1. **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.

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

**Sources:**

LFV-106-07: Mergers and Acquisitions, Chapter 4 (Sections 4.1-4.6)

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

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

**Commentary on Question:**

Candidates generally did well on this question. Most candidates demonstrated basic understanding of the underlying concepts. For the qualitative parts, some candidates had a tendency of writing very long answers without staying focused and relevant to what was being asked. When asked to describe impacts from one calculation component being changed, some candidates were not focused on answering the question and gave descriptions that were contradictory.

**Solution:**

(a)

(i) Describe unique aspects of the insurance industry that require actuarial analysis during a merger and acquisition (M&A) transaction.

(ii) List five key assumptions underlying actuarial appraisals.
1. Continued

Commentary on Question:
This part of the question was generally well answered. A minority of candidates were able to list the unique aspects of the insurance industry. Some candidates only stated that few transactions take place and therefore a market price could not be observed, but this is not uniquely applicable to insurance. Most candidates were able to list many key assumptions, though some candidates only addressed the value of the business needs to be projected, without describing the underlying variables that would need assumptions within that projection.

(i) Insurance liabilities can extend over a very long period of time. Insurance companies therefore have long term fiduciary responsibilities to policyholders. Further, insurance liabilities involve a great deal of uncertainty. The projection of the risks and the setting of reserves thus require actuarial techniques and analysis. Finally, the insurance industry is subject to specialized statutory accounting and capital requirements, determined by insurance regulators. Interpreting these regulatory reporting requirements requires actuarial expertise.

(ii) Key assumptions include: mortality, morbidity, lapse and persistency, investment returns and spread, operating expenses, determining the appropriate discount rate, cost of capital, and taxes.

(b) Calculate the Embedded Value (EV) as at December 31, 2018. Show all work.

Commentary on Question:
Many candidates got the correct discount rate. Most candidates knew to calculate a WACC, but often candidates neglected to make the cost of debt after tax. Some candidates subtracted the risk-free rate from the risk premium given in the question without realizing that the given value was itself already the difference versus the risk-free rate. Candidates correctly calculated the Adjusted Net Worth, but most candidates struggled with the Inforce Business Value component. Candidates often included the time zero profit in the go forward PV Book Profit, and incorrectly captured the timing of when each period’s cost of capital is incurred.

Discount rate, using CAPM and implicit recognition of debt:
Weighted Average Cost of Capital = 70% equity * cost of equity + 30% * cost of debt = 0.08185
Cost of equity = r + (beta * market risk premium) = 0.026+(1.4*0.055) = 10.3%
Cost of debt = 0.05 * (1-tax rate) = 0.05*(1-0.35) = 3.25%
1. Continued

\[ EV = \text{Adjusted Net Worth} + \text{Inforce Business Value} \]
\[ ANW = \text{Required Capital} + \text{Free Surplus} = 500 + 100 = 600 \]
\[ IBV = \text{PV Book Profit} – \text{PV Cost of Capital} = 211.69 \]
\[ PVBP = 90v + 95v^2 + 103v^3 = 245.71 \]
\[ PV\text{CoC} = 500*(0.08185-0.06)v + 480*(0.08185-0.06)v^2 + 460*(0.08185-0.06)v^3 \]
\[ + 440*(0.08185-0.06)v^4 = 34.02 \]
where \( v = 1/(1 + \text{WACC}) \)
\[ EV = 600 + 211.69 = 811.69 \]

(c) Explain the impact of each of the following events on the various components of Embedded Value for this company. Calculations are not required.

(i) Corporate tax rate decreases

(ii) A shift in the company’s business to less risky traditional products

**Commentary on Question:**
*Candidates did well on this part of the question. Most candidates were able to describe how the components of the EV calculation moved with the changes in the question. Some candidates did not demonstrate understanding of the interactions.*

(i) Firstly, a decrease in the corporate tax rate causes after tax book profits to be larger. This increases the Inforce Book Value since PV of book profits would be higher. Secondly, a lower corporate tax rate would increase the cost of debt, which in turn increases the weighted average cost of capital, thus amounts on a PV basis would decrease. While these two changes are directionally opposite, the impact of higher after-tax profits will more than offset the impact of discounting at a higher rate. Therefore, \( EV \) will be higher.

(ii) Currently, the company’s beta is greater than one. When insurance companies offer less risky traditional products, they usually have a beta of less than one, so a decrease in beta is expected here. This would reduce the cost of equity, thereby reducing the WACC, and amounts on a PV basis will be larger. In addition, shifting to less risky products would reduce the amount of required capital that needs to be held. In the other direction, lower risk traditional products will likely be less profitable.
1. Continued

(d) Assuming a hurdle rate of 9%:

(i) Calculate the risk adjusted return on capital (RAROC) and Economic Value Added (EVA) as at December 31, 2018

(ii) Determine if the company is creating value for shareholders based on these metrics.

Commentary on Question:
Candidates generally did well on this part of the question. Most candidates knew the relationship of RAROC versus hurdle rate and its implication on value creation. A few candidates mistakenly thought that value was being created as long as the two were equal. Some candidates were confused as to which values should be used for Risk Adjusted Capital, and erroneously used Required Capital instead of Economic Capital. There were also candidates who thought EVA was a percentage metric, or that RAROC was a dollar metric.

RAROC = NOPAT / Risk Adjusted Capital = 49.5 / 550 = 9%
where Risk Adjusted Capital = Economic Capital

RAROC = (EVA / Risk Adjusted Capital) + Cost of Capital
Since Cost of Capital = Hurdle Rate = 9%,
Then RAROC = 9% = (EVA / 550) + 9%, and EVA = 0

In order to create shareholder value, RAROC must exceed Cost of Capital, or expressed differently, EVA must exceed 0.

Therefore, in this case, the company is neither creating nor destroying value.
2. **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.

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

**Learning Outcomes:**

(1a) Construct the basic financial statement or its components for a life insurance company.

(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:**


**Commentary on Question:**

*Commentary listed underneath question component.*

**Solution:**

(a) Construct ABC's statutory income statement and year-end balance sheet for 2018. Show all work.

**Commentary on Question:**

*This part of the question tested the candidates’ ability to create an income statement and balance sheet under a reinsurance agreement. Candidates generally did well on this part of the question. Most candidates created an appropriate income statement with reasonable calculations. The most common omissions were the policy fee, annual cession fee, or maintenance expense. Some candidates incorrectly classified the components (for example, categorizing an expense item as revenue). Candidates struggled more with constructing a balance sheet or splitting out items that do not belong on a balance sheet (for example including investment income as its own item).*

*The sample solution below assumes that the commission is based on the full premium received (including the annual policy fee). Full credit was given if the annual policy fee was excluded from the commission calculation.*
The Investment Income calculation assumes that all time 0 cash flows accrue investment income. Full credit was also rewarded for calculating investment income based on starting surplus only (consistent with Life, Health and Annuity Reinsurance, Tiller: Chapter 4).

