ILA LFVU 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.

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:
  - Future Cashflows
  - Explicit Risk Adjustment
  - Contractual Service Margin

(iii) **Annually Repriced Hospitalization Individual Health Contract**

- Short Duration Contract
- Measured Using Premium Allocation Approach
  - 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
  - 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
  - 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

2. Continued

- Insurance liability cashflows are not consistent with market risks for credit losses
  - 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
  - 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
  - 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
  - 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 issue by U.S. life insurance companies.

Learning Outcomes:

(2a) Describe and differentiate between valuation assumptions under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

(2c) Calculate liabilities for life and annuity products and their associated riders under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

(2d) Calculate DAC assets for life and annuity products and their associated riders under the standard: U.S. GAAP.

Sources:

LFV-811-10: Actuarial Guideline XXXV (Formerly ILA-C811-10)

US GAAP for Life Insurers, 2nd Edition, Ch. 8

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)

(i) For equity indexed annuities, list the computational methods for U.S. Statutory reserves that are considered to be acceptable interpretations of the Commissioners Annuity Reserve Valuation Method (CARVM).

(ii) Explain the hedging requirements associated with each of the computational methods listed above.

Commentary on Question:

Most candidates did well on both sections of part (a), and appropriately only "listed" for section (i) and "explained" for section (ii).

Most candidates correctly identified the four computational methods in section (i). Acronyms received full credit.

4. Continued

The most common mistake in section (ii) was not distinguishing between the Basic Criteria and Option Replication Criteria that apply under the Enhanced Discounted Intrinsic Method (EDIM). Some candidates described the criteria without noting that there are two sets of criteria. Some candidates also failed to note that the criteria only apply under EDIM. To receive full credit, the candidate needed to state that under EDIM, you must certify quarterly that either the Basic Criteria or Option Replication Criteria have been met. The candidate also needed to provide a reasonable explanation of the criteria.

(i)

- EDIM - Enhanced Discounted Intrinsic Method
- CARVM with UMV - Commissioners Annuity Reserve Method with Updated Market Values
- MVRM - Market Value Reserve Method
- BSPM - Black-Scholes Projection Method

(ii) Under EDIM, the Appointed Actuary must certify quarterly that either the Basic Criteria or Option Replication Criteria has been met.

Basic Criteria:

- Equivalence of characteristics between option contracts held and options embedded in liabilities
- At issue, amount of hedge purchased must be >= specified percentage of product account value
- Company must have specific plan for hedging risks associated with interim benefit obligations
- Company must have system in place to monitor effectiveness of hedging strategy
- Company must state a maximum tolerance for differences between actual and expected hedge results

Option Replication Criteria:

- Same as Basic Criteria, except:
  - Equivalence of characteristics between target of option replication strategy and options embedded in liabilities
  - At end of each quarter, notional amount of target of option replication strategy must be >= specified percentage of product account value

The other computational methods have no hedging requirements.

4. Continued

(b) Calculate the pre-tax profit for calendar years 2014 and 2015 under U.S. GAAP, assuming the commission is entirely deferrable and the discount rate for DAC amortization is 4%. Show all work.

Commentary on Question:
Very few candidates calculated the exact pre-tax profit in part (b), but many were able to correctly calculate the major components. To receive full credit, a fully correct computation was not required provided the candidate demonstrated adequate knowledge of the components of pre-tax profit.

Many candidates were confused as to what was meant by "2 year point-to-point interest crediting," which reflects the change in the index over two years rather than two years of annual changes. This confusion did not have a material impact on the overall scores.

When calculating the income earned on the host contract in 2015, some candidates assumed the income earned in 2014 was compounded/reinvested whereas other candidates did not. Credit was given for either approach. The model solution reflects the approach taken by candidates who assumed no compounding/reinvestment.

When calculating DAC amortization, some candidates included interest on the beginning of year DAC whereas other candidates did not. Interest should be included and is reflected in the model solution, but credit was given for either approach.

