40\% \times (1000 - 1124.03)}{1 - 40\%} = 82.68$$

ICLACO$_{2018}$ = ICLBCO$_{2018}$ + FTCO$_{2018}$ = 1124.03+82.68 = 1206.71