

CSP-IC Model Solutions

Spring 2013

1. Learning Objectives:

1. The candidate will understand the preparation of financial statements and reports of Canada life insurance companies and be able to analyze the data in them.

Learning Outcomes:

- (1d) Explain fair value accounting principles
- (1g) Describe and critique the fundamental approaches of financial economics to valuation liabilities

Sources:

An Approach to Fair Valuation of Insurance Liabilities Using the Firm's Cost of Capital, NAAJ, Apr. 2002., pgs 18 -23

Fair Value of Liabilities: The Financial Economic Perspective, NAAJ, Jan. 2002

http://www.soa.org/library/journals/north-american-actuarial-journal/2002/january/naaj0201_2.pdf

Commentary on Question:

The question was trying to test the candidates' knowledge in fair value of liabilities by identifying the advantages and disadvantages of different methods, also by utilizing the knowledge by applying them in calculations. Part (a) can be given maximum points by listing the various advantages and disadvantages. Part (b) and (c) can be given maximum points by presenting the full calculation steps which requires deep thought in the derivations of fair value concepts. Most candidates did well in part (a) as only listings are required. But for part (b) and (c), very few candidates got full or substantial points as most of them used the wrong formulas.

Solution:

- (a) Describe the advantages and disadvantages of the following methods of calculating the fair value of liabilities:
 - (i) Direct method
 - (ii) Indirect method
- (i) Direct Method
Advantages:
 - Simpler to implement
 - More reliable assessment of the risk of financial leverage

1. Continued

Insurance risks can be accommodated by adjusting discount rates or expected cash flow

Disadvantages:

Hardly used in setting of exit prices
Issue of credit risk is front and center

(ii) Indirect Method

Advantages:

More easily related to exit prices
Implicitly reflect liquidity
Own credit risk does not appear to enter into the process

Disadvantages:

More complex to implement

(b) Calculate the required profit that enables the firm to earn its cost of capital assuming expenses of 15 at the end of year 1. Show all work.

$$\begin{aligned}MVA_0 &= (MVA_1 + A_1) / (1 + r + \theta_A) \\ &= (0 + 1200) / (1 + 0.1 + 0.03) \\ &= 1061.95\end{aligned}$$

$$\begin{aligned}DDE_0 &= (DDE_1 + DE_1) / (1 + r + \theta_K) \\ &= [0 + (1200 - 20\% \times 5000 - 15)] / (1 + 0.1 + 0.09) \\ &= 155.46\end{aligned}$$

$$\begin{aligned}\text{Indirect FVL}_0 &= MVA_0 - DTL_0 - DDE_0 \\ &= 1061.95 - 0 - 155.46 \\ &= 906.49\end{aligned}$$

$$\begin{aligned}RP &= (\theta_K - \theta_A) \times (MVA_0 - FVL_0) \\ &= (0.09 - 0.03) \times (1061.95 - 906.49) \\ &= 9.32\end{aligned}$$

(c) Calculate the quantity Z used in the certainty equivalent approach assuming no expenses and using the approaches defined in “Fair Value of Liabilities, the Financial Economic Perspective.” Show all work.

$$\begin{aligned}S &= [p Su + (1 - p) Sd] / (1 + r + \lambda\sigma) \\ &= [0.2 \times 5000 + (1 - 0.2) \times 0] / (1 + 0.1 + 0.09) \\ &= 840.34\end{aligned}$$

$$\begin{aligned}[p Su + (1 - p) Sd - Z] / (1 + r) &= [p Su + (1 - p) Sd] / (1 + r + \lambda\sigma) \\ [0.2 \times 5000 + (1 - 0.2) \times 0 - Z] / (1 + 0.1) &= 840.34 \\ Z &= 75.63\end{aligned}$$

2. Learning Objectives:

1. The candidate will understand the preparation of financial statements and reports of Canada life insurance companies and be able to analyze the data in them.

Learning Outcomes:

- (1a) Construct the basic financial statements for a life insurance company.

Sources:

ILA-C100-07: Financial Reporting Developments Accounting for Derivative Instruments and Hedging Activities: A Comprehensive Analysis of FASB Statement 133 (Overview and Appendix C only)

Commentary on Question:

This question tested the candidate's understanding of how FAS 133 impacts the recognition and measurement of derivatives and hedging activities.

Solution:

- (a) Briefly define the three types of hedging, as described in FAS 133.

Commentary on Question:

Candidates generally did well on this part.

Fair value hedges are used to hedge exposure to changes in fair value. Cash flow hedges are used to hedge exposure to variability in expected future cash flows. Hedges of net investments in foreign operations are used to hedge translation exposure to changes in foreign exchange rates.

- (b) Recommend the type of hedging that Mod Life should use for each product. Justify your answer.

Commentary on Question:

On this part, few candidates received full credit, but most candidates received partial credit. Many candidates did not recognize that Product A falls outside the scope of FAS 133 due to the insurance exclusion. For Product B, the model solution recommends a cash flow hedge, but if the candidate recommended a fair value hedge, credit was given if the candidate provided a sound reason. In either case, no credit was given for a recommendation without a sound reason.

2. Continued

Product A:

This product does not fall within the scope of FAS 133. The insurance exclusion applies since only the death benefit is adjusted for inflation.

Product B:

The choice is limited to either a fair value hedge or a cash flow hedge, since the nature of the risk to be hedged is unrelated to foreign operations. Fair value hedges address risks that arise due to prices, rates or terms that are fixed or known. Cash flow hedges address risks that arise due to prices, rates or terms that are variable or unknown. A cash flow hedge is recommended, since Mod Life wants to manage the unknown impact of inflation on future benefit payments.

- (c) Identify the significant criteria your recommended type(s) of hedging must meet to qualify for hedge accounting treatment under FAS 133.

Commentary on Question:

On this part, few candidates received full credit, but most candidates received partial credit.

The significant criteria are as follows:

- The relationship between the derivative instruments and the hedged item must be formally documented.
 - The risk management objective and strategy for undertaking the hedge must be formally documented.
 - The hedging relationship is expected to be highly effective in offsetting changes in cash flows or fair value.
 - The hedged item presents an exposure to changes in cash flows or fair value that could affect reported earnings.
 - The hedged item is not related to an asset or liability that is or will be re-measured with changes in fair value attributable to the hedged risk reported currently in earnings.
 - The hedged item is not related to an investment that is or will be accounted for by the equity method.
- (d) Describe the impact your recommendation would have on reducing volatility in Mod Life's GAAP earnings.

Commentary on Question:

On this part, few candidates received full credit, but most candidates received partial credit.

2. Continued

Product A:

The insurance exclusion precludes hedge accounting treatment under FAS 133. The gain or loss on the derivative instruments (i.e. the change in fair value of the derivative instruments) would be reported in earnings, resulting in earnings volatility.

Product B:

If the candidate recommended a cash flow hedge in Part (b):

If the hedge qualifies for hedge accounting treatment under FAS 133:

- The effective portion of the gain or loss on the derivative instruments would be reported in OCI and reclassified into earnings when the hedged item affects earnings.
- The ineffective portion of the gain or loss on the derivative instruments would be reported in earnings.
 - The ineffective portion equals the cumulative change in fair value of the derivative instruments minus the cumulative change in the present value of expected cash flows of the hedged item, but not less than 0.
 - Earnings would be volatile to the extent that the ineffective portion is greater than 0.

If the hedge does not qualify for hedge accounting treatment under FAS 133, the gain or loss on the derivative instruments (i.e. the change in fair value of the derivative instruments) would be reported in earnings, resulting in earnings volatility.

If the candidate recommended a fair value hedge in Part (b):

If hedge qualifies for hedge accounting treatment under FAS 133:

- The gain or loss on the derivative instruments (i.e. the change in fair value of the derivative instruments) would be reported in earnings.
- The offsetting loss or gain on the hedged item (i.e. the change in fair value of the hedged item) would be reported in earnings.
- Earnings would be volatile to the extent that the gain or loss on the derivative instruments is not exactly offset by the loss or gain on the hedged item.