Income statement
NAR ceded =

ceded % x face amount x (1 - terminal reserve per 1,000 / 1,000) =
0.75 x 1,000,000 x (1 - 0 / 1,000) = 750,000

gross premium =
(premium per 1,000) x face amount / 1,000 + annual policy fee =
10 x (1,000,000 / 1,000) + 50 = 10,050

ceded premium =
NAR ceded x (YRT premium per 1,000 / 1,000) + annual cession fee =
750,000 x (0.5 / 1,000) + 25 = 400

reinsurance allowance =
expense allowance % x ceded premium =
0.02 x 400 = 8

gross reserve =
face amount x (mean reserve per 1,000 / 1,000) =
1,000,000 x (0.55 / 1,000) = 550

ceded reserve =
NAR ceded x (YRT mean reserve per 1,000 / 1,000) =
750,000 x (0.4 / 1,000) = 300

commissions =
commissions % x gross premium =
0.95 x 10,050 = 9,547.50

premium tax =
premium tax % x gross premium =
0.02 x 10,050 = 201

expenses =
commissions + first year per policy + premium tax =
9,547.50 + 500 + 201 = 10,248.50
investment income =
investment rate of return \times (\text{initial surplus} + \text{gross premium} - \text{ceded premium} + 
\text{reinsurance allowance} - \text{expenses}) = 
0.05 \times (1,200 + 10,050 - 400 + 8 - 10,248.50) = 30.48

revenue =
gross premium - ceded premium + reinsurance allowance + investment income = 
10,050 - 400 + 8 + 30.48 = 9,688.48

benefits =
claims + surrenders + increase in gross reserve - increase in ceded reserve = 
0 + 0 + (550 - 0) - (300 - 0) = 250

gain from operations =
revenue - benefits - expenses = 
9,688.48 - 250 - 10,248.50 = -810.02

\begin{tabular}{lcc}
\text{Revenue:} & \multicolumn{2}{c}{9,688.48} \\
\text{Premium:} & \multicolumn{2}{c}{} \\
\quad Gross & 10,050 & \\
\quad Ceded & 400 & \\
\quad Net & 9,650 & \\
\text{Investment Income} & 30.48 & \\
\text{Reinsurance Allowance} & 8 & \\
\multicolumn{2}{c}{\text{TOTAL REVENUE}} & 9,688.48 \\
\end{tabular}

\begin{tabular}{lcc}
\text{Benefits:} & \multicolumn{2}{c}{} \\
\text{Claims} & 0 & \\
\text{Surrenders} & 0 & \\
\text{Reserve Increase:} & \multicolumn{2}{c}{} \\
\quad Gross & 550 & \\
\quad Ceded & 300 & \\
\quad Net & 250 & \\
\multicolumn{2}{c}{\text{TOTAL BENEFITS}} & 250 \\
\end{tabular}

\begin{tabular}{lcc}
\text{Expenses:} & \multicolumn{2}{c}{} \\
\text{Commissions} & 9,547.5 & \\
\text{Maintenance} & 500 & \\
\text{Premium Tax} & 201 & \\
\multicolumn{2}{c}{\text{TOTAL EXPENSES}} & 10,248.50 \\
\text{GAIN FROM OPERATIONS} & -810.02 & \\
\end{tabular}
2. Continued

Balance sheet
assets =
initial surplus + revenue - claims - surrenders - expenses =
1,200 + 9,688.48 - 0 - 0 - 10,248.50 = 639.98

liabilities =
gross reserve - ceded reserve =
550 - 300 = 250

surplus =
assets - liabilities =
639.98 - 250 = 389.98

Balance Sheet

Assets
Invested Assets  639.98
TOTAL ASSETS  639.98

Liabilities and Capital
Policy Reserves
  Gross  550
  Ceded  300
  Net  250
TOTAL LIABILITIES  250

Surplus  389.98
TOTAL CAPITAL  389.98

TOTAL CAPITAL AND LIABILITIES  639.98

Alternative solution
This solution is identical to the solution above, except it uses the textbook approach for investment income. The calculations for investment income are shown below, along with the calculations for all items that are impacted by investment income. All other calculations are unchanged from the solution above.

investment income =
investment rate of return x (initial surplus + initial reserve) =
0.05 * (1,200 + 0) = 60
2. Continued

\[
\text{revenue} = 10,050 - 400 + 8 + 60 = 9,718
\]

\[
\text{gain from operations} = 9,718 - 250 - 10,248.50 = -780.50
\]

\[
\text{assets} = 1,200 + 9,718 - 0 - 0 - 10,248.50 = 669.50
\]

\[
\text{surplus} = 669.50 - 250 = 419.50
\]

(b) Critique the following statements with respect to XYZ Re’s reinsurance practices and procedures. Assume XYZ Re is an OSFI regulated entity.

A. **XYZ Re’s Reinsurance Risk Management Policy (RRMP) is part of its overall risk management plan. It includes XYZ Re’s policy on the use of registered reinsurance. The RRMP is overseen and approved by senior management. The RRMP is required to be reviewed every three years to reflect changing market conditions. A Chief Reinsurance Officer is responsible for implementing the RRMP.**

B. **XYZ Re evaluates the ability of all current and potential reinsurance counterparties to meet their liabilities based on their external ratings. Reinsurance counterparties who are rated AA (or equivalent) or higher by at least two rating agencies are exempt from the evaluation. Other reinsurers are subject to XYZ Re’s due diligence, where XYZ Re will consider the reinsurance counterpart’s claims payment record, expected future claims obligations, balance sheet strength, funding sources, management, and retrocession arrangements. Reinsurance counterparties should be reevaluated anytime their external ratings are downgraded by one or more rating agency.**

C. **A subsidiary company of XYZ Re that enters into a reinsurance contract with XYZ Re is not subject to the same level of due diligence provided the subsidiary company is 100% owned by XYZ Re or the subsidiary is rated AA (or equivalent) or higher.**

D. **Policies and procedures are in place to ensure reinsurance contracts are unambiguous, comprehensive, written and binding. Reinsurance contracts can be executed up to 30 days after the effective date.**

E. **Reinsurance contracts should not contain terms or conditions that may limit XYZ Re’s ability to enforce terms of the contract in the case of insolvency. Funds withheld arrangements will form part of XYZ Re’s estate as part of insolvency.**
2. Continued

F. The Chief Reinsurance Officer annually declares to the Board that XYZ Re meets the reinsurance risk management practices and procedures set out in OSFI’s guidelines.

Commentary on Question:
This part of the question tested the candidates’ understanding of OSFI’s reinsurance procedures and policies. Candidates generally did well on this part of the question and communicated most or all the key points. For statements A through D, full credit was given if the candidate only pointed out the areas of the statement that needed to be improved without clarifying that the rest of the statement was correct. For statements E and F it was necessary to either state that the statement was correct, or provide commentary that demonstrated that the candidate understood that the statement was correct.

For statement D candidates that identified the necessity to have an unambiguous legally binding bridge contract in place if the contract is executed after it becomes effective received full credit.

