ILA LFVC Model Solutions
Fall 2014

1. **Learning Objectives:**
1.   The candidate will understand financial statements and reports of U.S. life insurance companies and be able to analyze the data in them.

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

Learning Outcomes:
(1d)   Explain the appropriate accounting treatments for items such as, but not limited to:
   (i)   Separate Accounts
   (ii)   Embedded options
   (iii)   Derivatives
   (iv)   Secondary guarantees

(1e)   Describe, use and recommend methods for performing reviews of reserves.

(7d)   Explain the actuary's professional responsibilities to stakeholders including obligations under Sarbanes-Oxley.

Sources:
LFV 102-09: Actuarial review of reserves and other annual statement liabilities

Valuation of Life Insurance Liabilities, Ch. 1 Overview of Valuation Requirements

Responsibilities of the Actuary for Communicating Sarbanes-Oxley Control

Actuarial Aspects of SOX 404, Financial Reporter, Dec 2004

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)
   (i)   List the categories of reserve reviewing techniques.

   (ii)   Recommend two appropriate reviewing techniques for Pelican Life's business and justify your choices.

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1. Continued

> (iii)   Calculate the total claims reserve as of Dec. 31. Show all work.

Commentary on Question:
The majority of candidates were able to list most of the categories described in LFV 102-09, as well as to make their recommendations based on how these techniques apply to the specifics of Pelican Life.

For part (iii), most of the candidates were aware of applying cumulative completion factor to claims paid, however, less than half of them were able to come up with the claim reserves from that point, while the rest them seemed to mistakenly use the expected total claims paid as claim reserve.

(i)
- Spot checks (test calculations. Transactional checks, and policy traces)
- Independent full re-computations
- Tests of aggregate progress of reserves from one fiscal period to the next
- Tests of relationship of reserve items to other financial items, and reasonableness of trend in that relationship over time
- Tests of inventory
- Tests of reserve adequacy

(ii)   Any two techniques listed above with reasonable justification are accepted. Candidates who only listed the recommendation of techniques but without relating it to Pelican Life's business to justify the recommendation were given no points; some candidates who provided descriptions for their choices of techniques but didn't give enough elaboration of how they applied to Pelican Life received partial credit

(iii)   Total expected paid = claims paid x cumulative completion factor
Reserve each month = total expected paid - claims paid
Total claims reserve = sum of reserves for each month

Month	Claims Paid (1)	Cumulative Completion factor (2)	Total Expected Paid (3) = (1)X(2)	Reserve = (3)-(1)
July	260	1.0	260	0
August	220	1.2	264	44
September	250	1.5	375	125
October	150	2	300	150
November	100	2.6	260	160
December	80	3.2	256	176

Total Claims Reserve = 0+44+125+150+160+176 = 655

1. Continued

(b) Critique each of these practices.

Commentary on Question:
For practice A: Most candidates were able to recognize the importance of effectiveness of internal control, but the majority of them overlooked the role played by actuaries in this process.

For practice B: Candidates did better on this one than practice A, as most of them can identify other risks and were able to suggest various controls as they see fit in this situation.

For Practice A:
- The company's actuaries should also be involved in assessing and attesting to SOX controls.
- Critical aspects of valuation and financial reporting are often outside the expertise of internal auditors and not easily audible by the internal auditors; the company's assessment report should contain some kind of statement from an actuary.
- The auditor should not simply sign a statement attesting that no controls failed; rather, the auditor should issue an attestation report on management's assessment of internal controls over financial reporting.
- SOX is focused on the effectiveness of the company's internal controls and does not state that a company must not fail any controls.

For Practice B:
- While this is a good control practice, there are other risks to accurately determining reserves.
- Other risks include the data, the compilation process, and the management review process.
- Controls should be put in place for these additional risks as well; they may include reconciliation of input and output totals, reconciliation of the general ledger to calculated balances, formal peer review of areas that require judgment, and regular review by management of changes in assumptions or methodologies
- There are other controls in addition to the ones listed above that the candidate could name; candidates who gave valid examples also received credit for those

(c) Pelican is domiciled in Canada and sells business in both Canada and the U.S. Recently, Pelican began listing its shares on the New York Stock Exchange in order to take advantage of the U.S. capital markets. Pelican has a large number of policies that were issued many years ago backed by long term assets.

1. Continued

      (i)   Outline the procedure for obtaining the value of the long term assets under Fair Value Accounting.

      (ii)   Explain how the implementation of International Accounting Standards would benefit Pelican.

Commentary on Question:
For (i): Many candidates pointed out to use market price for fair value, but some of them missed mentioning 'actively traded' and were only given partial credit. A number of candidates did not understand the question correctly and provided definition for Post-3855 asset classification (e.g. HFT, AFS etc…)

For (ii): Most candidates recognized the consistency IAS would bring, but did not mention the current situation without implementation of IAS, i.e. that Pelican Life would need to prepare financial statements for both US and Canada. Candidates that misunderstood part (i) also incorrectly answered part (ii) by explaining the beneficial accounting treatments of assets post the implementation of IAS.

(i)
- If the assets actively trade on one of the exchanges, the fair value would be the market price.
- If the assets do not actively trade on one of the exchanges, the hierarchy of valuation methods for determining their value is:
  - Market value when available,
  - Market value of similar instruments, with appropriate adjustments,
  - Present value of projected cash flows

(ii)
- By listing shares on the New York Stock Exchange in the U.S., Pelican must prepare its financial statements in accordance with U.S. GAAP
- Pelican must also prepare financial statements in accordance to the accounting principles of Canada, since it is domiciled there
- International Accounting Standards would establish one set of accounting standards that would be recognized around the world; Pelican would benefit by only having to prepare one set of financial statements

2. **Learning Objectives:**
3. The candidate will be able to understand and analyze the implications of emerging financial and valuation standards.

Learning Outcomes:
(3b) The candidate will be able to describe and assess the impact on reserves, capital, and/or income of emerging developments in International Finance Reporting Standards.

Sources:
Practical Guide to IFRS, PwC (July 2013)

US: FASB Exposure Draft (June 2013), pp. 21-64 (through to paragraph 834-50-37) plus Appendix A (pp. 376-395) and Appendix B (pp. 396-405)

CAN: Insurance Contracts under IFRS–IASB (June 2013), pp. 13-64

Commentary on Question:
This question tests the candidate's knowledge of IFRS Accounting Standards and methodology. Most candidates struggled on parts (a) and (b)(i) but performed well on (b)(ii).

Solution:
(a) Analyze how each of the following insurance contracts is measured under the proposed IFRS accounting standards using the June 2013 releases of the IASB and FASB Exposure Drafts.

     (i) Variable Deferred Annuity.

     (ii) Non-Proportional Life Reinsurance Ceded.

     (iii) Annually Repriced Hospitalization Individual Health Contract.

     (iv) Extended Auto Warranty.

Commentary on Question:
Most candidates failed to analyze how the insurance contracts will be measured under IFRS and instead discussed how they would be classified.