If the hedge does not qualify for hedge accounting treatment under FAS 133, the gain or loss on the derivative instruments (i.e. the change in fair value of the derivative instruments) would be reported in earnings, resulting in earnings volatility.

3. Learning Objectives:

3. The candidate will be able to evaluate various forms of reinsurance, the financial impact of each form, and the circumstances that would make each type of reinsurance appropriate.

Learning Outcomes:

- (3a) Describe the considerations and evaluate the appropriate form of reinsurance from the ceding and assuming company perspectives.
- (3b) Explain the consequences and evaluate the effect on both ceding and assuming companies with respect to:
 - (i) Risk transfer
 - (ii) Cash flow
 - (iii) Financial statement presentation
 - (iv) Tax impact, and
 - (v) Reserve credit requirements.

Sources:

Life and Health Reinsurance, Third Edition, 2005 by Tiller, Chapter 4, Basic Methods of Reinsurance.

Stochastic Analysis of Long Term Multiple-Decrement Contracts by Clark and Runchey, January 2008 (Excluding Appendices)

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Explain the key differences between YRT reinsurance and Coinsurance.

Commentary on Question:

The candidates, in general, did well on this part.

1. YRT reinsurance premiums are not related to the direct premiums that the insured pays whereas Coinsurance reinsurance premiums use the reinsurance quota share percentage applied to the direct premiums that the insured pays.
2. YRT reinsurance usually has a 100% expense allowance applied to the YRT reinsurance premium scale in the first policy year only whereas Coinsurance reinsurance has a varying percentage by policy year applied to the direct premiums that the insured pays.
3. YRT reinsurance typically only cedes the mortality risk whereas Coinsurance reinsurance cedes all policy risks.

3. Continued

(b)

Commentary on Question:

The candidates, in general, did well on the mathematical calculations. However, on part (ii), the candidates had difficulty in providing reasons for selecting each particular reinsurance arrangement.

(i) Calculate the Net Present Value (NPV) at policy inception of future cash flows, assuming no other cash flow items, for two reinsurance arrangements shown in the exam question. Show all work.

1. YRT

a. Reinsurance premiums for policy years 1, 2 and 3 are as follows:

$$\text{Policy year one} = 1,000,000 * .7 * 0/1000 = 0$$

$$\text{Policy year two} = 900,000 * .7 * 3.4/1000 = 2,142$$

$$\text{Policy year three} = 800,000 * .7 * 3.6/1000 = 2,016$$

b. Reinsurance claims for policy years 1, 2 and 3 are as follows:

$$\text{Policy year one} = 2,000,000 * .7 = 1,400$$

$$\text{Policy year two} = 1,980,000 * .7 = 1,386$$

$$\text{Policy year three} = 1,920,000 * .7 = 1,344$$

$$\text{c. NPV} = 0 + (2,142 - 1,400)/1.05 + (2,016 - 1,386)/1.05^2 - 1,344/1.05^3 = 117$$

2. Coinsurance

a. Reinsurance premiums net of expense allowance for policy years 1, 2 and 3 are as follows:

$$\text{Policy year one} = 3,000 * .5 * (1 - .4) = 900$$

$$\text{Policy year two} = 2,700 * .5 * (1 - .1) = 1,215$$

$$\text{Policy year three} = 2,400 * .5 * (1 - .1) = 1,080$$

b. Reinsurance claims for policy years 1, 2 and 3 are as follows:

$$\text{Policy year one} = 2,000,000 * .5 = 1,000$$

$$\text{Policy year two} = 1,980,000 * .5 = 990$$

$$\text{Policy year three} = 1,920,000 * .5 = 960$$

$$\text{c. NPV} = 900 + (1,215 - 1,000)/1.05 + (1,080 - 990)/1.05^2 - 960/1.05^3 = 358$$

(ii) Describe factors to consider when determining which reinsurance arrangement, if any, to accept.

1. Since the NPV of ceded cash flows for YRT are lower than the Coinsurance, the cash flows net of reinsurance for the direct company will be higher if reinsurance is done on a YRT basis.
2. NPV alone does not provide enough information.
3. Consider LPT's risk strategy.
4. Consider LPT's capital relief needs
5. Consider new business strain

3. Continued

(c) The following approach is proposed to evaluate reinsurance arrangements:

Commentary on Question:

The candidates had much difficulty explaining the relationship of reinsurance to economic capital.

Step 1: Calculate Gross Economic Capital (EC) for the underlying block of business

Step 2: Calculate Reinsurance % = Ratio of Reinsurance Premium to Direct Premium

Step 3: Reinsurance Economic Capital credit is equal to Gross EC * Reinsurance %

Critique this approach to evaluating reinsurance arrangements.

1. Under the proposed method, the Reinsurance Economic Capital credit is always proportional to premium, which is not appropriate.
2. Reinsurance Economic Credit should be a function of the amount of risk transferred as risk transferred is not necessarily proportional to premium.
3. Method may be effective for comparing different coinsurance reinsurance arrangements, but does not work for YRT reinsurance.
4. A better method would be to reflect the reinsurance structure directly in a stochastic model.

4. Learning Objectives:

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

Learning Outcomes:

- (4a) Describe and calculate basic performance measures.

Sources:

Embedded Value: Practice and Theory, SOA, Actuarial Practice Forum, March 2009
<http://www.soa.org/library/journals/actuarial-practice-forum/2009/march/apf-2009-03-frasca-lasorella.pdf>

Commentary on Question:

Most candidates demonstrated sound knowledge of EV and scored reasonably well in part (a) and (b). Some candidates did, however, miss the intention of the questions. For example, for part (b) (ii), the question was looking for differences between PVDE and IBV. But some mis-interpreted and explained components of EV instead. For part (c), candidates struggled with the detailed inclusions and exclusions of IBV and ANW.

Solution:

- (a) You are given the following statements:
 - EV is an accounting basis applied primarily to life insurance business that provides an alternate means of measuring the value of such business at time of issue.
 - Companies use EV for such purposes as profitability analysis, statutory reporting and acquisition purchase prices.
 - EV is a measurement of the value that shareholders own in an insurance enterprise comprised of capital, surplus, and the present value of earnings.

Evaluate the above statements and provide any corrections as necessary.

Commentary on Question:

For part (a), candidates did well. To get full credits, candidates need to outline other uses of EV.

1. False. EV can be applied to any long-duration insurance business. It measures the value of business at any point in time.
2. False. EV cannot be used for statutory reporting. In addition to profitability analysis and acquisition purchase prices, it can also be used for performance measurement for executive compensation and assessment of return for capital allocation purposes.

4. Continued

3. False. EV is a measurement of the value that shareholders own in an insurance enterprise, comprised of capital, surplus, and the present value of earnings to be generated from the existing business. It does not consider new business.
- (b) EV is expressed as $EV = IBV + ANW$, where:

IBV: In-force Business Value

ANW: Adjusted Net Worth

- (i) Explain these two components as they pertain to the company's book of business.
- (ii) Describe the difference between the calculation of present value of distributable earnings (PVDE) and IBV in terms of capital distribution.

Commentary on Question:

For part (b), most candidates demonstrated a knowledge of the components within the formula for IBV and ANW; however, to get full credit for this part, candidates needed to connect the details to the specific case in the question.

- (i) EV measure the value that shareholders own in Evergreen Life, comprised of capital, surplus, and the present value of earnings to be generated from the existing UL and VA business.

IBV:

- PV of after-tax statutory book profits (PVBP) less PV of Cost of Capital (PV COC) using BE assumptions at valuation date and risk discount rate.
- Book profits include: sum of (premiums, investment income, capital gains, charges from UL policies and fee income from VA policies) less sum of (claims, surrenders, maturities, expenses, increase in statutory reserves, and taxes).
- Cost of capital for an accounting period is the amount of investment earned on the capital at the beginning of the period at the Risk Discount Rate (RDR) in excess of the after-tax investment rate of return.
- Intangible assets are not included since they are not distributable.