Two common mistakes are summarized below:

- *The calculation of the interest credited on the host contract was frequently done incorrectly. Many candidates did not value the host contract and solve for a growth rate, but instead used the 3% floor interest rate.*
- *The income earned on the host contract was sometimes calculated as if it were earned on the entire 10,000,000 deposit. Some candidates failed to subtract the 400,000 cost of the options purchased at issue. Some candidates also incorrectly subtracted the 300,000 commission.*

<u>Determine the value of the host contract at durations 0, 1 and 2 years:</u>
Host(0) = 10,000,000 – 400,000 = 9,600,000
Host(2) = 10,000,000 x 1.03 = 10,300,000
Host Growth Rate = (10,300,000 / 9,600,000)^(0.5) – 1 = 3.58169%
Host(1) = Host(0) x 1.0358169 = 9,943,842

4. Continued

Calculate EGPs:
EGP = Income earned on host – Interest credited on host +
(Change in fair value of call options –
Change in fair value of embedded derivative)
EGP 2014 = (9,600,000 x 0.06) – (9,943,842 – 9,600,000) + 0 = 232,158
EGP 2015 = (9,600,000 x 0.06) – (10,300,000 – 9,943,842) + 0 = 219,842

Calculate the DAC k factor:
PV(EGP) at Issue = (232,158 / 1.04) + (219,842 / (1.04)^2) = 426,485
DAC k factor at issue = 300,000 / 426,485 = 70.34243%

Calculate DAC:
DAC = k factor x PV(EGP)
DAC at issue = 70.34243% x 426,485 = 300,000
DAC at end of 2014 = 70.34243% x (219,842 / 1.04) = 148,694
DAC at end of 2015 = 0

Calculate the pre-tax profit:
PTP = EGP – DAC amortization
DAC amortization =
Beginning of year DAC x 1.04 – End of year DAC
PTP 2014 = 232,158 – (300,000 x 1.04 – 148,694) = 68,852
PTP 2015 = 219,842 – (148,694 x 1.04 - 0) = 65,200

PTP can also be calculated more simply as EGP x (1 – k factor). Using this formula, it is not necessary to calculate DAC.

5. 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:

(1b) Construct financial statements for a life insurance company under U.S. Statutory accounting, methods, including describing the structure of the U.S. Annual Statement and explain the purpose of its major exhibits and schedules.

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

Sources:

Valuation of Life Insurance Liabilities, Lombardi, 4th Edition, Ch. 2

Actuarial Standard of Practice No. 21

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Prepare each of the following Statutory financial statements for calendar year 2013, ignoring items not relevant to the company:

(i) Summary of Operations

(ii) Balance Sheet at the beginning and end of the year

(iii) Analysis of Increase in Reserves during the year, assuming the tabular cost is 200 for the whole life policy and 0 for the deferred annuity

Commentary on Question:

For section (i), most candidates put the investment expense of 120 in costs instead of using it to calculate net investment income. There were also a number of candidates who didn't get the increase in reserves right. Some candidates calculated the capital gain incorrectly.

For section (ii), most candidates did very well. A few candidates were unable to calculate the surplus and cash for the end of 2013. Surplus equals the beginning of year value plus net income from section (i), and cash is the balancing item.

For section (iii), most candidates did very well. A few candidates calculated tabular interest incorrectly (tabular interest is the balancing item).

5. Continued

(i) Revenue
Premium = 3,000
Net investment income = 600 + (40,500 – 40,000) – 120 = 980
Total Revenue = 3,000 + 980 = 3,980

Costs
Surrender benefits = 29,000
Increase in reserves = 16,800 – 14,000 – 30,000 = -27,200
Commissions = 60
General insurance expenses = 100
Total Costs = 29,000 – 27200 + 60 + 100 = 1,960
Net gain from operations before dividends and FIT = 3,980 – 1,960 = 2,020
Dividend to policyholders = 200
Net gain from operations after dividends and before FIT = 2,020 – 200 = 1,820
Federal income taxes, excluding taxes on capital gains = 0.35 x 1,820 = 637
Net gain from operations after dividends and FIT and before realized capital gains
= 1,820 – 637 = 1,183
Net realized capital gains less capital gains taxes = 0.85 x (41,500 – 40,500)
= 850
Net Income = 1,183 + 850 = 2,033

(ii) Beginning of 2013

Assets	
Bonds, including accrued interest	60,000
Liabilites & Surplus	
Reserves	44,000
Surplus	16,000

End of 2013

Assets	
Bonds, including accrued interest	20,000
Cash	14,833 (balancing item)
Liabilites & Surplus	
Reserves	16,800
Surplus	18,033 (16,000 + 2,033)

5. Continued

(iii)

	Life Ins	Annuity	
Reserve, 12/31/2012	14,000	30,000	
Tabular net premiums	2,500	0	
Tabular interest	500	400	(balancing item)
Tabular cost	200	0	
Reserves released by death	0	0	
Reserves released by other terminations	0	30,400	
Other changes	0	0	
Reserve, 12/31/2013	16,800	0	

(b) Based on Actuarial Standard of Practice No. 21, assess the appropriateness of the valuation actuary's actions.