     (i) **Variable Deferred Annuity**
- Long Duration Contract
- Measured using the Building Blocks Approach. Building Blocks are:
  - Future Cashflows
  - Explicit Risk Adjustment
  - Contractual Service Margin

2. **Continued**

(ii) **Non-Proportional Life Reinsurance Cede d**
- Long Duration Contract
- Measured using the Building Blocks Approach. Building Blocks are:
    o Future Cashflows
    o Explicit Risk Adjustment
    o Contractual Service Margin

(iii) **Annually Repriced Hospitalization Individual Health Contract**
- Short Duration Contract
- Measured Using Premium Allocation Approach
    o Liability is not discounted if within a year

(iv) **Extended Auto Warranty**
- Long-duration contracts for auto repair under certain conditions
- Out of scope for IFRS Insurance Contracts

(b)

(i) Critique the discount rate with reference to the proposed standards:

(ii) Identify which of the following statements are false and recommend changes to make the statements true.

Commentary on Question:
Most candidates struggled on part (i), not offering enough detail in their critique of the discount rate. Most candidates did recognize that the 10-year treasury was not well matched to the timing of the liability. Many candidates noted both a top-down and bottom-up approach to setting interest rates, however this often led them to make contradictory conclusions. Part (ii) was answered well with most candidates identifying the false statements and providing acceptable recommendations.

(i)
- Discounting should be consistent with the timing of the insurance contract liability
    o The 10-year treasury is not well matched to the liability and shorter duration rates should be used
- Fulfillment cashflows should not be adjusted to reflect the nonperformance of the entity
    o Therefore, the discount rate should not be increased for own credit risk
- Instead of a single discount rate, a yield curve should be used to discount cashflows with different timing

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2. Continued

- Insurance liability cashflows are not consistent with market risks for credit losses
  - o Therefore, this should not be added to the discount rate
- The insurance cashflows have an illiquid nature that is inconsistent with the very liquid risk free rate
  - o Therefore, a liquidity premium should be added to the discount rate
- The calculation is based on current interest rates. Rates will need to be calculated based on what rates were when the initial recognition would have occurred for the interest accretion rates.

(ii) **Statement 1 is False**
- The company has guaranteed premiums beyond the level term period so it may not be able to reprice to fully reflect the risk
  - o Therefore, the contract boundary should extend beyond the renewal periods

Statement 2 is False
- The Premium Allocation Approach is used when the coverage period is 1 year or less
- It is also used when, at inception, it is unlikely for there to be significant variability in the expected value of the net cashflows to fulfill the contract
- Otherwise, the Building Block Approach should be used to value the contract
  - o Therefore, the building block approach should be used

Statement 3 is True

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

Learning Outcomes:
(4d)   Apply methods of valuation to business and asset acquisitions and sales. This includes explaining and applying the methods and principles of embedded value.

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

Commentary on Question:
The goal of this question was to test the candidates knowledge regarding an actuarial appraisal and embedded value. Candidates that did well were able to calculate the cost of capital and the present value of book profits.

Most candidates did well on part a).

Many candidates did not correctly define the book profit formula and some did not use the correct risk discount rate to calculate the cost of capital. Some students made errors in the timing of the discounting of the cost of capital, having it one period too soon. Another common error was that students were subtracting d(t) from the RDR rather than using (d)t - i(t) in the explicit approach to calculating CoC in part c).

Solution:
(a)   Describe items that should be considered to perform an actuarial appraisal for the potential acquisition.

The items that should be considered to perform an actuarial appraisal are:
- The future new business capability.
- ANW, IBV, VNB and sensitivity tests which could be used to support an actuarial appraisal.
- Historical financial data so assumptions about future growth can be made and applied to the VNB.
- The assumptions, which would differ from an EV calculation, because they would be from a buyer's perspective.

(b)   Calculate the following assuming a risk discount rate of 10%:

(i)   Present Value of Cost of Capital

(ii)   Present Value of After Tax Statutory Book Profits

(iii)   Inforce Business Value

Show all work.

3. **Continued**

(i) $PVCoC = \sum RC_{t-1} \times (RDR - i)/(1 + RDR)$

t	RC t-1	RDR - i	CoC	PVCoC t-1
1	4000	6%	240	218.18
2	3500	6%	210	173.55
3	3500	6%	210	157.77
4	3000	6%	180	122.94
5	3000	6%	180	111.77
			Sum	784.22

PVCoC = $784.22

(ii)   Book Profit(t) = Surplus(t) - Surplus(t-1)*(1+i(t))

t	Surplus(t)\	Book Profit(t)	PVBP(t)
0	10,000		
1	13,000	2,600	2,363.64
2	14,000	480	396.69
3	14,500	-60	-45.08
4	15,000	-80	-54.64
5	16,000	400	248.37
	Sum		2,908.98

(iii)   IBV = PVBP - PVCoC

BV = 2,908.98 - 784.22 = $2,124.76

(c)   Calculate the Present Value of Cost of Capital. Show all work.

There are two ways to solve this problem:

Explicit approach:
CostOfCapital(t) = [(RC(t-1) - D(t-1))*(RDR - i(t))] + D(t-1)* (d(t) - i(t))
PVCOC(t-1) = CostOfCcapital(t)/1.1^t

It is assumed D(t) = $2,000 of the required capital is funded by debt, which earns d(t) - i(t) = 6% - 4% = 2% and the rest is funded by equity who's CoC rate is RDR - i(t) = 10% - 4% = 6%.

3. **Continued**

t	RC(t-1)	D(t-1)	RDR - i(t)	d(t) - i(t)	CoC(t)	PVCoC(t-1)
1	2000	2000	6%	2%	160	145.45
2	1500	2000	6%	2%	130	107.44
3	1500	2000	6%	2%	130	97.67
4	1000	2000	6%	2%	100	68.30
5	1000	2000	6%	2%	100	62.09
					Sum	480.96

Therefore the PVCoC = $480.96.

Implicit approach:

RDR WACC(t) = e * (E/(D+E)) + d * (D/(D+E)), where e = 10%, d = 6%
CostOfCapital(t) = (RDR WACC(t) - 4%) * (RC(t-1) + D(t-1))
PVCOC(t-1) = CostOfCapital(t)/1.1^t

t	RC(t-1) + D(t-1)	RDR WACC	CoC(t)	PVCoC(t-1)
1	4,000	8.0%	160	145.45
2	3,500	7.7%	130	107.44
3	3,500	7.7%	130	97.67
4	3,000	7.3%	100	68.30
5	3,000	7.3%	100	62.09
			Sum	480.96

(d) Calculate the Embedded Value assuming that the current book value of assets equals the realizable market value. Show all work.

EV = ANW + IBV

ANW is the realizable value of capital and free surplus. It is given that the current book value equals the market realizable value, so the ANW = Surplus(0) = $10,000.

IBV was calculated previously to be $2,124.76.

EV = 10,000 + 2124.76 = $12,124.76.

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

Learning Outcomes:
(2a)   Describe valuation methods.