4. Continued

ANW:

- Consists of realizable (i.e. distributable) value of capital & surplus.
- Evergreen Life's statutory capital and surplus should be adjusted to include liabilities from UL & VA that are allocation of surplus (e.g. Asset Valuation reserve that comes from assets backing these businesses).
- Not the entire amount is distributable. Two approaches can be used to determine ANW: (1) Only free surplus is marked to market and tax effected, and (2) Both required/statutory capital and free surplus are marked to market and tax effected.

- (ii) PVDE is calculated with a starting level of required capital and includes the distribution of that capital.

IBV does not include distributions of capital, but includes an adjustment for the cost of the capital.

$$IBV = PVDE - RC$$

- (c) Calculate the EV assuming all assumptions are up-to-date and no changes in prospective assumptions. Show your work.

Commentary on Question:

Most candidates scored the ANW section well but did poorly on IBV calculation. They were expected to demonstrate knowledge of the components of ANW and IBV, with their inclusions and exclusions. However, many failed to do so. For example, ANW does not include intangible asset and IBV does not include cost of capital. On the other hand, most candidates realized that the given IBV was an opening value and needed adjustments.

ANW does not include intangible asset. IBV does not include cost of capital.

$$EV = ANW + IBV$$

$$ANW = \text{required capital} + \text{surplus} = 20.0 + 3.3 = 23.3$$

Revised IBV

= starting IBV + model corrections

= starting IBV + AVR correction + investment income correction + experience refund correction

$$= 40 + (1.4 - 2.5) + (33.0 - 40.0) + (12.0 - 8.0)$$

$$= 40 + (-1.1) + (-7.0) + 4.0$$

$$= 35.9$$

4. Continued

$$\begin{aligned} &\text{Ending IBV} \\ &= \text{revised IBV} + \text{expected contribution from New Business and In-force Business} \\ &\quad + \text{experience gains/loss} \\ &= 35.9 + 0.8 + 21.5 + 3.5 \\ &= 61.7 \end{aligned}$$

$$\text{EV} = \text{ANW} + \text{IBV} = 23.3 + 61.7 = 85.0$$

5. Learning Objectives:

6. The candidate will be able to integrate data from various sources into model office and asset/liability models.

Learning Outcomes:

- (6a) For an ALM model:
 - (i) Select appropriate assumptions and scenarios
 - (ii) Model dynamic behavior of both assets and liabilities
 - (iii) Model and explain various strategies, including hedging
 - (iv) Analyze and evaluate results including actual vs. projected differences
 - (v) Recommend appropriate strategies

- (6c) Explain limitations of models and possible sources of error:
 - (i) Quality of data
 - (ii) Granularity of the model

Sources:

ILA-C112-07: ALM for Insurers

ILA-C113-07: Chapter 22 of Life Insurance Accounting, Asset/Liability Management

Valuation of Life Insurance Liabilities, Lombardi, 4th Edition

- Chapter 13, Cash Flow Testing

ASOP 23 Data Quality (excluding transmittal Memo and Appendices)

http://www.actuarialstandardsboard.org/pdf/asops/asop023_141.pdf

Commentary on Question:

Part (a) is retrieval. Parts (b) and (c) of the question are testing for the understanding and knowledge on the ALM process and techniques. In general, the candidates have performed well in part (a), poorly in part (b), and average in part (c). To receive full credit, the candidate should provide adequate details on the ALM tools and demonstrate an understanding on the ALM process in part (b).

Solution:

- (a) Describe the following Asset Liability Management (ALM) diagnostic tools and list the advantages and disadvantages of each:
 - (i) Immunization
 - (ii) Cashflow Matching
 - (iii) Dynamic Financial Analysis

5. Continued

Commentary on Question

Most candidates were able to answer (i) and (ii), but not many were able to demonstrate understanding in DFA. To get full credit, candidates should also provide a definition/description of the tools.

Immunization

Definition:

- Matching the duration of asset and liabilities
- Impact from interest rate change on the values of the liabilities are offset by the corresponding impact on the asset values

Advantage:

- Directly/Easily calculated from the cash flows

Disadvantage:

- Does not work for large or non-parallel shifts in interest rates
- Uncertainty in liability cash flow patterns
- Requires rebalancing

Cash Flow Matching

Definition:

- Matching the asset and liability cash flows

Advantage:

- Eliminate interest rate risk

Disadvantage:

- Uncertainty in liability cash flow patterns
- Inflexibility in purchasing assets; Liability cash flows tend to have longer duration than asset cash flows, might be impossible to find assets with matching cash flows
- Unable to take advantage of the company's view in future interest rate position, resulting in lower investment income.

Dynamic Financial Analysis

Definition:

- DFA consists of 5 stages: summarizing the initial condition, construct a scenario generator, develop a financial calculator, build an optimizer to evaluate the best strategic alternative and analyzing results.

Advantage:

- Provide a multiple risk focus

5. Continued

Disadvantage:

- Complex model
- Long run time

(b) Critique the memo for completeness and appropriateness:

Commentary on Question

This section was answered poorly. The question was looking for comments and criticism with respect to the ALM process and technique. Instead most candidates focused on commenting the format of the memo based on a specific ASOP which the question did not specify.

- For the memo, we may need buy-in / approval from someone more senior than Valuation Actuary
- A successful ALM implementation requires senior management's support and commitment in the project
- Memo should ensure a clear assignment of roles and responsibilities
- ALM manager must balance the need to produce timely and actionable management information with a sensitivity towards contributors and their other ongoing responsibilities
- The memo suggests using immunization for the ALM tool. Other possible tools should also be considered, such as VaR
- Neither statutory nor gaap reporting is suitable for depicting investment risk. Recommend using economic value reporting
- ALM focus on risks at the enterprise level with a holistic approach, therefore an ALM department should be established rather than incorporating the ALM process to the valuation department.

(c) Determine the appropriateness of the data provided by the investment department and what additional information, if any, is necessary to ensure compliance with ASOP 23, Data Quality.

Commentary on Question

Most candidates had properly referred to the ASOP.

- Actuary should consider what data to use: current in-force assets, assets available for purchase, future interest rate patterns, strategy for negative cash flows.
- Additional information required on the assets: market value, timing of cash flows, quality and liquidity of the assets
- Consider the data definitions
- Consider the appropriateness of the data for the intended purpose of analysis
- Consider the sampling methods

5. Continued

- Reviewed the data for reasonableness, consistency and comprehensiveness
- Disclose reliance on data by others
- Adjust questionable data to improve quality of data
- Consider cost and feasibility of alternative data
- Actuary is not required to audit the data, determine whether the data is falsified or intentionally misleading, searching for questionable or inconsistent data
- If in the actuary's professional judgment it is not necessary to perform a review of data, then the actuary should disclose that a review was not done and disclose any resulting limitation on the use of the actuarial work product

6. Learning Objectives:

7. The candidate will be able to evaluate risks faced by a Company by virtue of the Company's products, assets and management strategies and practices and be able to evaluate the appropriateness of various methods of risk mitigation.

Learning Outcomes:

- (7a) Identify, categorize and evaluate potential sources of risk in products including but not limited to mortality, morbidity and lapse.
- (7b) Identify, categorize and evaluate potential sources of risk in investments including but not limited to credit risk liquidity and asset-liability matching.
- (7e) Describe and apply methods of risk mitigation and hedging and to understand the limitations of such methods.

Sources:

ILA-C124-10: "S&P's Insurance Criteria: Refining the Focus of Insurer ERM Criteria", June 2006, excl. pp. 20-26.

ILA-C125-10: Insurance Risk Management Response to the Financial Crisis, CRO Forum, April 2009.