A) • It is appropriate for XYZ to include a Reinsurance Risk Management Policy as part of its overall risk management plan
• XYZ should include its policy on both registered and unregistered reinsurance
• The RRMP should be implemented by senior management but approved by the board
• The RRMP should be reviewed annually not every three years
• It is appropriate to have a Chief Reinsurance Officer who is responsible for implementing the RRMP

B) • XYRE should not rely on external ratings for its evaluations. All reinsurers (including those rated AA or higher) should be included.
• The list of items to consider as part of XYZ Re’s due diligence is appropriate
• Reevaluations should be done throughout the lifetime of the contract, not just when there is a ratings downgrade.

C) • It is not appropriate to reduce the level of due diligence for a subsidiary (regardless of if they are AA or higher, or 100% owned). The same level of due diligence is required for subsidiaries as for unrelated reinsurers.
2. Continued

D) It is appropriate for the contract to be unambiguous, comprehensive, written, and binding. The contract should be executed before the effective date.

E) This statement is appropriate

F) This statement is appropriate
3. **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:**

(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:**

Educational Note Comparison of IFRS 17 to Current CIA Standards of Practice, September 2018

LFV-141-18: IFRS 17 Insurance Contracts – IFRS Standards Effects Analysis, May 2017, IASB (section 1, 2, 4, 6, 9 and Appendix A&B)

Educational Note on Setting Expected Mortality Assumption in CGAAP Life Insurance Valuation

CIA Educational Note: Margin for Adverse Deviations (MfADs), November 2006

**Commentary on Question:**

*Commentary listed underneath question component.*

**Solution:**

(a) Explain the purpose of including margins for adverse deviations (‘MfADs’) in CALM reserves.

**Commentary on Question:**

*Candidates generally did well on this part of the question. Candidates were given credit for other reasonable explanations but did not receive credit for simply stating MfADs help to increase reserve.*

- The purposes of including MfADs should take account of the effect of the uncertainty of the assumptions and data for the CALM reserve calculation, but not take account of the possibility of catastrophe or events that are implausible to occur under usual operations.
- The uncertainty of the assumptions and data exists due to any mis-estimation of the risk, deterioration or potential improvement in the best estimate assumptions.
3. Continued

- MfADs should reflect the level of confidence that actuaries have in the best estimate assumptions.
- MfADs should also reflect the level of precision used, the distance (or timing) of when the event is expected to occur, and the potential financial impact of the consequence of the event including the statistical fluctuation of the event when and if it occurs.

(b)

(i) Describe four significant considerations that may impact the error of estimation of the best estimate morbidity assumption.

(ii) Recommend an appropriate MfAD by gender that BDC Life should use for the following assumptions:

- incidence rates
- termination rates

Justify your answers.

Commentary on Question:
Candidates generally did poorly on part (i). Candidates were given credit for other reasonable considerations such as unknown homogeneity of the business, and lack of experience in claims adjudication practices. Some candidates only listed the considerations without any description.
Candidates generally did well on part (ii). Candidates were required to justify each incidence and termination rate assumption by gender to receive full credit. Candidates were only given partial credits if MfADs were proposed without strong justifications by gender.

(b) (i) Four considerations that may impact the error of estimation of the best estimate morbidity assumptions:
- Lack of Credibility - given the low exposure to disability claims with only 75 lives disabled in any given month, and generally 3007 lives are being required to establish full credibility (This assumes the criteria for a good credibility method also applies here.)
- Lack of Diversification – There is very little exposure to females as the entire block purchased is predominantly male. This lack of diversification requires higher margins for females for both incidence and termination rates.
- Limited to No Underwriting Expertise – BDC life recently entered this market and have little experience or expertise in UW techniques/Admin system, etc.
- Additional Operational Risk – Given the lack of experience of running a disability block, BDC life is exposed to additional operational risk.
3. Continued

(ii) SOP recommends the following ranges for incidence rates and termination rates:

- An addition of 5% to 20% of the best estimate assumption for morbidity incidence rates
- A subtraction of 5% to 20% of the best estimate assumption for morbidity termination rates

Due to the signification considerations on lack of credibility of the data, higher operational risk and lack of expertise in underwriting procedures, MfADs that are at least the average of low and high end are recommended for both assumptions:

- For incidence rates, margins in the range of (12.5%, 20%) are recommended for males. As female experience is even less credible, an MfAD that is higher than for males is recommended. For example, 15% is recommended for male and 20% is recommended for female.
- For termination rates, margins in the range of (-20%, -12.5%) are recommended for males. As female experience is even less credible, an MfAD that is higher than for males is recommended. For example, -15% is recommended for male and -20% is recommended for female.

(c) Discuss the differences between the following:

- Provisions for Adverse Deviation under the current standards of practice
- Risk Adjustments under IFRS 17

Commentary on Question:

Most candidates received partial credit by correctly stating one or two differences. Most candidates discussed the key difference that IFRS 17 includes provision for non-financial risk only while current SOP provides uncertainty for both economic and non-economic assumptions.

Differences between PfADs under SOP vs. Risk Adjustments under IFRS 17 are as follows:

- The PfADs under the current SOP cover uncertainty for both economic and non-economic assumptions while IFRS 17 includes provision for non-financial risk only. Provisions for financial risk under IFRS 17 are included either by adjusting the discount rate or by adjusting the cash flows with no provision being held for any asset liability mismatch or investment expense risk.
- Risk adjustment for non-financial risk under IFRS 17 depends on the entity’s own compensation requirements for taking risk, rather than exclusively on the uncertainty of the estimated future cash flows.
3. Continued

- A new requirement under IFRS 17 is to disclose the confidence level to which the risk adjustment for non-financial risk corresponds. This is not required under current SOP.
- The entity can apply different methods to determine the risk adjustment for non-financial risk, such as the “cost of capital” method or the “confidence level” method, or any other method that satisfies certain criteria, while PfADs under current SOP have recommended MfADs ranges to be applied for non-financial risk assumptions.
- The current level of PfADs (with selected MfADs) provides for level of uncertainty but not for level of confidence or entity-specific compensation required for bearing the uncertainty.
- Current SOP suggests consideration of diversification benefits that is often done implicitly and would include consideration of both financial risk and non-financial risk, while IFRS 17 requires the risk adjustment for non-financial risk to reflect the degree of diversification benefit the entity includes when determining the compensation and it requires for non-financial risk only.
- PfADs under current SOP are done on a net basis for reinsurance contracts and must be done for direct and ceded business separately under IFRS 17.
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.
   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.

(1e) Apply and recommend methods for performing reviews of financial statements including reserves.

(2c) Recommend and justify appropriate valuation assumptions.

**Sources:**
CIA Educational Note: CALM Implication of AcSB Section 3855 Financial Instruments-Recognition & Measurement (June 2006)

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

**Commentary on Question:**
*Candidates generally did not demonstrate knowledge of the impact of asset designations on the income statement and liabilities.*

**Solution:**
(a) 
(i) Management proposes to designate bonds backing the liabilities as Available for Sale (AFS) as they expect that bonds will be sold and replaced with new bonds over time. Critique this proposal.