Sources:
LFV-634-13: CIA Consolidated Standards of Practice – Section 2100, 2300, 2500
CIA Educational Note: Considerations in Valuation of Segregated Fund Products, Nov. 2007

Commentary on Question:
For all parts of this question, we were looking for an assessment of the validity of the statements (i.e. true/false) and reasons behind the assessment.

Solution:
Discuss the appropriateness of each of the student's statements:

(i)   It is appropriate to write down the acquisition expenses (AAE) using a fixed proportion of the revenue from collected expense charges (MERs) for this block, where the time taken to write down the AAE will depend on market performance.

(ii)   It is appropriate to calculate a liability using an approach that does not explicitly test the recoverability of the unamortized AAE.

(iii)   The "Bifurcated Approach" of valuing the block of business is better than the "Whole Contract" approach for the following reasons:

- The bifurcated approach produces a lower reserve;
- The bifurcated approach produces a more stable reserve;
- The bifurcated approach defers the writing down of the AAE as long as possible;
- The bifurcated approach allows for more appropriate modeling of hedged liabilities.

(iv)   It is never appropriate to hold a liability less than zero for this block of business.

(v)   It is impossible to determine a C-3 risk for this block of business so setting it to zero is appropriate.

4. Continued

Commentary on Question:
For the first part of this question, many students expended a lot of effort reciting descriptions of the bifurcated and whole contract approach which did not earn points. The key aspects were term & write down pattern established at inception. For all parts of this question, students received full marks if they provided both the correct statement of whether true or false and gave a reason for their assessment.

(i) False.
According to the standards of practice, the appropriate method should
- have a term consistent with the extended term established at inception
  - inconsistent with the student comment "the time taken to write down the AAE will depend on market performance"
- have a write down pattern reasonably matched with cash flow available
- the amount of write down does not fluctuate from the expected amount established at inception provided that it is recoverable

(ii) False
Recoverability should be tested at least annually.
- If not fully recoverable, the balance of the unamortized AAE is written down to the recoverable amount.
- Whole contract approaches does calculate a liability without explicitly testing the recoverability of the unamortized AAE, but any variation that could allow the unamortized AAE to increase in a period is inconsistent with the standards of practice

(iii) Assess each comment separately:
- (first bullet) False
  - The total liability under the Whole Contract Approach will be less than or equal to that under the Bifurcated Approach because all future revenue is taken into consideration for the Whole Contract Approach.
- (second bullet) This depends on whether the liability for the guarantee is negative or not.
  - The total liability under the whole contract approach is more likely to be negative and often a zero floor is applied when the liability is negative.
  - results in the whole contract liability being more stable.
  - Once the liability for the guarantee has become positive the liability under the whole contract will become more volatile than under the bifurcated approach
  - Because implicit allocation of revenue between AAE and guarantee may change from period to period

4. Continued

- (third bullet) False
  - the Whole Contract Approach will defer possible writing down of the AAE as long as possible because the AAE has first priority on all revenue.
- (fourth bullet) True
  - The Bifurcated Approach is more appropriate when a hedging program is in place for the segregated fund guarantees.
  - Assuming the cash flows being hedged includes a component related to expected revenue, it would be difficult to anticipate the effect of market movements on these cash flows in the modeling if the allocation of fee income to the guarantees is changing from period to period.

(iv) False
- When there is hedging, zero floor would disrupt the parity between the asset and liability sides of the balance sheet
- A change in fair market value of derivatives would be expected to be offset by a change in liability

(v) False
- A C-3 Pfad must be established consistent with CALM principles
- The reinvestment / disinvestment risk must be reflected
- Scenario testing may be used to determine the sensitivity of the policy liabilities to a range of reinvestment assumptions
  - Helpful in choosing and calibrating an approximation method
- Most common is discounted cash flow method, although stochastic is allowed in standards of practice

5.

Learning Objectives:
3.   The candidate will be able to understand and analyze the implications of emerging financial and valuation standards.

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:
OSFI Life Insurance Regulatory Framework (in Emerging Standards)

LFV-628-10: Framework for a New Standard Approach to Setting Capital Requirements (see Financial and Capital Management – RBC Section of the syllabus)

OSFI e-19 Own Risk and Solvency Assessment

Commentary on Question:
Most candidates did relatively well on parts a and b. For part c, candidates generally did not perform as well.
Where evaluation is asked for, candidates are expected to provide explanation to justify the valid/invalid conclusion for each of the evaluation, and more points are allocated to the explanations. The explanations are to show candidate's understanding of the materials and ability to apply that knowledge to the specific situation.

Solution:
(a)   State the relationship, using a formula, between a company's assets, liabilities and capital for the revised regulatory capital requirements under the LIFR changes.

       Commentary on Question:
       Most candidates were able to state the formula correctly and demonstrate their understanding of the revised capital requirements. Few candidates were able to describe how the solvency buffer is determined.

       TAR (Total Asset Requirement) = Estimate of Policyholder Liabilities + Solvency Buffer (or Target Required Capital)

       The Solvency Buffer is determined based on a Condition Tail Expectation (CTE) of 99 over 1 year or a 1-in-200 event.

       Alternate formula may be allowed as per the following:
       TAR (Total Asset Requirement) = Best Estimate of Policyholder Liabilities + IFRS Risk Margin + Target Required Capital

5. Continued

(b) Explain the impact the LIFR changes will have on each of the following:

(i) Policyholders, creditors and industry stakeholders;

(ii) Life insurance companies;

(iii) The Office of the Superintendent of Financial Institutions (OSFI);

(iv) Level and quality of regulatory capital for a going and gone concern.

Commentary on Question:
Candidates did relatively well on this part. Most candidates were able to explain the impact the LIFR changes will have on policyholders and life insurance companies. Few candidates were able to explain the impact for level and quality of regulatory capital for a going and gone concern.

(i) Policyholders, creditors and industry stakeholders:
- high level of protection that insurers able to pay their future obligations
- enables others to assess the risk-taking activities of the company
- insurers able to withstand major economic & other shocks

(ii) Life insurance companies:
- Board of Directors need to augment their skills & hold manage accountable for risk taking
- increased resources may be needed for governance and risk management
- capital levels may need to change due to internal capital targets set by Board

(iii) The Office of the Superintendent of Financial Institutions (OSFI):
- will monitor insurers to ensure they remain consistent with each other and implementation is coordinated
- will require more specialized resources
- provide industry stakeholders sufficient opportunities to be contribute and be heard
- commit to provide feedback and explain rationale for decisions

(iv) Level and quality of regulatory capital for a going and gone concern:
- encourages company's capital to be able to withstand severe, but plausible, stress scenarios (going concern)
- an insurer needs to ensure high quality capital forms a large portion of their capital

5. **Continued**

- Tier 1 capital should be comprised largely of equity in order to support ongoing insurer viability over the longer term given the longer-term nature of life insurer business
- gone concern capital ensures policyholders and senior creditors can be paid when the insurer is in winding up mode
- gone concern capital may include additional lower quality capital such as hybrids and subordinated debt instruments

(c) Given each of the following statements:

(i) Under ORSA the insurer only needs to focus on its four major risks (insurance, market, credit and operational risks);

(ii) Both large and small insurers must use the same sophisticated methods to estimate the amount of capital needed if the risk profiles are identical;

(iii) Internal Capital Targets may be set equal to the Supervisory Level plus an applicable margin if deemed to be more conservative than the company's own assessment of its risk;

(iv) The Chief Risk Officer is responsible for signing off on the insurance company's ORSA.