Commentary on Question:

The goal of this question is to test candidates' understanding of ALM strategies essential to insurance companies, including how different asset categories can be used and how they influence insurance companies' overall performance

Candidate needs to

- a) Demonstrate an understanding of general ALM Process
- b) Demonstrate an understanding of asset categories and how they are used to back insurance products
- c) Clearly communicate the advantages and disadvantages of each recommendation to mitigate the different risks

Solution:

- (a) The company backs these products with investment grade corporate bonds that are held to maturity. Within its Asset Liability Management (ALM) strategy, ABC is willing to review and modify their investment strategy and credit risk limits depending on prevailing market conditions.
 - (i) Determine if convexity is an important component of the company's interest rate risk. Justify your answer.
 - (ii) Explain potential problems with the company's approach to its ALM strategy.

6. Continued

Commentary on Question:

Overall, most candidates received partial credit for describing the importance of convexity affecting overall ALM strategy. However, to receive full credit, candidate must explain the key features of FA and UL products that produce liability convexity, not just vague points from convexity definition. Candidates should also provide supporting rationale for the appropriate conclusion.

- (i) There is convexity in liability: including but not limited to minimum guaranteed crediting rates, as well as persistency risks embedded. It is not appropriate to assess a company's risks on asset alone and conclude there is no convexity risk.
- Convexity is an important component of the company's interest rate risk, and it is second order interest rate risk.
 - There is significant convexity in liability due to the persistency risk / policyholder behavior / minimum guaranteed crediting rates in company's 2 largest products
 - There is minimal convexity in asset: the asset portfolio included public corporate bonds only, which has low or no convexity. No derivatives allowed means there will be no additional convexity in assets
 - Hence, there is significant convexity mismatch in Asset – Liability
- (ii) Credit limits should not just be on total portfolio: there should be limits on sector, geographic areas, or maximums for any one holding.
- Investment grade, \geq BBB, is not a meaningful credit limit because the range of available investments is too wide.
 - Adjusting limits to resolve limit breaches is not sound risk management.
- (b) Describe key problems with the current dynamic lapse formula and recommend changes.

Commentary on Question:

Overall, most candidates have difficulties describing the limitations of current lapse assumptions. Candidates need to provide explanation on how the recommendations address the problems associated with lapse formula.

- Model needs to be designed and calibrated independently from the risk taking function: in this case agents selling lots of policies have an incentive to understate the products' risks

6. Continued

- Models based on historical data, even with adequate data points included, may not be enough to understand extreme situations. The dynamic lapse formula is calibrated to a falling interest rate environment and assuming policyholders will act the same when interest rate rises is not appropriate.
- The company may be significantly understating additional lapses and therefore be unprepared for disintermediation risks when interest rates rise: loss of future profits, unable to recover acquisition costs, forced to liquidate bonds when prices fall, forced to obtain additional funding

Some additional comments are relevant to the problems includes:

- The modeling actuary was the only one reviewed/improved/implemented this formula - this may not be enough independent expert review or adequate control.
- Agents may not be considered experts to have the formula calibrated to.
- Buy-and-hold strategy means the company is not actively managing credit risks thus default risk may be important

- (c) Determine which product has higher persistency risk, using only projected profitability. Justify your answer.

Commentary on Question:

Overall, candidates did well in part (c). To receive full credit, candidate must provide clear explanation leading to the appropriate conclusion.

Universal Life has more persistency risk because

- Cost from Front End Commission is higher - can't be recovered if policy surrenders early
- Acquisition Expenses are higher - can't be recovered if policy surrenders early
- Lower surrender charges (or higher surrender values) - policyholders are less discouraged about leaving
- Higher mortality margin - from annual COI charges so profits can't be realized if policy surrenders early, since this is

7. Learning Objectives:

8. The candidate will understand the professional standards addressing financial reporting and valuation.

Learning Outcomes:

- (8a) Explain the role and responsibilities of the appointed/valuation actuary.

Sources:

ILA-C635-13: Participating Account Management and Disclosure to Participating Policy Holders and Adjustable Policy Holders

Commentary on Question:

This question was intended to test the student's understanding of the requirements and opinions of the Appointed Actuary with respect to adjustable products including the general principles for deciding on fairness of changes made to adjustable products.

The best answers to this question critiqued each section and bullet point separately. It is not necessary to include headers describing which point is being critiqued; it is done here for clarity.

Solution:

Critique the communication.

Introductory Paragraph:

- The communication to the board should be annual
- Should send a copy of the report to OSFI within 30 days of presenting to the board

Bullet Point 1

- Should continue to group policies by smoking status
- Policy classifications should be established at issue

Bullet Point 2

- Should not separate policies into different cohorts by face amount
- There should be no post-issue changes in classification

Bullet Point 3

- Expenses should not be loaded
- Future adjustments should not permit recovery of past losses

Bullet Point 4

- Cannot adjust pricing lapse rate
 - Lapses are not explicitly allowed for in the contract

7. Continued

Bullet Point 5

- Consider Policyholder Reasonable Expectations
- The original illustration is a basis for customer's expectations

Bullet Point 6

- Appropriate to ignore par experience
- Should be no cross-subsidization from one cohort to another

Bullet Point 7

- Acceptable to not adjust face amounts downward for over 85 group
 - This not unfair to that group
- Acceptable to not adjust face amounts upward if less than 2% percentage change
 - May result in unreasonable implementation expenses

Bullet Point 8

- Communication of the change in death benefit is necessary
- Should include an explanation that is understandable, informative, and transparent
- Should not include critical illness product information

8. Learning Objectives:

5. The candidate will understand the Risk Based Capital (RBC) regulatory framework and the principles underlying the determination of Regulatory RBC and Economic Capital.

Learning Outcomes:

- (5a) Describe the MCCSR/RBC regulatory framework and the principles underlying the determination of Regulatory RBC.
- (5b) Compute MCCSR for a life insurance company, including:
- (i) Identification of significant risk components
 - (ii) Identification of specialized product MCCSR requirements
 - (iii) Interpreting results from a regulatory perspective

Sources:

Valuation of Liabilities, Lombardi

- Chapter 16, Risk-Based Capital, exclude 16.6

Commentary on Question:

Question tests basic knowledge of how RBC works and why RBC is important. Numerical example is relatively straightforward for a well versed student. The key in the very last part of the question is to make a recommendation of what to do (notice the use of the word recommend in the question).

Solution:

- (a) List reasons for regulators' interest in a company's RBC position.
- RBC measure increased the capital requirements for insurers and increased the authority of regulators over life insurance companies with deteriorating financial conditions.
 - The primary concern of regulators is the policyholders and the insurer's abilities to satisfy their contractual obligations to policyholders.
 - The act is meant to minimize the risk of insolvency and to allow insurers to measure the soundness of insurance companies.
- (b) The actuary in charge of statutory reporting prepared the RBC reports and made the following comment:
- “I calculated the RBC Ratio at 105%. Since the ratio is greater than 100% I am sure the regulators will be satisfied.”
- Critique the above comment.

8. Continued

The actuary is obviously not trained in the ways of RBC. Most companies target their RBC level at 200-300% of target RBC.

There are five action levels triggered based on the RBC level. An RBC ratio of 105% would fall into the “regulatory action level” trigger (100-150%). The company would be required to submit an action plan to improve RBC and the commissioner would specify the required next steps.

The company would need to be above 150% to avoid corrective actions ordered by the Commissioner.

(c)

- (i) Calculate the RBC ratio. Show all work.
- (ii) Evaluate the two investment strategies and recommend changes to each strategy as necessary to meet management targets.

A size factor is computed based on the number of issuers of bonds (Size Factor = Total Weighted Issuers / Total Number of Issuers). Total Weighted Issuers = First 50 x 2.500 + Next 50 x 1.300 + Next 300 x 1.000 + Over 400 x 0.900.

So the size factor is $(50 \times 2.5 + 50 \times 1.3 + 300 \times 1.0 + 100 \times 0.9) / 500 = 1.16$.