(ii) Discuss an alternate designation for the bonds supporting the liabilities of the whole life policies. Justify your answer.

**Commentary on Question:**
*Several candidates focused on the impact of AFS assets on Investment Income and not the Income statement. Partial credit was given for suggesting Held-to-Maturity. This is not ideal as the question indicated assets will be sold and replaced. As Whole Life cash flows will be variable, the company cannot rely on being able to hold bonds until maturity.*
4. Continued

(i) AFS are carried at market value on the balance sheet. Treatment of investment income is split: Regular investment income is booked to the income statement but market value movements resulting from changes in yield curve is booked to OCI. Under CALM, liabilities are set equal to the market value of the supporting assets, and the full change in liabilities goes through the income statement. Hence, use of AFS will create an income statement mismatch when there are market value movements in assets: Investment income will be split between income and OCI while the offsetting change in liabilities will be fully recognized in income. Income statement results will be unintuitive and difficult to explain.

(ii) Alternative designation is Held-for-Trading (HFT) or Fair Value Option (FVO). Under this designation, assets are held at market value and all of the investment income goes through the income statement. Hence, any investment income resulting from market value movements will be fully offset by the change in liabilities. This will eliminate the income volatility and make results more understandable.

(b) Recommend appropriate valuation assumptions for any Canadian common shares used to support the liabilities. Justify your recommendation.

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

Best estimate assumption should not be more favourable than historical benchmark. Use of TSX over a long period would be acceptable. Total (e.g.: 10%) should be split between capital gains and dividend income

Pads:
20% reduction for capital gains plus a 30% one-time market value shock, at the point where it maximizes liabilities. Determined through testing.
A pad on dividend income between 5-20%. Recommend 12.5% (average of low and high range) or higher as HFX is a new company.
Projected equity balances must be in line with the Company’s investment strategy.
In addition, total investment in equity must meet the 20/20/75 rule, which is that the value of the equities cannot exceed 20% of the cashflows for the first 20 years, and 75% thereafter.

(c) Explain the challenges related to the true-up process used when the CALM analysis is run prior to the balance sheet date.
4. Continued

Commentary on Question:
Candidates were generally able to describe roll-forward process, but not the challenges associated with the process.

CALM is generally run off valuation date with a PPM approximation used to generate results. This process must take into account the change in fair value of assets since the run date.

Challenges:
Develop true-up process to reflect values as of the reporting date.
Process needs to be well designed and produce acceptable results.
Process needs to be repeatable. Should be well documented and auditable.
Additional controls needed to ensure process is accurate and any approximations are acceptable.

(d)

(i) List four controls commonly used to ensure that any differences in the policy liabilities, period over period, are explained.

(ii) Describe how the change in the fair value of assets is incorporated in each control.

Commentary on Question:
Candidates generally listed some or all of the controls but were not able to describe how the change in the fair value of assets were incorporated.

Some of the common controls used to monitor and explain change in liabilities are:
Trend analysis – Monitoring historical patterns
Roll-forward analysis – Roll forward by category – e.g.: new business, terminations, basis changes, aging.
Policy movement analysis – Changes in reserve attributed to underlying cause – e.g.: expected change, variance due to mortality, variance due to lapses
Source of Earnings – Built from policy movement to explain income statement.
Duration calculations – Measure duration of cash flows, ensure changes can be explained
Yield analysis – Ensure asset yields are consistent
Inclusion Controls – Controls over policy counts and movement
4. Continued

Changes in the fair value of assets:
Assuming an HFT designation for assets, any changes in the yield curve will result in unrealized gains and losses in investment income offset by an equal change in liabilities. This amount has no impact on the Company’s income and therefore should be backed out of any reserve analysis in order to ensure comparable results over time.
Hence, it is necessary to track investment income split between regular investment income and unrealized gains and losses due to market movement.

This would not apply to inclusion controls as this method does not rely on the value of the liabilities.
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-141-18: IFRS 17 Insurance Contracts – IFRS Standards Effects Analysis, May 2017, IASB (section 1, 2, 4, 6, 9 and Appendix A&B)

PwC In Depth a Look at Current Financial Reporting Issues Jun 2017

Commentary on Question:
This question tested the candidates’ knowledge on emerging standards, in particular IFRS 17.

Candidates performed well on this question, with most candidates completing parts (a) and (b) correctly.

For part (c), many candidates did not correctly calculate the CSM amortization. Common errors included incorrect use of year-start vs. year-end amounts, formula errors and incorrect interest accretion treatment. Candidates who did well correctly performed the CSM amortization and interest accretion calculations.

Solution:
(a) Outline the grouping requirements for insurance contracts in IFRS17.

IFRS 17 requires insurance contracts to be grouped into:
1. Onerous at initial recognition
2. Contracts that have no significant probability of becoming onerous
3. Other profitable contracts

Groups limited to contracts issued within one year of each other.

(b) Calculate the following at issue:

(i) Contractual Service Margin (CSM)

(ii) Amount immediately recognized in profit or loss

Show all work.
5. Continued

**Male Cohort:**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Premium</td>
<td>300,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected Death Benefit</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
</tr>
</tbody>
</table>

Present Value of Cashflows = -300,000 + 100,000v + 100,000v^2 + 100,000v^3 + 100,000v^4 + 100,000v^5 = 132,948

Given Risk Adjustment = 0

Contractual Service Margin = max (-FCF, 0)

= max (-132,948, 0)

= 0

Amount recognized immediately = Loss of 132,948

**Female Cohort:**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Premium</td>
<td>1,500,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected Death Benefit</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
</tr>
</tbody>
</table>

Present Value of Cashflows = -1,500,000 + 100,000v + 100,000v^2 + 100,000v^3 + 100,000v^4 + 100,000v^5 = -1,067,052

Given Risk Adjustment = 0

Contractual Service Margin = max (-FCF, 0)

= max (1,067,052, 0)

= 1,067,052

Amount recognized immediately = 0

**Combining results of Male and Female cohorts:**

Contractual Service Margin = 0 + 1,067,052

= 1,067,052

Amount recognized immediately in P/L = Loss of 132,948 + 0

= Loss of 132,948
5. Continued

(c) Two years have passed since the policies were issued. You are given:

- The CSM for the female group at the end of first year is 1,000,000.
- The female mortality assumption has been updated, yielding the following projected lives for females:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>50</td>
<td>49</td>
<td>48</td>
<td>45</td>
<td>42</td>
<td>39</td>
</tr>
</tbody>
</table>

- The Coverage Unit (CU) used for CSM amortization is the face amount inforce at year start.

Calculate the CSM for the female group at the end of year 2. Show all work.