Commentary on Question:
The vast majority of candidates did very well on this part.

- Should not respond since not designated by Board
- Should not simply ignore request either
  - While not stated in the standard, common sense and professional courtesy would dictate that the valuation actuary should forward the request to an actuary who can respond
  - Responding actuary should be appropriately responsive to reasonable requests for methods, assumptions and data
  - The financial transactions request is not reasonable but the other requests are
  - Materiality is not an exception for compliance
  - Sign off by an external auditor is not an exception for compliance

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) Explain and distinguish the roles of capital from the perspectives of regulators, investors, policyholders and insurance company management

(5c) Explain and describe the concept and roles of Economic Capital including:
- (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) pp 4-34

Economic Capital Overview: Chad Runchey, August 2012

Commentary on Question:

Commentary listed underneath question component.

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.

6. Continued

- 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

6. Continued

(b) 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 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.

(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.

6. Continued

(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

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:

6. Continued

Mortality = (1*1*1) + (.25*14*1) + 0 + 0 + (.25*4*1)
= 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)
= 3.5 +196 - 283.5 + 0 + 42 = -42
Morbidity - Recovery = 0 - 283.5 + 729 - 94.5 + 81 = 432
Lapse = 0 + 0 - 94.5 + 49 + 7 = -38.5
Expense = 1 + 42 + 81+ 7 + 16 = 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) Describe the U.S. Risk Based Capital (RBC) regulatory framework and the principles underlying the determination of Regulatory RBC, and be able to compute RBC for a U.S. life insurance company including:
- (i) Identification of significant risk components
- (ii) Identification of specialized product RBC requirements
- (iii) Interpreting results form a regulatory perspective
- (iv) Implementation under U.S. principle-based approach

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

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

Sources:

Valuation of Liabilities, Ch 16 Risk-Based Capital (exclude section 16.6)

Reinsurance: Chapter 4: Basic Methods of Reinsurance

Reinsurance: Chapter 5: Advanced Methods of Reinsurance

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)

(i) Calculate the RBC C-2 requirement as of year-end 2012

(ii) Calculate the RBC C-3 requirement as of year-end 2012

Show all work.

7. Continued

Commentary on Question:
Part A was very well done. Most candidates were able to get full marks for the question.

The RBC C-2 requirement is defined as the Net Amount at Risk (NAAR) x C-2 factor, where the NAAR is the face amount minus stat reserve.

T20 C-2 requirement = (24 – 2) x 0.002 = 0.044
T10 C-2 requirement = (200 – 9) x 0.002 = 0.382
WL C-2 requirement = (250 – 20) x 0.002 = 0.460

Total C-2 requirement is 0.044 + 0.382 + 0.460 = 0.886 mil

The RBC C-3 requirement is Statutory Reserves x C-3 factor.

Total C–3 requirement = (2 + 9 + 20) x 0.01 = 0.31 mil

(b)

(i) Explain how JWL can transfer the mortality and interest rate risk under each proposal.

(ii) Assume the ceded YRT reinsurance reserve credit for the Whole Life product is estimated by using 20% of the gross statutory reserve. Recommend the proposal that would allow JWL to transfer more mortality and interest rate risk. Justify your answer.

Commentary on Question:
i) A lot of the candidates did not fully answer the question as they did not explain how the risks were transfer. They noted that the mortality and or interest rate risk was transferred, but not the mechanism to transfer the risks (i.e. death benefits paid, or reinsurance reserve credit received).

ii) This part was not answered very well at all, as only a few candidates got this correct. Many candidates misinterpreted the question as 'recommend proposals that would allow JWL to transfer more mortality and interest rate risk'; and then proceeded to list some methods which transferred more risk as opposed to picking between the two proposals. Some candidates did not use C-2 and C-3 as barometers of risk, but rather reserve amounts; in which case part marks were given.

7. Continued

Mortality risk is transferred under the YRT proposal as 50% of the NAAR is paid by the reinsurer on the death of the insured. Very little interest rate is transferred as very little reserve credit can be taken by the insurer for the YRT reinsurance proposal.

Under coinsurance, mortality risk is transferred as 50% of the policy benefits are paid by the reinsurer. Interest rate risk is transferred as the reinsurance reserve credit is 50% of the statutory reserve.