RBC is the size factor X statement value X RBC factor. Government bonds have no RBC factor so their contribution to required RBC is zero.

$$= 1.16 \times 1100 \times 0.013 = 16.588.$$

Using the provided formula, the Authorized Control Level (ACL) Risk-Based Capital was calculated as follows:

$$\text{ACL RBC} = 0.5 \times \{0 + 5 + [(16.588 + 30)^2 + 0 + 50^2]^{0.5}\} = 36.67.$$

RBC Ratio = Total Adjusted Capital / Authorized Control Level Risk-Based Capital = $95 \div 36.67 = 259\%$.

Current Investment Strategy:

Yield is low because of conservative investments and RBC ratio is more than adequate given that management only requires 200%.

8. Continued

- Can increase yield by buying bonds with higher risk class and trading in less risky bonds
- Could trade in bonds and invest in other asset classes having higher yields such as stock.
- Watch RBC though and make sure it meets management's tolerance.
- Not many assets earn more than 12%; would be difficult to earn 12% ROC, may want to reduce minimum to reflect investment environment

Alternate Investment Strategy:

Yield is higher because of riskier investments and RBC ratio is more than adequate given that management only requires 200%. Sort of the opposite problem that the current strategy has (maybe we really need to take the very best of both strategies).

Focus should be on increasing RBC

- Improve quality of bonds by buying better NAIC class. Better classes have lower capital requirements
- Increase the number of issuers. The higher number of issuers has smaller adjustment factors.
- Have more unaffiliated stock. Unaffiliated has a smaller capital factor than affiliated
- Reduce the beta on affiliated stock, beta adjustments are included in capital requirements
- Invest more in asset classes with lower factors, this can be cash or other type of investments

9. Learning Objectives:

7. The candidate will be able to evaluate risks faced by a Company by virtue of the Company's products, assets and management strategies and practices and be able to evaluate the appropriateness of various methods of risk mitigation.

Learning Outcomes:

- (7c) Describe and evaluate the other risks an insurance company faces including operational, marketplace and expense risks.
- (7d) Describe how risks (e.g. product, investments and operational) and opportunities interact and how they influence firm strategy.
- (7e) Describe and apply methods of risk mitigation and hedging and to understand the limitations of such methods.

Sources:

ERM Specialty Guide, Chapters 1-6.

ILA-C124-10: "S&P's Insurance Criteria: Refining the Focus of Insurer ERM Criteria", June 2006, excl. pp. 20-26.

Commentary on Question:

The goal of this question is to test candidates' understanding of ERM, including how risks (such as product risks, investments risks and operational risks) and opportunities interact with each other and how they influence an insurance company's ERM process

Candidate needs to

- a) Demonstrate an understanding of overall ERM Process
- b) Clarify the uses of risk mitigation strategies associated with specific insurance products
- c) Clearly communicate the advantages and disadvantages of each recommendation to mitigate risks

Solution:

- (a) Explain how the following factors affect the quality of the ERM process according to the ERM Specialty Guide:
 - Judgment
 - Breakdowns
 - Collusion
 - Management override

Commentary on Question:

Overall, most candidates received credit for describing how the four factors affecting ERM.

9. Continued

Solution:

- Judgment - human judgment can falter under the pressures of time and information constraints
- Breakdowns - mistakes and errors can result from fatigue, distractions or lack of training and experience
- Collusion - two or more individuals may collude to circumvent controls, conceal activity or alter data
- Management override - may suspend prescribed controls for illegitimate purposes

(b) FL's management is especially concerned about risks associated with:

- Potential excess volatility on its variable annuities block
- Redundant XXX reserves held for its term insurance products
- Amount of capital locked in its closed blocks

(i) Describe the pros and cons of using each of the following strategies to mitigate the above risks:

- Hedging
- Securitization
- Strategic Risk Management

(ii) Recommend the most suitable strategy to mitigate the above risks for each of FL's blocks of business.

Commentary on Question:

Overall, most candidates received partial credit for describing the pros and cons of using each of the risk mitigation strategies. However, to receive full credit, candidate must go beyond retrieval and show comprehensive knowledge by providing detailed explanation and appropriate conclusion concerning the situation described in the question.

Hedging

- Earnings are based on fixed % of the underlying assets and hence they are sensitive to market movement. Company may want to incorporate a static portfolio hedge for their VA business, designed to offset losses from lower revenues because of a potential decline in assets.
- Dynamic hedging can also be used.
- Protect statutory and GAAP earnings
- Protect tail risks
- Protect the company from policyholder behaviors / basis risks.

9. Continued

Securitization

- Reserve relief for Term. The viability of these securitizations is predicated on the redundancy of a large proportion of the excess reserves. Can be used as an alternative to reinsurance
- Closed block securitization. Relief for assets assigned to support the closed block.
- EV securitization. Capital relief and New Business Strain relief.
- Reduce VA volatility
- Mortality catastrophe bonds to help mitigate mortality risks

Strategic Risk Management

- Focus on products with better risk-return profile
- Realize natural hedge in the product mix: longevity risks from annuities and mortality risks from life insurance products
- Achieve scale by managing assets supporting the products together

10. Learning Objectives:

1. The candidate will understand the preparation of financial statements and reports of Canada life insurance companies and be able to analyze the data in them.
2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canada life insurance companies.

Learning Outcomes:

- (1c) Describe how to compute the taxable income of a life insurance company.
- (2c) Calculate liabilities for Life and Annuity products and their Associated Riders

Sources:

Canadian Insurance Taxation, Third Edition, 2009, by Price Waterhouse Coopers

- Chapter 3, Liability for Income tax
- Chapter 4, Income for Tax Purposes –General Rules
- Chapter 6, Reserves
- Chapter 11, Investment Income Tax
- Chapter 27, Provincial Premium Taxes

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

http://www.actuaries.ca/SOPhttp://doodle.com/q3z7wb26cf8q9y48_Doc/Complete/SOP_e_Complete_December09.pdf

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Calculate the provision for adverse deviation in Haitian Gourdes that Sky Life should hold for the currency risk. Show all work.

Commentary on Question:

This question tests the student's ability to calculate a provision for adverse deviation that should be held for currency risk. For the most part this question was well done.

Base scenario:

$$F = S \times ((1 + ia) / (1 + ib))^m$$

Where:

F = forward exchange rate

S = spot exchange rate (price in currency a of a unit of currency b)

ia, ib = risk-free interest rates for the respective currencies

m = maturity in years for the forward exchange rate

10. Continued

All numbers are in 000's

At time 0: $S = 42.30$

At time 3: $F = 42.30 \times ((1.09) \div (1.0139))^3 = 52.557$

Value of required asset at $t = 3$ in CAD = amount maturing $\div F$
 $= 10,000 \div 52.557 = 190$

Value of required asset at $t=0$ in CAD = CAD amount at $t=3 \div (1+i_{CAD})^3$
 $= 190 \div 1.0139^3 = 183$

Value of required asset at $t=0$ in HTG = CAD amount at $t=0 \times S$
 $= 183 \times 42.30 = 7,722$

Adverse scenario:

$$F_t = S \times ((1 + (\text{mean} - \text{standard deviation}))^{(1/m)})^t$$

At time 3: $F_3 = 42.30 \times ((1 + (0.653 - 0.461))^{(1/3)})^3 = 50.422$

Value of required asset at $t=3$ in CAD = amount maturing $\div F_3$
 $= 10,000 \div 50.422 = 198$

Value of required asset at $t=0$ in CAD = CAD amount at $t=3 \div (1+i_{CAD})^3$
 $= 198 \div 1.0139^3 = 190$

Value of required asset at $t=0$ in HTG = CAD amount at $t=0 \times S$
 $= 190 \times 42.30 = 8,049$

Minimum provision:

$$F_t = 95\% \times F_t \text{ from base scenario}$$

At time 3: $F_3 = 95\% \times 52.557 = 49.930$

Value of required asset at $t=3$ in CAD = amount maturing $\div F_3$
 $= 10,000 \div 49.930 = 200$

Value of required asset at $t=0$ in CAD = CAD amount at $t=3 \div (1+i_{CAD})^3$
 $= 200 \div 1.0139^3 = 192$

Value of required asset at $t=0$ in HTG = CAD amount at $t=0 \times S$
 $= 192 \times 42.30 = 8,128$

Provision for Adverse Deviation:

Using adverse scenario = liability for adverse scenario - liability for base scenario
 $= 8,049 - 7,722 = 327$

Using minimum provision = liability with 5% margin - liability for base scenario
 $= 8,128 - 7,722 = 406$

PfAD = max (provision using adverse scenario, minimum provision)
 $= \max(327, 406) = 406$

- (b) Recalculate the current year's taxable income of Sky Life in Canada, including reinsurance, policy loans, and premium tax in the calculation. Show all work.