CSM after interest accretion = 1,000,000 * (1.05)  
= 1,050,000

FCF before assumption update = 100,000v + 100,000v^2 + 100,000v^3 = 272,325

FCF after assumption update = 300,000v + 300,000v^2 + 300,000v^3 = 816,974

Increase in present value of Fulfilment Cashflows = 816,974 – 272,325  
= 544,650

CSM at the end of year 2 before amortization = 1,050,000 – 544,650  
= 505,350

Calculation for CSM amortization:

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face value per contract</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>Number of lives at start of year</td>
<td>49</td>
<td>48</td>
<td>45</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Face value x lives (coverage units or CU)</td>
<td>4,900,000</td>
<td>4,800,000</td>
<td>4,500,000</td>
<td>4,200,000</td>
<td></td>
</tr>
<tr>
<td>Total % sum assured (Amortization percentage)</td>
<td>27%</td>
<td>26%</td>
<td>24%</td>
<td>23%</td>
<td></td>
</tr>
</tbody>
</table>

Amortization Amount = 27% * 505,350 = 134,577

CSM at the end of year 2 after amortization = 1,050,000 – 544,650 – 134,577  
= 370,773
6. **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.

(1e) Apply and recommend methods for performing reviews of financial statements including reserves.

**Sources:**

Participating account management and disclosure to par policyholders


**Commentary on Question:**

*Commentary listed underneath question component.*

**Solution:**

(a) Describe the purpose of each of the three par sub-accounts.

**Commentary on Question:**

*Candidates did not do well on this part of the question. Candidates had to identify demutualization as the key milestone to separate Open and Closed blocks, not whether the product was open to New Business or not (Open block could contain blocks closed to business as well). Few candidates addressed whether the ancillary sub-account could include other “non-par” like policies from pre-demutualization.*

SBX Life demutualized on January 1, 2001

- The closed sub-account contains par policies sold prior to the date of demutualization
- The Open sub-account contains par policies sold after demutualization
- PfADs are to be held in a separate ancillary sub-account of the participating account
- The Ancillary sub-account may also include riders or other policies that pay no dividends
6. Continued

(b) You are reviewing the following Statement of Changes for the closed block included in the year-end financial statements for the participating accounts:

<table>
<thead>
<tr>
<th>Statement of Changes</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening Surplus as at Dec 31, 2017</td>
<td>230</td>
</tr>
<tr>
<td>Currency Adjustment</td>
<td>4</td>
</tr>
<tr>
<td>Net Earnings before the payment of Policyholder Dividends</td>
<td>125</td>
</tr>
<tr>
<td>Policyholder Dividends distributed for the year</td>
<td>(175)</td>
</tr>
<tr>
<td>Amounts distributed to shareholders</td>
<td>(4)</td>
</tr>
<tr>
<td>Closing Surplus as at Dec 31, 2018</td>
<td>180</td>
</tr>
<tr>
<td>Total Assets</td>
<td>31,980</td>
</tr>
</tbody>
</table>

(i) Assess the appropriateness of items included in the Statement of Changes

(ii) Assess the appropriateness of the management actions regarding distributions from the par account

Commentary on Question:
Candidates did not do well on this part of the question. Candidates failed to identify surplus as the terminology for disclosure for Open blocks, and very few candidates were able to point out that the total assets amount disclosed was incorrect. Candidates who noted no amount should be distributed to shareholders in part (i) received partial credit.

(i) For Closed blocks, instead of opening and closing surplus, we should have opening and closing excess. Note surplus is terminology used for disclosing requirements for Open block.

To further clarify, excess is the amount by which the value of the assets of the closed block exceeds the amount of the policy liabilities of the closed block.

The total liability of the closed block can be calculated as follow:
Total Closed Block Liability = Best Estimate Future Experience + Present Value of Future Dividends + Dividend Stabilization Reserve
= 25,000 + 4,000 + 2,300
= 31,300

Note the Provisions for Adverse Deviation belongs to the ancillary account and should not be included here for the closed block.

Thus, “Total Assets” should equal closing excess plus liability
= 31,300 + 180 = 31,480
6. Continued

(ii) It is noticed that the SBX Life has distributed policyholder dividends more than the amount earned last year, however, such allocation is considered appropriate given current year DSR is also fairly high. The company is likely trying to distribute some of the excess DSR it has built up from prior periods.

In addition, for the closed fund, SBX Life should not be transferring any amount to shareholders, as shareholders get profit through the release of PfADs held in the Ancillary sub-account.

(c) Over the years, the closed block has diminished in size.

(i) Explain the risks involved with managing dividends for a small closed block in conjunction with an ongoing open block.

(ii) Propose how the company should manage this risk.

**Commentary on Question:**
Candidates generally did well on this part of the question. Candidates identified tontine as the key risk and offered DSR to be the tool to use for managing this risk. Common omissions included specifics of how to use DSR to manage the risk, and discussion of an independent peer review as additional way to manage the risk. Partial credit was awarded for proposing to merge the remaining closed block with open block upon OSFI approval.

(i) One of the key risks to avoid is the tontine effect, under which dividends are inappropriately shifted from current policies to a smaller number of policies which remain active in future years.

(ii) DSR - Dividend Stabilization Reserve should be used to avoid the tontine effect, and the DSR, positive or negative, should not continue to grow for an extended period.

In addition, OSFI expects that each company has a policy with respect to the maximum operational size of the DSR for each closed participating account and that at least the amounts in excess of this will be distributed in a timely manner to policyholders through modification of the policyholder dividend scale

Also, SBX Life should have an independent actuary to review and offer an opinion as to whether the policyholder dividend policy and the actual payment of dividends are fair to the closed block participating policyholders, are consistent with their reasonable dividend expectations, and are such that the emergence of a tontine is avoided.
6. Continued

(d) The Appointed Actuary for SBX Life has:

- Worked for SBX Life for the past 15 years
- Performed valuation of SBX Life’s actuarial liabilities for past 7 years
- Had the role of Chief Operating Officer of SBX Life but is no longer in that role
- Ensured SBX’s Life’s compliance with CIA’s Standards of Practice and current regulation and legislation
- Kept current with CIA’s continuing professional development requirement
- Been the subject of an adverse finding by a CIA Disciplinary Tribunal

Critique the suitability of the above actuary as an Appointed Actuary for SBX Life in accordance with guidelines of the Office of Superintendent of Financial Institutions (OSFI).

Commentary on Question:
Candidates generally did well on this part of the question. A common error by candidates was immediately disqualify the AA candidate given he/she has been the subject of an adverse finding by a CIA Disciplinary Tribunal, whereas he/she can still be appointed upon OSFI approval.

- Candidate must have worked in Canada for at least 3 of the last 6 years. Candidate meets this requirement.
- For at least one of those years, the candidate must have performed valuation of Canadian actuarial liabilities of an insurance company. Candidate meets this requirement.
- Candidate must have experience with the CIA’s Standards of Practice and relevant insurance legislation and regulation. Candidate meets this requirement.
- Candidate should be up to date with respect to the CIA’s Continuing Professional Development requirement. Candidate meets this requirement.
- Candidate 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.
- Overall, the said candidate is highly likely to be appointed, pending further review of the CIA Disciplinary Tribunal circumstances.
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:
(2a) Compare and apply methods for life and annuity product liabilities.