Evaluate the validity of each statement based on OSFI's Own Risk and Solvency Assessment along with any applicable modifications to ensure compliance. Justify your answer.

Commentary on Question:
Most candidates were able to evaluate and justify part i) and iii). For part iv), most candidates stated the Appointed Actuary has the responsibility for signing off the ORSA, which is incorrect. For part ii), most candidates failed to evaluate the statement correctly, with some candidates stating the statement is invalid since large and small insurers should not have the same risk profiles.

(i) Invalid. Insurers are expected to use more sophisticated methods to estimate the amount of own capital needed for material complex risks. For less material and less complex risks, or for those that are not readily quantifiable, insurers may opt for simpler quantitative analysis combined with well documented qualitative considerations and incorporate these amounts into their overall assessment for capital adequacy. An insurer is also expected to provide descriptions and explanations of key risks they are exposed to, including sources of each risk.

5.   Continued

    (ii)   Valid since their risk profiles are identical. However, smaller less complex insurers are allowed to use less sophisticated methods to determine their capital based on their risk profile. For less complex risk exposure, these insurers may rely more heavily on simple quantitative analysis and well documented qualitative considerations.

    (iii)   Invalid as capital requirements should not simply be determined by adding a simple margin to Solvency targets. According to Guideline A-4, Internal Capital targets need to be above Supervisory targets based on scenario and stress testing.

    (iv)   Invalid since the Board has ultimately responsibility for overseeing ORSA. The associated tasks of performing ORSA may be delegated by the Board to Senior Management to design & implement the process; however, the Board must review the reasonableness and appropriateness of the results based on the Board approved stated risk appetite and risk tolerance.

6.   **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 form a regulatory perspective

(5c)   Explain and apply the concepts, approaches and method for determining Economic Capital
        (i)   Identification of the significant risk components
        (ii)   Selecting calculation methods appropriate to stakeholder's perspectives
        (iii)   Describing how a company would implement an Economic Capital Program

Sources:
Valuation of Liabilities, Lombardi, 4th Edition, Ch. 16 (excl. 16.6)

Economic Capital for Life Insurance Companies, SOA Research paper, Ch. 1, 3, 4, 5, 6

A Multi-Stakeholder Approach to Capital Adequacy, Conning Research & Consulting

LFV-121-08: Economic Capital Modeling: Practical Considerations (same as ILA-C121-08)

Economic Capital Overview: Chad Runchey, August 2012

LFV-606-13: OSFI Guideline – Minimum Continuing Capital and Surplus Requirements (MCCSR) For Life Insurance Companies, Sections 1 – 5, 8 – 9, January 1, 2013

LFV-628-10: Framework for a New Standard Approach to Setting Capital Requirements (same as ILA-C628-10)

LFV-636-13: OSFI Guideline A-4 Internal Target Capital Ratio for Insurance Companies (same as ILA-C636-13)

Commentary on Question:
Commentary listed underneath question component.

6. **Continued**

Solution:
(a)   Describe the advantages and disadvantages of ABC implementing an economic capital framework.

Commentary on Question:
Most candidates did well on this question and were able to describe at least 5 or 6 points about the economic capital framework.

Advantages:
- Better risk-based return for decision making – this will help ABC determine where to better allocate capital for the product
- Economic capital accounts for diversification & concentration of risk. In Canada, MCCSR gives little credit for risk diversification. In the USA, RBC indirectly recognizes some risk correlation with the covariance adjustment.
- Can compare different types of risk with a common currency to quantify and make decisions (will be useful for ABC because their operations are in two different regimes with different risks). This bakes risk appetite & tolerance into decision-making and measurement of risk
- For ABC's Canadian operations, it could be made to align with the framework proposed by OSFI, AMF and Assuris by using the same risk horizon, confidence level and approaches proposed. The work/expertise gained by creating an EC model can get an internal model approved by OSFI in the future.
- Improved risk measurement and management as all risks are included in the assessment (for example, operational or unique risks to Canada and the United States).

Disadvantages:
- Economic capital may be similar to statutory capital as ABC's insurance products are similar to those in the industry. Therefore, ABC may not gain much insight for the investment.
- Economic capital requires that risks are identified – this will be hard to do in the new American market and with some risks such as operational risks. There can also be problems in finding the data required to evaluate some risks.
- Statutory and economic capital results may be conflicting.
- Economic capital models are complex and effort will be required internally/externally to improve transparency of results.

Other advantages that earned credit were:
- Improve upon formulaic approaches taken by solvency regulation that do not take into account the company's processes and risk management.
- Alignment and comparability with Solvency II, NAIC in calculation of RBC involving internal models and the IASB solvency regulation framework. It is also aligned with the internal model approach being proposed in Canada as well as possibly aligned with the Basel II requirements for credit risk.
- Under RBC/MCCSR, if more premium is charged for the same risk exposure – the required capital would increase (this is not ideal)
- Be able to see the "true" level of capital adequacy undistorted by regulatory/ financial reporting requirements
- Better assess performance of senior management
- Improves perception from rating agencies and other external parties

Other disadvantages that earned credit were:
- Cost or budget constraints, especially since ABC is new to economic capital
- Time constraints. More time will be required to analyze the economic balance sheet. Implementation will also take time
- System Constraints. For example, long run times or the stochastic-on-stochastic problem.
- People Constraints. There may be a knowledge gap within the company about economic capital models.
- Economic capital measures have no external consequence
- Selection of risk thresholds and parameters are often arbitrary

(b) With regards to ABC's individual disability income product:

(i) Determine the available capital under Minimum Continuing Capital Surplus Requirement (MCCSR).

(ii) Describe each of the following requirements and identify the minimum Net Tier 1 Ratio and Total Ratio to meet each requirement:

- The Supervisory Target Capital Ratio

- The Minimum Capital Ratio

Commentary on Question:
For Part (i) some students failed to calculate an amount for morbidity risk.

Part (ii) was generally well done.

6.   Continued

(i)   Morbidity risk = SFF(M) x (New Claims Risk + Continuing Claims risk), where SFF(M) is an adjustment for Statistical Fluctuation.

New claims risk:
- Use annual earned premium
- Use 30% factor because the length of premium guarantee remaining is more than 5 years and because the product is individually underwritten.
- This factor is multiplied by 0.75 because the benefit period is 2 years.