10. Continued

Commentary on Question:

This question tests the student's ability to apply Canadian tax rules and adjust the given taxable income to incorporate reinsurance, policy loans and premium taxes. Most students did not realize that the information in the tables was provided in 000's, whereas the taxable income was in single unit dollars. Students were not penalized for this oversight.

The solution is given in 000's.

- Canadian-resident life insurers are not taxed in Canada for foreign insurance business

Only include the Canadian insurance business of Sky Life in taxable income

- Calculate Maximum Tax Actuarial Reserves (MTAR) used in taxable income
= Direct reserve - Total Ceded Reserve - Policy Loans

Include reserves ceded to registered and unregistered reinsurers.

MTAR @ prior year = 50,000 - 30,000 - 10,000 - 5,000 = 5,000

MTAR @ current year = 60,000 - 36,000 - 12,000 - 6,000 = 6,000

Change in MTAR = 6,000 - 5,000 = 1,000

Previously, only the change in gross reserve was included in taxable income

= 60,000 - 50,000 = 10,000

Increase in taxable income from including ceded reserves and policy loans
= 10,000 - 1,000 = 9,000

- Premium taxes are deductible from net income for tax purposes

Premium tax payable = 5% × (direct premiums - policy dividends)
= 5% × (20,000 - 4,000) = 800

Decrease in taxable income from premium tax = 800

- Insurers must include the amount of net premiums written on the sale of life insurance policies in income
- Net premiums written include direct premiums less premiums ceded under reinsurance agreements

10. Continued

Decrease in taxable income from ceded premiums = 12,000

Premium tax reimbursed by reinsurers = $5\% \times$ ceded premiums
= $5\% \times 12,000 = 600$

Increase in taxable income from ceded premium tax = 600

- Claims paid on insurance policies are deductible on a paid basis

Increase in taxable income from ceded claims = 11,000

Total change in taxable income = $9,000 - 800 - 12,000 + 600 + 11,000$
= 7,800

Total taxable income in Canada = original amount + change
= $7,500 + 7,800 = 15,300$

11. Learning Objectives:

1. The candidate will understand the preparation of financial statements and reports of Canada life insurance companies and be able to analyze the data in them.
8. The candidate will understand the professional standards addressing financial reporting and valuation.

Learning Outcomes:

- (1e) Describe international accounting standards.
- (8c) Identify and apply actuarial standards of practice relevant to financial reporting and valuation.

Sources:

Education Note: Classifications of Contracts under International Financial Reporting Standards

<http://www.actuaries.ca/members/publications/2009/209066e.pdf>

ILA-C622-12: CIA: Consolidated Standards of Practice: (Section 2400) – Nov 2009

Commentary on Question:

The first part of the question tested the student's understanding of what it means for a contract to qualify as an insurance contract, first by asking the students to describe the considerations, then by giving the students a number of examples to assess. The last part of the question gave an example of a communication about an understated liability and asked the students to critique the letter.

Solution:

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

Commentary on Question:

Most students understood what was being tested.

IFRS 4: insurance contract = “contract under which one party accepts significant insurance risk from another party (p/h) by agreeing to compensate p/h if specified uncertain future event adversely affects p/h

Insured Event

- Contract must specify at least one insured event that could trigger a benefit based on a legal obligation
- Benefit can be uncertain as to its occurrence, its amount, or its timing
- IFRS 4 requires the uncertainty to be present on the level of the individual contract
- And to arise as a result of risks other than financial risk

11. Continued

- Policyholder needs to be exposed to relevant risk regardless of whether contract exists or not

Significant insurance risk

- Significant if and only if insured event could cause insurer to pay significant additional benefits in any scenario,
- Excluding scenarios that lack commercial substance

Determination of commercial substance

- Scenario has commercial substance if it has a discernible effect on the economics of the transaction.

Decision basis

- Determination of significance is performed on an individual contract basis

Changes in the level of insurance risk

- If level of risk that previously didn't qualify as insurance later becomes significant, it is reclassified as insurance

- (b) Assess whether each contract would qualify as insurance for IFRS accounting purposes. Justify your answer.

Commentary on Question:

A few students failed to justify their answers and did poorly as a result. In addition, many students mistakenly attempted to identify if each contract was a life insurance contract.

- (i) Not an insurance contract. Loss of \$100 on \$10M portfolio is not significant
- (ii) Insurance contract. Significant because insured amount is equal to market value of new item.
- (iii) Insurance contract. Guarantee now has value is and is considered significant risk transfer
- (iv) Both T100 and Annuity are considered insurance contracts. Insurance risk is determined on the 2 contracts separately. Both considered significant risk transfer.
- (v) Not an insurance contract. Since contract issued at newly underwritten rate where evidence of insurability is satisfactory, this contract does not affect the assessment of risk transfer
- (vi) Insurance contract. Once a contract qualifies as an insurance contract, it is always an insurance contract.
- (vii) Insurance contract. Insurance risk since it may not be possible to buy an asset that has a 2% yield when the deferred annuity is purchased.
- (c) Critique the communication.

11. Continued

Commentary on Question:

Many comments, such as those on controls, although important points to consider were not required to meet the Standard of Practice requirements.

- The communication should be to senior management.
- If a Canadian Insurer, a copy of the communication should also go to the board.
- Monitoring should be at least quarterly
- Report should include a recommendation for rectification.
- A deadline for rectification should be specified
- If there is no rectification by the deadline then the appointed actuary would report the issue to the regulator

12. Learning Objectives:

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

Learning Outcomes:

- (2b) Recommend appropriate valuation assumptions

Sources:

ILA-C634-13 : CIA Consolidated Standards of Practice – Section 2100, 2300, 2500

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

Commentary on Question:

The question is trying to test the student's understanding on setting up assumptions and MfAD levels especially in terms how they can utilize the knowledge and provide their judgment when facing a new situation. In this case, it's designing a brand new product.

Focus on application of knowledge and provide judgment

Most candidates can recall the basic MfAD boundaries in the standard but failed to make recommendations and support why or provide judgments. There is no one absolute correct answer and the solution below is to illustrate what might be expected from candidates. If a candidate can raise different opinions and clearly explain why, credits would be given.

Solution:

- (a) Evaluate the appropriateness of best estimate and MfAD assumptions.

Mortality

As it's fully underwritten and same underwriting standard as the whole life products, appropriate to expect best estimate mortality for the new combo product to be consistent with whole life product.

The low margin for the mortality rate per 1,000 is an addition of 3.75 divided by the best estimate curtate expectation of life at the life insured's projected attained age. The high margin for the mortality rate per 1,000 is an addition of 15 divided by the best estimate curtate expectation of life at the life insured's projected attained age. Current MfAD level is below the average of high and low bounds according to CSOP. But with large enough past experience, company experience seemed to be credible and be able to estimate mortality rates with confidence. The MfAD assumed seemed to be appropriate.

However, credits would also be given if the candidates raise concerns on the how the new combo products might be marketed and sold leading to different customer profile/mix hence impacting the company's risk profile. With the lack of experience with the new product, higher best estimate mortality rate and/or MfADs should be used.