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

Sources:
CIA Educational Note: Reflection of Hedging in Segregated Fund Valuation (May 2012)

Commentary on Question:
This question tested the candidates’ knowledge of the approaches used to reflect hedging in the valuation of Segregated Fund liabilities. Candidates generally did not do well on this question.

Solution:
(a) Calculate the liability under the First Principles Stochastic-on-Stochastic (SOS) Method for the sample real-world path. Show all work.

Commentary on Question:
This part of the question tested the candidates’ knowledge of hedging under the First Principles Stochastic-on-Stochastic (SOS) approach. Many candidates did not know that a European Put Option can only be exercised at maturity. Also, when calculating the hedge payoffs, candidates did not apply the delta and the rho to the equity and interest changes respectively. Full credit was awarded for discounting using a flat 3% or for discounting using the projected risk-free rates. The solution below is based on a flat 3%.

The liability can be broken down into the following four components:

(1) The present value of the fee portion of liability cash flows.

\[
PV \text{ Fees net of hedge costs} = \frac{5}{(1.03)^{-1}} + \frac{5}{(1.03)^{2}} + \frac{5}{(1.03)^{3}}
= 14.1
\]

(2) The present value of the claims portion of liability cash flows.

The European put option can only be exercised at maturity, where the guarantee value is 1000 and the market value is 988.

\[
PV \text{ Claims} = \frac{(1000 - 988)}{(1.03)^{3}}
= 11.0
\]
(3) The present value of the equity portion of the hedge payoff.

The payoff for the hedge is 100% of the delta times the change in equity.

At time 1, payoff = (-3.30 * -5%) * 100 * 100% = 16.5
At time 2, payoff = (-3.90 * 2%) * 100 * 100% = -7.8
At time 3, payoff = (-4.40 * 2%) * 100 * 100% = -8.8

PV Hedge Payoff (equity change) = 16.5/(1.03^1) -7.8/(1.03^2) – 8.8/(1.03^3) = 0.6

(4) The present value of the interest portion of the hedge payoff.

The payoff for the hedge is 80% of the rho times the change in interest.

At time 1, payoff = (-1.60 * 0.0%) * 10 * 80% = 0
At time 2, payoff = (-1.20 * -0.5%) * 10 * 80% = 4.8
At time 3, payoff = (-0.70 * 0.5%) * 10 * 80% = -2.8

PV Hedge Payoff (interest change) = 4.8/(1.03^2) – 2.8/(1.03^3) = 2.0

Total Liability = PV Claims – PV Fees net of hedge costs – PV Hedge Payoffs
= 11.0 - 14.1 - 0.6 - 2.0
= -5.7

(b) Propose a simple SOS with Hedge Asset Proxy Approximation Method to value the liability. Justify the proposal.

Commentary on Question:

This part of the question tested the candidates’ understanding of the SOS with Hedge Asset Proxy approach. For this part, there is no one correct solution. Full credit was given if the method proposed aligned with the requirements of an SOS with Hedge Asset Proxy. The method proposed in the solution below is just one example. Many candidates described the advantages and disadvantages of the SOS with Hedge Asset Proxy approach without ever actually proposing a method.

Hedge payoff = 95% of the change in Risk Neutral Liability

This approach uses a relation to express the market value of hedge portfolio as a function of the investment benchmark. The investment benchmark could be Real World or Risk Neutral liability.
7. Continued

In this approach, the hedge portfolio is defined by investment benchmark, eliminating need to model hedge portfolio. Thus, the hedge gains or losses are determined by the relation to the change in investment benchmark. It is no longer necessary to calculate the sensitivities of the investment benchmark.

The logic is that the market value of hedge portfolio should fluctuate in a random manner around investment benchmark. Thus, the gains or losses of hedge portfolio can be calculated using a function of:
- the change in the investment benchmark, and
- the change in economic environment in the outer loop

These gains or losses are then added to liability cash flows along the Real World path.

(c) Describe the basis risk and counterparty risk of the proposed SOS with Hedge Asset Proxy Approximation Method.

Commentary on Question:
This part of the question tested the candidates’ knowledge of two of the risks associated with the SOS with Hedge Asset Proxy approach. Candidates performed best on this part of the question. Many candidates only gave general descriptions of basis risk and counterparty risk. To received full credit candidates had to relate these risks back to the proposed SOS with Hedge Asset Proxy approach.

Basis risk
- Risks can be explicitly modelled in the SOS with hedge proxy method using the relation that models the market value of the assets.
- There might be an insufficient margin on mortality and lapse assumptions if this method is based on historical data that is representative of best estimate experience. In this case, an additional margin would be added to the valuation. If the model has been calibrated with the first-principles SOS method, this additional margin might not be necessary as it may already be captured.

Counterparty risk
- This risk cannot be explicitly modelled with this approximation method because the hedge portfolio itself is not modelled.
- Hedging programs may involve additional counterparty risk resulting from derivatives above that inherent in other product lines. The risk would be dependent on the type of derivatives used within the hedge program.
8. **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:**

1. Apply and recommend methods for performing reviews of financial statements including reserves.

4. Explain and apply methods in earnings management and capital management.

**Sources:**

CIA: Sources of Earnings: Determination and Disclosure, August 2004

CIA Educational Note: CALM Implication of AcSB Section 3855 Financial Instruments—Recognition & Measurement (June 2006)

**Commentary on Question:**

*Commentary listed underneath question component.*

**Solution:**

(a) List six characteristics of a good sources of earnings analysis.

**Commentary on Question:**

*Candidates generally were able to identify some of the characteristics.*

- Easy for users to understand
- Consistent with the way earnings are reported and the way the business is managed
- Can be produced in a timely manner
- Well documented and validated
- Consistently applied from period to period
- Technically robust. Reported Earnings are consistently explained (between reporting periods)
- Include all material components of Reported Earnings; and
- Can be used by management to assist in managing the business by identifying the fundamental drivers of earnings.
8. Continued

(b) Calculate the following components of the 2018 sources of earnings analysis:

(i) Expected earnings on inforce business

(ii) Impact of new business

(iii) Income on surplus

(iv) Experience gain/loss

(v) Changes in Methodology and Assumptions

Show all work.

Commentary on Question:
Candidates generally did not do well on this part of the question. Most candidates did not remove “Change in fair value of HFT assets (surplus-related)” in their expected earnings on in-force calculation. Many candidates used “Actual minus expected earning on Surplus” to calculate “Income on Surplus”; Some candidates did not remove the basis change impact when calculating earnings on in-force. Most candidates received credit for “Changes in Methodology and Assumptions.”