New claims risk = 30% x 0.75 x $40,000,000 = $9,000,000

Continuing Claims Risk:
- The duration of disability is 2 years or less because the benefit period is only 2 years at most. Therefore, the factor will only vary by the length of benefit period remaining.
- $20M has a benefit period under 1 year, so 4% applies
- $50M has a benefit period between 1and 2 years (2 years is maximum benefit), so 6% applies

Continuing claims risk = 4% x $20,000,000 + 6% x $50,000,000 = $3,800,000

Adjustment for Statistical Fluctuation, or SFF(M):
- M = 9,000,000 + 3,800,000 = 12,800,000
- Since M > $9,000,000, then use SFF(M) = 0.70 + 900/sqrt(M)

SFF(M) = 0.70 + 900/SQRT(12,800,000) = 0.951557647.

Morbidity risk = SFF(M) x (New claims risk + Continuing Claims risk)
 = 0.95156 x (9,000,000 + 3,800,000) = 12,180,070

Base Required Capital = (Asset default (C-1) risk + Lapse risk + Changesin interest rate environment (C-3) risk + Morbidity risk)

MCCSR capital available = Internal target capital ratio x (base requiredcapital)
= 180% x (3,000,000 + 7,000,000 + 6,000,000 + 12,180,070)
= $50,724,126

6. Continued

(ii)   Minimum Capital Ratio: 60% Net Tier 1 and 120% Total Capital = 120%
Supervisory Target Capital Ratio: 105% Net Tier 1 and Total Capital = 150%

The Minimum Capital Ratio:
- minimum amount of capital to cover the defined risks plus a margin for operational risks.
- failure to maintain this level of capital would result in OSFI being very concerned with the ongoing viability of the insurer

The Supervisory Target Capital Ratio:
- OSFI views this as an early warning signal for intervention.
- there will be increased supervisory attention, including a general early warning status (stage 1).

(c)   With respect to ABC's economic capital:

(i)   Define the aspects of the morbidity risk ABC should consider in their economic capital model.

(ii)   List a possible catastrophic event that could impact disability incidence and termination rates.

(iii)   Calculate the Economic Capital required for the Underwriting & Demographic risks with and without the diversification benefit. Show all work.

Commentary on Question:
For part i), candidates that did well defined the aspects of morbidity risk and explained them rather them listing them. For ii), many candidates gave an event that impacted incidence but not necessarily termination rates.

For ii), some candidates gave an event that increased incidence but not necessarily decrease termination (recovery) rates.

For part iii), most candidates were able to calculate the economic capital without diversification. It was expected that candidates would also be able to apply their knowledge of correlation matrices to calculate diversified economic capital. The majority of candidates attempted to calculate the diversified EC measures and many got partial credits, some also did well in completing the calculations.

6.   **Continued**

(i)   There are 4 main aspects to morbidity risk:

1) Catastrophe Risk: Any event that could cause widespread disability or prolongment of disability. Prolongment of disability can occur if the likelihood of recovery and return to employment is diminished or if the likelihood of dying while disabled is decreased

2) Volatility Risk: Risk from the variations in claim size, number of claims and length of the claim.

3) Mis-estimation Risk (parameter risk): Risk that past experience is not a good predictor of the future. This can arise from errors in collecting data, heterogeneous data or by random fluctuations, for example.

4) Trend Risk: Risk regarding how future experience may unfold.

(ii)   Any example where incidence rates increase and termination rates (the likelihood of a disabled person recovering/dying, in other words, disabled person coming off claim) decrease would be a catastrophic event for incidence and termination.

Two examples of catastrophic incidence and termination events:

1) Mass job loss (increased unemployment) incenting those who are disabled to remain on disability as they would not have a job to return to and those who may lose their job to claim disability to continue their paychecks. Incidence would increase (as there are more claims for disability) and termination rates (the likelihood of coming off claim) would decrease as those who are disabled would try to stay on claim.

2) An epidemic infectious disease which causes insureds to fall under the definition of disability without potential to recover while at the same time not killing them. This increases incidence rates of disability while also decreasing disabled claim terminations (as they cannot work and are not dying).

(iii)   Economic capital without diversification is just the sum of the economic capital for each risk:

Economic Capital w/o diversification = 1 + 14 + 27 + 7 + 4 = 53

6. Continued

To get the diversified economic capital, the risks must be correlated, summed and then square-rooted:

Economic Capital with diversification =

$$\left(\begin{bmatrix} 1 & 14 & 27 & 7 & 4 \end{bmatrix} \times \begin{bmatrix} 1 & 0.25 & 0 & 0 & 0.25 \\ 0.25 & 1 & -0.75 & 0 & 0.75 \\ 0 & -0.75 & 1 & -0.50 & 0.75 \\ 0 & 0 & -0.50 & 1 & 0.25 \\ 0.25 & 0.75 & 0.75 & 0.25 & 1 \end{bmatrix} \times \begin{bmatrix} 1 \\ 14 \\ 27 \\ 7 \\ 4 \end{bmatrix} \right)^{1/2}$$

= Square root of the sum of the risks:

Mortality $\quad = (1*1*1) + (.25*14*1) + 0 + 0 + (.25*4*1)$
$\qquad\qquad = 1 + 3.5 + 0 + 0 + 1 = 5.5$

Morbidity - Incidence $= (.25*1* 14) + (1*14*14) + (-0.75*27*14) + (0*7*14) + (0.75*4*14)$
$\qquad\qquad = 3.5 + 196 - 283.5 + 0 + 42 \quad = -42$

Morbidity - Recovery $= 0 - 283.5 + 729 - 94.5 + 81 = 432$

Lapse $\qquad\qquad = 0 + 0 - 94.5 + 49 + 7 \qquad = -38.5$

Expense $\qquad\qquad = 1 + 42 + 81 + 7 + 16 \qquad = 147$

Total = 5.5 - 42 + 432 - 38.5 + 147 = 504

Economic capital with diversification = $\sqrt{504} = 22.45$

Diversification benefit = 53 - 22.45 = 30.55

7. **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.

6. 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:
(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 form a regulatory perspective

(6a) Describe the considerations and evaluate the appropriate reinsurance form from the ceding and assuming company perspectives.

(6b) Explain the consequences and calculate the effect on both ceding and assuming companies with respect to:
  (i) Risk transfer
  (ii) Cash flow
  (iii) Financial statements
  (iv) Reserve credit requirements
  (v) Tax

Sources:
LFV-606-13: OSFI Guideline – Minimum Continuing Capital and Surplus Requirements (MCCSR) For Life Insurance Companies

Life, Health & Annuity Reinsurance, Tiller, 3rd Edition, Ch. 4-5

Commentary on Question:
Candidates did relatively well on part a). For part b), most candidates failed to provide the quantifications and make recommendations based on the provided statistics. More details are provided below.

Solution:
(a) Identify two differences between YRT and coinsurance agreements.

   Commentary on Question:
   Most candidates were able to provide two differences between YRT and coinsurance agreements and receive full credits.

---

7. **Continued**

Any two of the following:
- YRT premiums are non-guaranteed while coinsurance premiums are as % of what ceding company set
- YRT transfers only specific risk such as mortality or morbidity but very limited interest rates or lapse risk. However, coinsurance transfers a % of all the risks including interest rates, lapse to the reinsurer.
- Reserves are transfer for coinsurance while YRT does not required reserves transfer at the beginning.
- Administration of coinsurance is relatively complex while YRT's administration is very easy and simple

(b) Reinsurer B will only offer YRT reinsurance with a 50% quota-share arrangement for one of the three lines of business Life Insurance Company A sells. Recommend the line of business Life Insurance Company A should be ceding. Justify your recommendation.