12. Continued

Lapse

Since T100 is already lapse supported and with additional product features, it might be more prudent to assume even lower lapse rate with the absence of CSV.

The low margin is 5% of the best estimate and the high margin is 20% of the best estimate. The direction of MfAD should increase the policy liability. With no past experience of this kind of product, MfAD should be as least as high as the average of lower and upper bound of PH behavior MfAD. 10% assumed would be too low and should consider to be at least as high as 12.5%.

CI Incidence Rate

CI standalone product has different sets of underwriting standards and likely to have additional tests from T100, it's appropriate to assume higher best estimate CI incidence rate in the new combo product.

The high and the low margin is 5% and 20%. Current MfAD level is below average of high and low bound according to CSOP. With no past experience, it is more appropriate to assume higher MfAD than 5%. Should consider to be at least as high as 12.5%

LTC option elected rate

It's hard to comment on the appropriateness of best estimate assumption without further information. But the best estimate should be prudent and based on credible company data or industry data.

The high and the low margin is 5% and 20%. Current MfAD level higher than the upper bound for PH behavior of 20%. If there was no confidence in the election rate assumption, should generally be capped it at 20%.

Maint Exp

The new combo products provide more options and might incur multiple claims. Hence the best estimate assumption should be higher than the maint exp of T100.

The high and the low margin is 2.5% and 10%. 2.5% is at the lower bound of MfAD, with no past experience and the complexity of the combo product, higher MfAD should be used. With significant considerations, it should be at least the average of the high and low margin.

- (b) Comment on the appropriateness of investment strategy proposed and recommend changes.

12. Continued

T100 and new combo product are expected to have different shapes of CFs and liability durations. Assuming the current investment strategy is designed to match the T100 CFs well hence there is very little asset liability mismatch. That means the current investment strategy might not be suitable for the combined CFs from T100 and the new combo products. By backing the new combo product using the existing T100 asset segment and investment strategy can cause larger asset liability mismatch, liquidity issues and possibly disintermediation risks. This will in term cause higher earning volatility for both blocks.

A new asset segment should be created for the new product with investment strategy that will better match the pattern and duration of the new product's CFs. A good starting point would be to compare the investment strategies for the 3 standalone products and maybe combine them as the new investment strategy for the combo product. If it's not feasible to create a brand new segment at the launch of the product, FX Life should compare the CF pattern and duration projected for the new product with the current T100. More liquid and shorter term assets might be added to in the investment strategy to better match the combined CFs.

13. Learning Objectives:

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

Learning Outcomes:

- (2b) Recommend appropriate valuation assumptions

Sources:

CIA Educational Note: Best Estimates Assumptions for Expenses – November 2006

CIA Educational Note: Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies: July 2002

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

Commentary on Question:

The question tried to test the candidate's understanding of credibility, MfAD setting and expense calculations. The candidate was required to remember the credibility formula as well as be able to correctly judge which years of data was appropriate to include in the calculation. The candidate needed to have an understanding of MfADs to appropriately recommend what to use. Lastly, the candidate needed to know what expense items should be included in a maintenance cost calculation.

Many candidates struggled with remembering the credibility formula. Also, some candidates likely only had time to write down a description of how they would calculate the answer, and did not have time to fully calculate the solution.

Solution:

- (a) Calculate the mortality ratio to apply to the industry mortality table to use as the expected mortality assumption for the fully underwritten policies. Show all work.

Epidemic years 2007 and 2008 should be excluded, as they are outliers in the pool of data. As only recent data should be used, 2006 is also excluded.

$$\text{Number of deaths} = (125 - 20) + (130 - 15) + (155 - 25)$$

$$\text{Number of deaths} = 350$$

3007 deaths recommended for full credibility with Poisson at $p = 90\%$ and $r = 3\%$

Partial credibility defined as $Z = \min [(\text{number of deaths} / 3007)^{0.5}, 1]$

$$Z = \min [(350 / 3007)^{0.5}, 1]$$

$$Z = 34\%$$

Expected assumption = $Z * \text{company mortality ratio} + (1 - Z) * \text{industry mortality ratio}$

Company mortality ratio = actual claims / expected claims

$$\text{Actual claims} = (150,000 - 10,000) + (150,000 - 10,000) + (200,000 - 15,000)$$

13. Continued

Actual claims = 465,000

Expected claims = (230,000 - 15,000) + (250,000 - 15,000) + (260,000 - 20,000)

Expected claims = 690,000

Company mortality ratio = 465,000 / 690,000

Company mortality ratio = 67%

Expected assumption = 34% * 67% + (1 - 34%) * 78%

Expected assumption = 74%

(b) For the following assumptions:

- (i) Mortality
- (ii) Per policy maintenance unit cost expense
- (iii) Policyholder behavior

Recommend an appropriate margin for adverse deviation for each of the above assumptions. Justify your answers.

The application of a margin for adverse deviations should result in an increase to the value of the liability net of reinsurance.

The MfAD would be at least the average of the applicable high and low margin whenever at least one 'significant consideration' exists

- (i) The low and high margin for the mortality rate per 1,000 is an addition of 3.75 and 15 divided by the best estimate curtate expectation of life at the life insured's projected attained age.

The following significant considerations are present:

The credibility of the company's experience is too low to be the primary source of data as SNJ is a small company

The cohort of risks lacks homogeneity due to mix of full and simplified underwriting

Anti-selection present from underwriting criteria

Policy of internal replacement favorable to rotation of old business and impact not supported by credible experience

Simplified underwriting

Anti-selection by sales force

As a result of these significant considerations, should hold a margin closer to the high end, such as at least average of 9.375 / ex

- (ii) The low and high margin is 2.5% and 10% of the best estimate expense including inflation thereof.

13. Continued

The following significant considerations are present:

Change is likely in distribution of in force among lines of business or products that can alter unit expense rates

As a result of the above significant considerations, should hold at least average of 6.25%

- (iii) The low and high margin is 5% and 20% of best estimate assumption

The following significant considerations are present:

Low credibility

Future experience difficult to estimate: class of risks reflects new terms and conditions

As a result of the above significant considerations, should hold at least average.

(c)

- (i) Identify the expense items that should be included in or excluded in the per policy maintenance unit cost calculation. Justify your answers.
- (ii) Calculate the per policy maintenance unit cost for 2012 and 2013. Show all work.

Items that should be included:

All investment expenses related to assets used to support GAAP policy liabilities

Salaries for policy admin staff

Salaries for IT staff

Items that should be excluded:

Commissions are excluded from unit cost as they are included separately as a percentage of premium.

Investment expense for the assets which support capital are excluded from unit costs as the expenses are not related directly to the policies

Underwriting medical costs are excluded from unit costs as they are considered an acquisition expense

Salaries for underwriting staff are excluded from unit costs as they are considered an acquisition expenses

Merger and acquisition expenses incurred prior to the date of the acquisition or merger are excluded from unit costs as the expenses are not related directly to the policies

13. Continued

Where an acquisition has taken place, consideration is given to future expenses to integrate/reduce staff and infrastructure; such amounts are reflected in the valuation in the periods they are expected to be incurred.

Total expenses for SNJ in 2011 = per policy unit cost for 2011 * number of policies for SNJ

Total expenses for SNJ in 2011 = $40 * 60,000$

Total expenses for SNJ in 2011 = 2,400,000

Inflation should be reflected for each year.

SNJ in 2012 = $2,400,000 * 1.02$

SNJ in 2012 = 2,448,000

SNJ in 2013 = $2,400,000 * 1.02^2$

SNJ in 2013 = 2,496,960

Maintenance expenses are the sum of only the expense items that should be included.

Maintenance expenses for CCS in 2011 = Investment expenses for assets supporting policy liability + Salary for policy admin staff + Salary for IT staff
= $30,000 + 200,000 + 180,000 = 410,000$

Inflation should be reflected for each year.