Expected earnings on inforce business
= Expected Revenue – Expected expense
= Premium + Change in fair value of HFT assets (product-related) - (Death claim + Surrender + premium tax + Change in actuarial liabilities due to death + Change in actuarial liabilities due to lapse + expense)
= 1500 + 500 - (700 + 300 + 300 + 700 + 200 + 90)
= -20

Impact of new business
= Revenue on New business – Expense on New business
= (100 + 40) – (100 + 2 + (-30) + (-10) + 50)
= 28

Income on surplus
= Actual Change in fair value of HFT assets (surplus-related)
= 50
8. Continued

Experience gain/loss
= Actual income – expected income – Basis change impact
= (1650 + 325 - (560 + 225 + 33 + 500 + 325 + 100)) – (-20) – 200
  = 232 – (-20) - 200
  = 52

Management Action
Change in methodology and assumptions = basis change
= 200
9. **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: Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies: July 2002

CIA Educational Note: Selective Lapsation for Renewable Term Insurance Products, February 2017

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

**Commentary on Question:**
*Commentary listed underneath question component.*

**Solution:**
(a) Calculate a blended expected mortality ratio for male lives using the normalized method. Show all work.

**Commentary on Question:**
*Most candidates correctly calculated the credibility factors and the blended expected mortality ratio. Fewer candidates calculated the total company expected claims correctly.*

Calculate the company expected claims assuming 100% mortality = Company claims / Mortality Ratio
Male = 64 / 80% = 80; Female = 42 / 83% = 50.6; Total = 130.6

Calculate Credibility Factors = min(Sqrt(# claims /3007),1)
Male = Sqrt(64/3007) = 0.14589, Female = Sqrt (42/3007) = 0.11818, Total = Sqrt(106/3007) = 0.18775

Calculate the total company blended expected mortality ratio and corresponding expected claims using the total company credibility factor and total company mortality ratio.

The total company blended expected mortality ratio = (credibility factor)*Total company mortality ratio + (1 - credibility factor)*Industry mortality ratio
0.18775 * 82.3% + (1 - 0.18775) * 76.2% = 77.3%
9. Continued

The total company expected claims = total company expected mortality ratio * total company expected claims
77.3% * 130.6 = 101

Calculate Blended Expected Mortality Ratios by sub-category; for example:
Male blended expected mortality ratio = (cred factor) * Male company mortality ratio + (1 - cred factor) * Male Industry mortality ratio
Male = 0.14589 * 80% + (1 - 0.14589) * 70% = 71.5%, Female = 78% * (1 - 0.1181) + 83% * 0.1181 = 78.6%

Calculate Blended Expected Number of Claims by sub-category; for example:
Male Expected # claims by Sub Category = Male blended expected mortality ratio * number of claims at 100% mortality
Male = 71.5% * 80 = 57.17, Female = 78.6% * 50.6 = 39.77, Total = 96.94

Calculate the blended expected Mortality Ratio using the Normalized method for the male:
Male Blended Expected Mortality Ratio by sub-category * Total Company Expected Claims / Male Blended Expected Number of Claims
71.46% * 101 / 96.9 = 74.47%

(b) Describe factors to consider when setting the selective lapse rate assumption.

Commentary on Question:
Most candidates provided a list of the factors; however, many candidates did not provide a description of the factors.

- Size of Premium Rate Increase: large increases are more likely to result in higher selective lapses.
- Period Between Premium Increases: selective lapse rates are likely to be higher if the period between increases is longer.
- Duration: selective lapse rates are likely to be lower at higher durations for the same attained age.
- Policy Size: larger polices are likely to experience higher selective lapse rates.
- Distribution System Used: high replacement activity and/or operation in an upscale market may lead to higher selective lapse rates.
- Heaped Renewal Commissions: higher commissions at premium renewal dates are likely to result in lower selective lapse rates.
- External Market Conditions: at the time of renewal, if lower cost alternatives are available, more healthy clients will consider leaving the block.
- Proportion of Healthy Lives Remaining: in the extreme, if no healthy lives remain, the selective lapse rate will be zero.
9. Continued

- Conversion Activity: high conversion rates at later durations may improve mortality for the remaining lives.

(c) Calculate the residual mortality rate using the VTP2-revised method. Show all work.

Commentary on Question:
Some candidates did not demonstrate clear understanding of VTP2-original and VTP2-revised methods, and earned partial credit for the selective lapse rates and average lapse rates calculations. Candidates who demonstrated a clear understanding of the two methods went on to correctly complete the calculation for full credit.

VTP2-original
Selective Lapse Rate (S) = (Total Lapse - Base Lapse) * Selective %
S = (80% - 5%) * 90% = 67.5%
Average Lapse Rate (A) = (Total Lapse - Base Lapse) * (100% - Selective %)
A = (80% - 5%) * (100% - 90%) = 7.5%

VTP2-revised
Selective Lapse Rate (S) = ( (Total Lapse - Base Lapse) * Selective % ) / (1 - Base Lapse)
S = ( (80% - 5%) * 90% ) / (1 - 5%) = 67.5% / 95% = 71.1%
Average Lapse Rate (A) = ( (Total Lapse - Base Lapse) * (100% - Selective %) ) / (1 - Base Lapse)
A = ( (80% - 5%) * (100% - 90%) ) / (1 - 5%) = 7.5% / 95% = 7.9%

1. Solve for select mortality rate using VTP2-original
$q[x+t] = [(1 - A)*q'[x]+t - (1 - A - S)*q"[x]+t]/S$
$q[x+t] = [ (1 - 7.5%) * 1.2 - (1 - 7.5% - 67.5%) * 3.0 ] / 67.5% = 0.53$

2. Calculate residual mortality rate using VTP2-revised
$q"[x]+t = [(1 - A)*q[x]+t - S*q[x+t]]/(1 - A - S)$
$= [ (1 - 7.9%) * 1.2 - 71.1% * 0.53 ] / (1 - 7.9% - 71.1%) = 3.45$
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.

**Learning Outcomes:**

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

**Sources:**

CIA Educational Note: Guidance on Fairness Opinions Required Under the Insurance Companies Act Pursuant to Bill C-57 (2005)

**Commentary on Question:**

This question tested the candidates’ understanding of adjustable products and the criteria for fairness.

**Solution:**

(a) Assess how the terms of the contract meet the definition of fairness according to the Insurance Companies Act (pursuant to Bill C-57).

**Commentary on Question:**

For this part of the question most candidates identified some of the key criteria for fairness and made an assessment of how the terms of the contract either met or did not meet the criteria. Candidates who identified the key criteria and appropriately assessed the contract terms against them generally did well on this part of the question. A few candidates commented on how the contract met the preconditions to making an assessment on fairness based on the criteria defined in the guidance. Given this is under the definition of fairness section in the guidance, credit was also awarded for this.

The criteria for fairness does not permit adjustments (or increases in adjustments) to recover losses incurred prior to the adjustment date. However, the terms of the contract states that the review will recover mortality losses over the prior 5 years. This would be considered unfair. There are some exceptions in the guidance for allowing recovery of mortality losses, however, these require solid support and there is no indication of this in the contract.