Commentary on Question:
Numerical values are provided in this question and candidates are expected to determine which line of business is the most capital intensive, hence the use of reinsurance to reduce the amount of capital required, by performing a simple sum calculation. However, a number of candidates failed to provide the quantifications and make recommendations based on these calculations. Instead, these candidates did qualitative analyses on the nature of the three products (DI, CI and LTC). Some candidates also linked the responses to part a) and provided qualitative analyses on whether YRT or coinsurance should be used for each line of business. It is important to note that the question did not ask for such a linkage.

Many candidates have chosen CI because they failed to relate the provided figures (new claims & cont. claims) as capital requirements.

	IDI	*CI*	*LTC*	*Simple Sum*
New Claims	*6.80*	*8.16*	*4.45*	*19.41*
Cont. Claims	*2.20*	*-*	*10.40*	*32.60*
Simple Sum	*9.00*	*8.16*	*14.85*	*52.01*

Company A should reinsure out their most capital intensive line of business to Reinsurer B. The question provides numerical values for new claims risk and continuing claims risk, and hence, the morbidity risk capital can be calculated by performing a simple sum.

Based on the above table, IDI required $9M capital, CI required $8.16M capital and LTC required $14.85M capital. Since LTC is the most capital intensive line of business, Company A should reinsure LTC to Reinsurer B.

8. **Learning Objectives:**
1.   The candidate will understand financial statements and reports of Canada life insurance companies and be able to analyze the data in them.

Learning Outcomes:
(1c)   Describe how to compute the taxable income of a life insurance company.

Sources:
Canadian Insurance Taxation, Ch. 3 Liability for Income Tax

Canadian Insurance Taxation, Ch. 4 Income for Tax Purposes – General Rules

Canadian Insurance Taxation, Ch. 6 Reserves

Commentary on Question:
This question tests the candidate's knowledge of Canadian Taxation Standards. Most candidates answered part (a) well but struggled during their calculation in part (b). However, most were able to receive part credit for their intermediate calculations.

Solution:
(a)   Explain how the following items are handled under general Canadian corporate tax legislation, and why such treatment is inappropriate for the taxation of life insurers:

  (i)   Deductions for liabilities

  (ii)   Foreign income for multi-nationals

   Commentary on Question:
   This question was generally answered well but many candidates did not explain how the items are handed under general tax legislation, focusing only on the treatment for life insurers.

   (i)   **Deductions for Liabilities**
   - Under general tax legislation, reserves are generally not deductible for tax purposes
   - Denying insurers deductions for reserves would effectively require the industry to report profits on a cash basis
   - Reserves must be specifically permitted under the ITA to be deductible by an insurer
   - Insures may deduct and amount of the reserves up to the maximum permitted by the regulators

8. Continued

    (ii) **Taxable Income for Multi-Nationals**
- Other industries tend to carry on foreign business through subsidiaries while Life Insurers historically operate through branches
- As a result, foreign par policyholders share in the profits of the company as a whole and rely on security through the financial strength of the entire company
- Taxation of foreign branches would require life insurers to compute and use foreign tax credits
- This would be onerous because foreign tax rules differ significantly from Canadian rules
- As a result, Canadian resident life insurers are not subject to tax on foreign insurance income

(b) Determine the 2013 after-tax net income for this par block assuming a tax rate of 35%. Show all work.

Commentary on Question:
Most candidates did not make a distinction between taxable and statutory income while constructing their income statement, only receiving part marks for their solution. However, most candidates were able to receive partial credit for the calculations provided.

Taxable Income
Premiums – Include net (direct and assumed, less ceded) Par Block premiums written on life insurance and amounts received in respect of annuities. Exclude Experience Rating Refund, should be included for statutory income calculation only.
- $= 2,500 + (200) = 2,300$

Investment Income – Policy Loans, include repayment of any amounts received as a repayment of a policy or as interest. Imputed Interest on Real Property, include and add on to cost of property. For tax purposes, replace statutory value with Gross Canadian Life Investment Income time the ratio of MTAR (par) to MTAR (total).
- $= (2,000 + 1,000 + 9,900) * (9,750 / 189,000) = 665$

Claims – Include all Par Block Claims
- $= (1,200)$

Policyholder Dividends – Include all Par Block dividends as is to the extent it was not deducted in a previous year as a reserve
- $= (400)$

8. Continued

Expenses – Include all Par Block acquisition and Other Expense
- = (50) + (250) = (300)

Commissions – Include all Par Block Commissions
- = (100)

Change in Reserve – Include actual Par Block Tax Reserves deducted rather than MTARs
- = 9,000 – 9,600 = (600)

Unearned Premium Reserves – include for Group Term Policies only.
- = 0

Incurred but Unreported Claims – Include all Par Block IBNR
- = 50 – 70 = (20)

Taxable Income = 2,300 + 665 + (1,200) + (400) + (300) + (100) + (600) + 0 + (20) = 345

Tax Payable = 345 * 35% = 121

Statutory Income
Premiums – Include net (direct and assumed, less ceded) Par Block premiums written on life insurance and amounts received in respect of annuities and Experience Rating Refund
- = 2,500 + (200) + 50 = 2,350

Investment Income – Policy Loans, include repayment of any amounts on Par Block received as a repayment of a policy or as interest. Imputed Interest on Real Property, include all Par Block amounts and add on to cost of property. Include all other Par Block Investment Income.
- = (10 + 20 + 500) = 530

Claims – Include all Par Block Claims
- = (1,200)

Policyholder Dividends – Include all Par Block dividends as is to the extent it was not deducted in a previous year as a reserve
- = (400)

Expenses – Include all Par Block acquisition and Other Expense
- = (50) + (250) = (300)

8. **Continued**

Commissions – Include all Par Block Commissions
- = (100)

Change in Reserve – Include change in Par Block Net Statutory Policy Liabilities
- = 8,000 – 8,500 = (500)

Unearned Premium Reserves – include for Group Term Policies only.
- = 100 – 150 = (50)

Incurred but Unreported Claims – Include all Par Block IBNR
- = 50 – 70 = (20)

Pre-tax Statutory Income = 2,350 + 530 + (1,200) + (400) + (300) + (100) + (500) + (50) + (20) = 310

Net Income after Tax
Net Income after Tax = Pre-tax Statutory Income – Income Tax Payable
- 310 – 121 = 189

9.

Learning Objectives:
1.   The candidate will understand 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 statement or its components for a life insurance company.

(1b)   Describe the structure of the Canada Annual Statement and explain the purpose of its statements, key exhibits and schedules.

(1c)   Describe how to compute the taxable income of a life insurance company.

(1d)   Describe, use and recommend methods for performing actuarial reviews of reserves.