CCS in 2012 = $410,000 * 1.02$

CCS in 2012 = 418,200

CCS in 2013 = $410,000 * 1.02^2$

CCS in 2013 = 426,564

Total expenses to include in unit costs = SNJ expenses + CCS expenses + additional temporary expenses related to the acquisition

Total expenses in 2012 = $2,448,000 + 418,200 + 40,000 = 2,906,200$

Unit cost = total expenses / number of policies

Unit cost in 2012 = $2,906,200 / (60,000 + 6,000) = 44.03$

Total expenses in 2013 = $2,496,960 + 426,564 + 15,000 = 2,938,524$

Unit cost in 2013 = $2,938,524 / (60,000 + 6,000) = 44.52$

14. Learning Objectives:

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

Learning Outcomes:

- (2a) Describe Valuation Methods
- (2b) Recommend appropriate valuation assumptions

Sources:

CIA Educational Note Valuation of Universal Life Policy Liabilities

Commentary on Question:

Part (a) of the question tested the candidate's knowledge of the steps involved in valuing a UL policy. Part (b) of the question tested the candidate's ability to evaluate valuation assumptions and methodologies.

Almost all candidates did poorly in part (a). Most people misunderstood what was asked (i.e. specific steps for UL) and instead listed out steps to CALM valuation, or CIA guidance on setting MfADs in general. Part (b) was more well done, and many candidates were able to give reasonable suggestions on dealing with assumptions such as funding patterns for premium.

Solution:

- (a) Describe the steps used to value a Universal Life (UL) product according to the CIA Educational Note on Valuation of Universal Life Contract Liabilities.

Firstly, must understand the fundamentals and features specifically associated with a UL product:

- Product Design (if there are guarantees)
- Credited Rate Setting (company's strategy in deciding how much to credit)
- Adjustment Setting (company's strategy on when / how to adjust crediting rates)
- How product will be illustrated to potential policyholder
- Market for the UL product

Identify policy elements that have imperfect pass through ability / adjustability, and rank them in priority. These elements will represent a significant area of risk exposure for the company, as they cannot be passed onto the policyholder.

Identify distinct segments within the in-force population where policyholder behavior may be different. These include elements such as:

- Funding level (minimally funded vs. high funded)
- Premium persistency (level pay vs. single pay)

14. Continued

- Investment account selection (equity funds vs. fixed income accounts)
- Partial withdrawals

Each of these elements will result in different levels of risk for the company, some of which cannot be passed through to the policyholder through the adjustable nature of UL.

An investment strategy for the product needs to be developed, and a model should be created.

Conduct scenario testing by different subsegments to identify any correlations, and to understand how results differ across different policyholder subsegments. This testing would lead to the final refinements to the valuation subsegments. For all scenarios dependent assumptions such as those related to investment strategy, a methodology should be developed for on-going measuring and monitoring.

Not all assumptions will need to be scenario tested. Examples of non-scenario tested assumptions that can apply to the entire inforce population are:

- Mortality
- Administration expenses
- Investment account spreads

Once non-scenario tested assumptions have been set, a methodology should be developed to regularly measure and monitor them on a go-forward basis.

Develop a projection model for this product. The model should be able to reproduce actual policy illustrations without any material discrepancies. Using the projection model, a valuation model can be developed.

Finalize the assumptions / procedures for valuing the various subsegments. Test the model and process for reasonableness.

Some assumptions are sensitive to small changes in policyholder behavior. For these, conduct Sensitivity testing to ensure that outcomes are within the risk tolerance of the company.

If some of the policyholder behavior assumptions are deemed to be strongly correlated to economic assumptions, then the relationship needs to be defined and understood, with a methodology developed for on-going measuring and monitoring.

Results from this testing can be used to further refine the inforce population segmenting in the valuation model.

Establish controls for future change management.

- (b) Critique the above assumptions and methodologies used to value this UL product.

14. Continued

Mortality Assumption

Define the non-scenario tested assumptions that apply across all subsegments.

It is good practice to blend company specific experience with industry experience. Reviewing every two years would be sufficient for an assumption like mortality, which has more gradual changes in trend (vs. economic assumptions).

Consider the possible impact of anti-selective lapse, where high lapse rates are seen on healthy lives and only poor risks remain.

Consider the impact of guaranteed mortality charges. If significant mortality deterioration occurs (for example due to anti-selective lapse), the guaranteed charges may no longer be sufficient to adequately pay for the mortality risk on the inforce population.

Funding / Premium Persistency

Identify the distinct market or in-force subsets, differentiating between sections in the population based on policyholder behavior.

In order to do this, must understand different policyholder reasoning for buying the product. This will impact lapse and premium persistency assumptions

Some examples of considerations:

Minimally funded level COI policies may have been marketed as T100 at sale, which would impact lapse experience.

Policyholders whose agents emphasized crediting rate, tax advantages and other savings / accumulation aspects at the time of sale will likely have different levels of premium persistency than other policyholders.

If quick-pay premiums are featured, or if policies are administered to target a specific paid-up date, premium persistency will be impacted.

Currently there are 3 different funding level assumptions.

Because no specific required premium is payable, a premium persistency assumption is needed.

One possible approach is to look at the policy administration system to find out the initial premium assumption that was illustrated at time of sale. Then compare the actual premium deposits to what was illustrated to get a sense of whether the policyholder has been predictably following the illustrated premium schedule, and if reasonable, use illustrated pattern.

Another approach is to look at actual premium deposit pattern, and assume future premium pattern will be similar.

Once a methodology is chosen, can combine funding level assumptions and premium persistency assumptions - perhaps 3 each - into 9 "buckets."

Since there is only one account in this case, no need to worry about policyholders switching between different investment accounts.

14. Continued

We should assume higher partial withdrawals in the overfunded policies (at a duration where surrender charges are low) as policy owners switch to investment options with higher credited rates because they may be offering new money rates. In addition, the premium persistency may drop in overfunded policies as people can place their money in better investments.

Once set, need to develop a process for measuring, monitoring, and re-setting these policyholder behavior assumptions by segment regularly (i.e. yearly), and also reflecting any changes in crediting rates.

Withdrawal/Lapse

Currently using one aggregate lapse assumption. Since we've been selling for almost 10 years, we should start seeing some experience in this area & to be able to have different withdrawal assumptions for each bucket.

Can add valuation segments for partial withdrawal assumptions.

Maximally funded may be marketed as alternative to investment products, affecting lapse.

Level and duration of surrender charges will influence policyholder behavior / lapses.

If joint last to die, which are often purchased for estate tax planning purposes, lapse rates might be low.

Tax implications that may affect policyholder behavior, i.e. if lapsing the policy would result in policy owner paying tax on the surrender value.

Expense

It is good to have expenses assumptions determined specifically for this product. There may be additional administration cost from annual statement and annual tax exempt testing.

It is good practice to review regularly and monitor potential increase in costs.

Investment Spread

The investment spread is the difference between earned rates and credited rates. Since there are equity assets backing the general account (and therefore affecting the earned rate and the investment spread), the investment spread is not likely to be level.

There can be a one-quarter lag between the time when rates change and when the company can adjust credited rate, which represents a risk.

Capping crediting rate adjustment to 80% of actual rate change will also affect investment spread.

14. Continued

Also should consider how illustrations provided to policyholders assumed company would react to an increase in rates.
It is good practice to review and update regularly.

Discount Rate

It is good practice to determine this using CALM.

Starting with current policy fund balance, current assets, valuation policy components & assumptions, project future policy elements and future asset and liability cash flows.

This process may need to be performed on a duration-by-duration basis rather than policy-by-policy.

For some types of policies, policyholder behavior, credited rates, or other policy components may be dependent on other elements of the projection. In such cases the steps would require an iterative approach.

Conduct roll forward scenario testing for each subsegment incorporating linkages / correlations defined.

Test the sensitivities on the interest rates and equity rates and also include variable liability cash flows under each scenario.

It is good practice to review and update quarterly.