However, the criteria for fairness does allow the use of historical mortality experience to the extent it informs changes in future best estimates of mortality which may be reflected in the premium adjustment.

The criteria for fairness would also require that the review and resulting adjustments are specific to the policyholder’s Policy class (at issue). The contract states that the review will be based on policyholder’s policy class. This would be considered fair.
10. Continued

The criteria for fairness also allows the insurer to adjust the premium to reflect taxation and regulatory changes. The contract wording allows the company to do this. This would be considered fair.

Some of the desirable preconditions in order to assess the fairness of the contract (under the definition of fairness section in the guidance) that the contract meets is that it’s clear on the timing of the review and the mortality and interest rate basis are clearly defined.

In general, given the company has unilateral control over the drafting of contracts and the post issue adjustments, “not fair” is to be interpreted as “favouring the company”.

(b) Determine which of the following products should be considered “adjustable” according to the terms of the Insurance Companies Act (pursuant to Bill C-57). Justify your responses.

A. A participating whole life product, that has no explicit dividends, but has a premium review every five years. Revised premiums reflect best estimate assumptions going forward but are subject to contractual maximums.

B. A whole life policy whose loan rate changes quarterly and is guaranteed never to exceed 90% of the Government of Canada 3 to 5 Year Bond Yield.

C. A Universal Life policy with two investment options: an equity account tied to the TSX return and a 5-year Guaranteed Investment Account whose credited rate is guaranteed to be at least equal to the company’s overall rate of return on AAA 5-Year Corporate Bonds less 2%.

D. A Universal Life policy with a Death Benefit that includes a Return of Premium whose costs of insurance are guaranteed and whose expense charges may increase with the Consumer Price Index. Mortality charges are calculated by multiplying contractually guaranteed Yearly Renewable Term rates by the current Net Amount at Risk.

E. A whole life policy where the company may increase premiums in the event the 5-Year Government of Canada Bond Yield falls below 4%, but does not require the company to decrease premiums should the rate remain above 4%. Future premiums are guaranteed not to exceed 150% of the original premium.

F. A segregated fund annuity contract that guarantees the death benefit will be 100% of deposits paid, and guarantees a maturity benefit of 90% of deposits paid. The Management Expense Ratio (MER) is guaranteed never to exceed 3%, and is currently at 2.50%.
Commentary on Question:
Candidates generally struggled with this part of the question. Further commentary is provided below.

A. Not adjustable. Par policies do not fall under the definition of adjustable products according to the CIA guidance and Bill C-57.
Commentary on Question:
A common answer here was that Par products are considered adjustable.

B. Not adjustable. Loan rates that vary over time do not, by themselves, make a policy adjustable.
Adjustable. The daily interest account does not make it adjustable. The equity fund with a rate tied to the TSX does not make it adjustable. However, credited rates for the 5-year GIA are not linked to market rates or indices i.e. the rate is not tied to a measure the policyholder could determine. This makes the product adjustable.
Commentary on Question:
Some candidates missed the fact that the actual GIA rate set by the company cannot be determined by policyholder.

C. Not adjustable. Death benefit is not unilaterally set by the Company.
Mortality charges are contractually guaranteed. The fact they are increasing doesn't make them adjustable. They are on a schedule. Expense charges increasing using a known index does not make the product adjustable.
Commentary on Question:
This statement was generally done well.

D. Adjustable. This is a one-way contract but this doesn’t determine whether the policy is adjustable or not. Since the company can increase premiums when interest rates fall, the policy is adjustable. The guarantee that premiums cannot exceed 150% of original doesn't change the adjustability definition. Even if premiums were at guarantee the policy would stay adjustable.
Commentary on Question:
This statement was generally done well.

E. Not Adjustable. Annuities are not normally considered adjustable life policies. However, the death benefit guarantee adds a variable life component. Since there is a variable life component and expense deductions can go as high as 3%, the policy now has an adjustability feature.
Commentary on Question:
Candidates generally struggled with articulating the reason for their stance on the adjustability of this product.
11. **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.

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:**

(2a) Compare and apply methods for life and annuity product liabilities.

(4d) Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital.

**Sources:**
LFV-XXX-18: OSFI Draft Guideline – Life Insurance Capital Adequacy Test (LICAT), Chapters 1 – 3, 5 – 9, 11, Jan 18

**Commentary on Question:**

*This question tested candidates’ knowledge of capital requirements for segregated fund guarantees. Candidates were generally able to provide a number of recommendations, but only some candidates provided proper justification.*

*Candidates were generally able to provide the general form of TGCR, and those who answered this question by analyzing each elements of the formula (and provide recommendations based on the analysis) generally did well.*

*Candidates generally did poorly regarding changes that will increase the margin offset factor/risk charge. Most candidates could only mention MER increase as their recommendation and very few were able to point out other ways to achieve the goal.*

**Solution:**
Recommend possible modifications to the current product characteristics to help reduce the TGCR. Justify your answer.

The general form of TGCR: $GV \cdot h() \cdot w() \cdot f() - (\alpha/100) \cdot AV \cdot g()$

To reduce the TGCR, we can make changes that would lower the Basic Cost Factor
- Change how gross capital (GC) is adjusted upon a partial withdrawal
  - Change pro-rata by market value method to dollar-for-dollar, since guarantee level will be lower
11. Continued

- Change the product to invest in lower volatility funds since the investment funds are now in intermediate risk equities (i.e. mix of well-diversified Canadian and global equities)
  - For example, incentivize a moment of assets to money market or fixed income
  - Extra effect of making AV-to-GV ratio higher over extreme scenarios which also reduce the basic cost factor
- Decrease the MER
  - A higher MER gives a higher chance that the guarantee will be in the money which will increase the factor
  - Lowering MER will be offset by the extra risk charge/ MER offset amounts that are collected (a lower MER, will result in a lower MER offset factor, which will increase the TGCR calculated)

Make changes that will lower the Time Diversification Factor
- Sell product with dispersed maturity dates across product, will allow for time diversification factor to reduce TGCR, and therefore widen the target market
- This is allowed for GMMB products
- Allow up to 10% of maturities to occur in each 3 month period

Make changes that will increase the Margin Offset Factor / Risk Charge
- Increase the MER
  - A higher MER gives a higher risk charge which will decrease the TGCR
  - Impact will be offset by the extra guarantee risk of putting the guarantee into-the-money (a higher MER, will result in a higher basic cost factor, which will increase the TGCR calculated)
- Decrease the following to increase the margin offset:
  - Investment management expense and advisory fees
  - Commissions, bonuses (dividends) and overrides
  - Maintenance expenses
  - Amounts required to amortize unamortized acquisition costs (net of available surrender charges)

Make changes that will lower the Asset Mix Diversification Factor
- Introduce fixed income, balanced and money market funds
  - Reflect the benefits of fund diversification, and
  - Introduce lower volatility funds (fixed income) vs current higher volatility equity funds

Other:
- Lower the level of guarantee
- Replace the 10-year rollover with a fixed maturity date