Sources:
Canadian Insurance Taxation, Ch. 4, Ch. 11, and Ch. 27

LFV-618-13: OSFI Guideline D-10: Accounting for Financial Instruments Designated as Fair Value Option, October 2009

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

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Explain the key challenges created by the Section 3855 implementation.

   Commentary on Question:
   Many candidates demonstrated a fairly good understanding of the key challenges due to practical issues and Held for Trading including FVO. Candidates did not do as well when describing the other classifications.

   (1) Held for Trading (HFT) including Fair Value Option (FVO):
   Assets classified as HFT or FVO will be marked to fair value, and may result in asset values and investment gains/losses of these assets being volatile.
   Given the fact that CALM is usually tested off valuation dates, with a Policy Premium Method (PPM) type calculator being used to approximate the CALM result at the balance sheet date, there is a need to develop an effective true-up process. The ability to demonstrate the completeness and appropriateness of this approximation and for it to be auditable are critical.

9. Continued

(2) Available for Sale (AFS):
This classification poses significant challenges if used for assets backing policy liabilities. If the quantum of AFS assets backing policy liabilities is material, then there will be a disconnect between the change in the policy liabilities charged to income and the investment income credited to income, which results in income variability and difficulties explaining results. This may cause the actuary to issue a qualified opinion.

(3) Policy Liabilities at Cost (term of liability equals 0 or no discounting):
Certain elements of the policy liabilities have traditionally been measured based on smoother historical cost-based accounting values. Some of these items must be reported on a prescribed basis. There will be an accounting mismatch in the post-3855 regime if matching asset values are volatile with the volatility varying depending upon the designation of the asset.

(4) Practical Issues:
The sub-classifications of invested assets may create record-keeping difficulties. For dual reporters – particularly entities reporting both CGAAP and US GAAP – it may be best or desirable to classify an asset differently in one regime than the other. This may not be possible with existing asset administration and accounting systems or may increase the possibility of errors. The actuary will need to introduce additional checks and controls.

(5) Future Taxes:
The asset accounting changes will result in new tax timing differences which will need to be valued. This may complicate the determination of the value of tax differences.

(b) Calculate the following for Theta's bond portfolio as the end of 2013:

    (i)   Net Income

    (ii)   Other Comprehensive Income (OCI)

Commentary on Question:
Most of the candidates calculated Held For Trading and Held To Maturity net income correctly. Few candidates demonstrated a good understanding of Available For Sale net income and Other Comprehensive Income calculations.

(1) HFT uses fair value, and gain/loss recognized immediately in P/L
HFT net income = HFT investment income + change in fair value
= 100 + (27,000 − 26,000) = 1,100

9. **Continued**

(2) AFS net income = AFS investment income + change in book value
= 300 + (50,000 -48,800) = 1,500

(3) HTM net income = HTM investment income + change in book value
=200 + (20,000 – 20,200) = 0

(i)   Total net income = 1,100 + 1,500 + 0 = 2,600

AFS OCI = (Change in market value) - (Change in book value)
= (70,000 - 69,000) - (50,000 -48,800) = -200

(ii)   Total OCI = -200

(c)   Your actuarial assistant has summarized the steps followed to prepare Theta's
2013 year-end financial statement and tax statement. Critique each of the
following statements.

(i)   Fair Value Option (FVO) is applied to loans to small companies, private
bonds, and Toronto Stock Exchange (TSX) traded investments;

(ii)   Premium tax rates are determined by Theta's head office jurisdiction;

(iii) There are no tax implications for policy loans;

(iv)   Investment Income Tax (IIT) is calculated assuming a 15% tax rate
applied to net investment income.

Commentary on Question:
*This is straightforward question; most candidates were generally able to critique
some inaccurate parts of the statements.*

(i)   The statement is incorrect.
FVO should not be used for loans and mortgages to small companies.
FVO should not be used for private bonds, obtaining fair values for private
bonds may be problematic and it is difficult to find price quotations for
same issuer, size, risk, duration. FVO should be used for TSX investments
since prices are publicly available, they are active market and prices are
quoted on regular basis

(ii)   The statement is incorrect.
Residence of insured at time of premium payment determines jurisdiction
and applicable rate

9. Continued

    (iii)   The statement is incorrect.
Insurer must include policy loan repayment and interest in taxable income.

    (iv)   The statement is incorrect.
IIT is determined using Life Investment Income = prescribed yield * insurer's average maximum tax actuarial reserves
Prescribed yield is based on moving average interest rate paid on certain Government of Canada bonds.
IIT = 15% of Taxable Canadian Life Investment Income

10. **Learning Objectives:**

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

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

Learning Outcomes:

(2b)   Recommend appropriate valuation assumptions.

(7c)   Identify and apply actuarial standards of practice relevant to financial reporting and valuation.

Sources:

Standards of Practice: Practice-Specific Standards for Insurers (Sections 2100, 2300, 2500), January 1, 2013

OSFI Guideline E15: Appointed Actuary – Legal Requirements, Qualifications and External Review, September 2012

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

Commentary on Question:
Commentary listed underneath question component.

Solution:

(a)   Explain the peer reviewer's role and obligations as they relate to an assumption change memo.

Commentary on Question:
Commentary on part (a):
Most candidates touched on points such as "ensure the work of the AA is compliant with Standards of Practice and regulatory guidelines", "ensure assumptions and methodologies are appropriate" and "write a memo documenting the peer review".

Candidates struggled to answer the question in the context of an assumption change memo and did not mention key points such as "review material changes in valuation assumptions" and "investigate material events that would suggest modifications in valuation assumptions or methods"

Some candidates confused the role of the peer reviewer with an auditor. A common mistake was putting down qualifications criteria for a peer reviewer instead of explaining the role pertaining to the assumption change memo.

10. Continued

Model Solution to part (a):
- Ensure the work of the AA is in compliance with standards of practice
- Ensure the work of the AA is consistent with requirements established by OSFI
- Review material changes affecting the valuation
- Assess the risk of material misstatement or omissions arising from each change
- Discuss the assumptions and methods used for valuation with the AA
- Ensure that assumptions are at the appropriate point of the range of acceptable practice
- Write a report describing the peer review
- The peer reviewer is a source of independent consultation advice for the AA
- The peer reviewer is an additional source of professional education for the AA

Examples of material changes that peer reviewer should look at:
- Changes in key actuarial valuation assumptions
- Material events that would suggest that valuation assumptions or methods may need to be modified
- Assumptions for material blocks with high sensitivity for which no changes have been made

(b)   Critique each of these recommendations.

Commentary on Question:
Commentary on part (b):
This is a challenging question as it covers a broad range of topics. Some candidates may have had a limited amount of time left towards the end of their exam.

Candidates received partial marks for mentioning the ranges for MfADs and recognizing the existence of signification consideration(s) require the MfAD to be greater than the average of the low and high margins.

Recommendation 1, 2 and 4 were generally well done. For recommendation 3, candidates that did not do well disagreed with the statement when it is reasonable to recognize half of the expected savings. Candidates had trouble with recommendation 5, 6 and 7.
- *For 5, most of them did not realize UL Level COI is lapse supported and current assumption is not conservative.*
- *For 6, many candidates were aware that historical benchmark return is based on the longest available historical period, but did not mention the use of broad-based market index by actuaries*

10.   Continued

- *For 7, most candidates acknowledged the use of additional scenarios, but a good portion of them missed the point on how they should be used in conjunction with prescribed scenarios – many of them suggested that the most adverse (additional) scenario should be used*

Recommendation 1
- Assumption based on credible company experience
- Appropriate to leave assumption unchanged given only a small increase that may not repeat the following year

Recommendation 2
- For mortality, low margin is 3.75/ex and high margin is 15/ex
- Proposed MfAD is within the range allowed and still above the mid-point
- No significant consideration present, assumption based on credible experience
- Not ideal time to reduce MfAD when experience has increased and cause is still not known
- Suggest they wait at least another year to see how experience develops, and ensure still have full credibility

Recommendation 3
- Assumption based on recent company experience and allocations
- It is allowed to project future expense improvements if reductions can be forecasted with confidence
- Reductions assumed are conservative as only used half of what is projected
- Inflation is applied to expenses
- Proposed assumption reasonable given the circumstances

Recommendation 4
- For expenses, low margin is 2.5% and high margin is 10%
- Assuming future reductions in unit expenses is a significant consideration for expenses
- Should use at least average of low and high margin when a significant consideration is present
- Cannot set the MfAD below the mid-point of 6.25%
- Suggest that reduce expenses but leave MfAD at current level until get evidence that savings will materialize
- Would also be appropriate to suggest a decrease to 6.25%

Recommendation 5
- Company study on which experience is based is relatively old
- More current industry experience indicates significantly lower more current experience

10. Continued

- Likely that company experience from newer lapse study will be lower than in prior study
- Lower lapse rates increase reserves for Level COI UL, so current assumption is not conservative
- Suggest that AA considers a small decrease in level COI lapse rates of 0.25% this year
- Can also agree that it is fine to do full review the next year, when results of newer study are available

Recommendation 6
- Maximum return allowed is historical return of a benchmark of comparable assets
- Historical benchmark return is based on the longest available historical period
- The actuary would select a benchmark return based on a broad-based market index
- In Canada, the available data is of sufficient quality and credibility to establish an appropriate benchmark
- This recommendation is not within standards, cannot use a return higher than 9.3%

Recommendation 7
- The reserve held would not be less than that from the prescribed scenario that produces the largest reserve
- The actuary would test additional scenarios that are appropriate to the circumstances
- Selected scenario should make sufficient but not excessive provision for the insurer's obligations
- Suggest that the AA should consider testing more than two additional scenarios
- Appropriate to test, but not use, scenarios with reserves higher than the reserve reported

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.

Learning Outcomes:

(2b) Recommend appropriate valuation assumptions.

Sources:

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

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) List and describe the general considerations and potential factors for determining differentiation for mortality table construction.

Commentary on Question:

The question is straightforward, requiring only information which could be retrieves directly from the information in the textbook. In general, students had a hard time fully answering the part of the question asking about the consideration factors.

General considerations for determining mortality table differentiation include:

- The actuary would select predictive factors for differentiating the mortality assumption.
- Selected factors may or may not be supported by available credible data; the actuary will choose a subset that balances credibility and accuracy.
- A key decision involves identifying potential factors and selecting factors that best differentiate the valuation mortality assumption.

The actuary would not make the same assumption for two policies unless she expects similar experience. Differential choices can alter both the current and the projected policy liabilities. The actuary would consider

- data credibility,
- whether the differentiation makes intuitive sense,
- the behaviour of differentiation over time (whether the effect wears off, remains level or increases),
- the correlation between factors which impacts the chance of double counting

11. Continued

Current industry mortality tables differentiate between four basic factors:

- age,
- gender,
- smoking status and
- duration.

The annual CIA mortality study includes mortality by product type, face amount band and underwriting type (face amount and underwriting type are interrelated / correlated).

Large companies with sufficient experience tend to split their mortality assumptions by at least the four basic factors. The actuary would consider how mortality evolves differently for the four basic factors. The actuary would consider additional factors such as:

- face amount, underwriting type, preferred risk classification, product type.
- distribution type or geography.

Reinsurers may consider differentiating by ceding company.

(b)

    (i)   Calculate the expected number of claims for the combined block of business in aggregate and by block using the Limited Fluctuation Credibility Theory (LFCT) Normalized Method with a simple Poisson model with $p = 90\%$ and $r = 3\%$.

    (ii)   Recommend whether or not to combine the mortality table for the Green Life and Blue World blocks. Justify your answer.

Commentary on Question:
In general, students knew the description of the steps for calculation and the formulae for each step. However, some of the students had a difficult time figuring out which data to use, such as mortality ratio and expected claims.

In addition, many students did not appropriately justify their recommendation on if the mortality should be combined or not.

    (i)   Step 1: Credibility Factor = Minimum {(# claims / 3007) ^ 0.5, 1}
            (reflects p=90% and r=3%)
            Green Life = minimum { (857 / 3007) ^0.5, 1} = 0.53;
            Blue Life = minimum { (407 / 3007)^0.5, 1} = 0.37;
            Combined = minimum { (1264/3007)^0.5, 1} = 0.65

11. Continued

Step 2: Calculate the total company blended expected mortality and the corresponding expected claims:
Combined expected mortality ratio = 0.65 x 70.9% + (1 - 0.65) x 80.9% = 74.4%
Corresponding expected claims = 74.4% x 1192 = 887

Step 3: Calculate the total company expected number of claims:
Green Life = 0.53 x 73.2% + (1-0.53)* 80.9% = 76.8%;
Blue Life = 0.37 x 66.4% + (1-0.37)* 80.9% = 75.6%;
Combined = 911/1192 = 76.4%

And the total company expected number of claims:
Green Life = 76.8% * 820 = 630;
Blue Life = 75.6% * 372 = 281;
Combined = 630 + 281 = 911

Step 4: Normalize the Actual / Expected Ratios from Step 3
Green Life = 76.8% * 887/911 = 74.8%;
Blue Life = 75.6% * 887/911 = 73.6%;
Combined = 76.4% * 887/911 = 74.4%

 And normalize the expected number of claims:
Green Life = 887 / 910.8 * 629.7 = 613;
Blue Life = 887 / 910.8 * 281.1 = 274;
Combined = 887 / 910.8 * 910.8 = 887

(ii)   Generally, would recommend combining the mortality.

Potential reasons would include:
* It is acknowledged that the two blocks of business are fairly similar.
* Size of Blue Life block is small compared to Green Life. If do separately, would bring in more industry data. If combine Green & Blue blocks, can better reflect own company's experience.
* From a process standpoint, there are efficiencies to be gained by combining the tables -- one experience study instead of two, consistency across valuation models.

On the flip side, any difference for the experiences may not be captured with combined approach, so if experience emerges differently, may not catch trends on a timely basis.