Proposal 1, 50% YRT on WL

NAAR on WL after reinsurance: 0.5 * 250 mil - (20 mil - 0.5 * 0.2 * 20) = 125 - 18 = 107 mil

Reduction of 230-107 = 123 mil in NAAR, 123 * 0.002 = 0.246 mil in RBC C-2

Reduction of 0.01*0.5*20*.2 = .02 in RBC C-3

Total RBC reduction of 0.246 + 0.02 = 0.266 mil for Proposal 1

Proposal 2, 50% Coins on T10 & T20

NAAR on T10&T20 after reinsurance: (24+200) mil * 0.5 - (2+9) mil * 0.5 = (224 - 11)*0.5 = 106.5 mil

Reduction is 50% in RBC C3 since reserve credit is 50%. 0.5*(2+9)*0.01 = .055 mil

Total RBC reduction of 0.213+0.055 = 0.268mil for Proposal 2

Since Proposal 2 produced more reduction in total RBC C2 (mortality risk) and C-3 (interest risk), Proposal 2 would allow ABC to transfer more mortality and interest rate risks.

8. 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.

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

Learning Outcomes:

(1a) Construct financial statements for a life insurance company under U.S. GAAP accounting methods and principles

(2c) Calculate liabilities for life and annuity products and their associated riders under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

(2d) Calculate DAC assets for life and annuity products and their associated riders under the standard: U.S. GAAP.

Sources:

US GAAP for Life Insurers, Herget et. Al., 2nd Edition, Ch. 6 and Ch. 14 (SFAS 115)

Commentary on Question:

This question tested the candidate's understanding of details of the composition of Estimated Gross Profits (EGP) for FAS 97 products. In particular, a situation where COI rates are level was examined.

Solution:

(a) Calculate the expected SOP 03-1 reserve at 12/31/2013 based on model projected results for 2013. Show all work.

Commentary on Question:

In determining the formulas, candidates need to have reviewed Tables 6-18 through 6-22 in detail. Note that in the example in the text, cashflows occur at mid-year; therefore, since candidates were told that cashflows occur at the end of the year, the formula in the text needed to be modified, as follows:

SOP03-1 (2013 projected) = SOP03-1 (2012) * (1 + i) + benefit ratio * 2013 Assessments (projected)- 2013 Excess DB (projected)

Less than 25% of candidates were able to correctly state the formula for Assessments. Based on the information given, two possible answers were accepted:

8. Continued

1. 2013 Assessments (projected) = Net Investment Income + COI + SC = 210 + 50 + 80 = 340

OR

2. 2013 Assessments (projected) = Interest Margin + COI + SC = 210-100 + 50 + 80 = 240

Most candidates stated correctly the formula for Excess DB, and the benefit ratio:
2013 Excess Death Benefits (projected) = Death Benefits - AV released on death = 300 - 260 = 40
benefit ratio = PV (SOP Excess DB) / PV (SOP Assessment) = 700/2200 = 31.8%

Inserting the results in the formula yields either (i) 239.72 or (ii) 207.92 *corresponding to the two possibilities for Assessments.*

(b) Assume the actual 2013 cashflows occur 7 years after issue with no prospective unlocking. Calculate the actual SOP03-1 reserve at 12/31/2013 based on actual 2013 cashflows. Show all work.

Commentary on Question:
About 35% of candidates correctly identified the need to update the benefit ratio for the difference between actual and projected. Most of the others used the same benefit ratio as in part (a), which is incorrect. Once again, there were two acceptable answers for the Assessments item:

1. 2013 Assessments (actual) = Net Investment Income + COI + SC = 200 + 45 + 100 = 345 OR
2. 2013 Assessments (actual) = Interest Margin + COI + SC = 200 -110 + 45 + 100 = 235

2013 Excess Death Benefits (actual) = Death Benefits - AV released on death = 250 - 225 = 25
Adjustment to PV(SOP Excess DB) = (25-40)*(1.04^-7) = -11.4

There were two acceptable answers for the revised benefit ratio, as follows:

1. Adjustment to PV(SOP Assessment) = (345-340)*(1.04^-7) = 3.8
   Adjusted benefit ratio = adj PV(SOP Excess DB) / adj PV(SOP assessment) = (700-11.4)/(2200+3.8)=0.3125

OR

2. Adjustment to PV(SOP Assessment) = (235-240)*(1.04^-7) = -3.8
   Adjusted benefit ratio = adj PV(SOP Excess DB) / adj PV(SOP assessment) = (700-11.4)/(2200-3.8)=0.3135

8. Continued

Using essentially the same formula as before:
SOP03-1 (2013 actual) = SOP03-1 (2012) * (1 + i) + adjusted benefit ratio * 2013 Assessments (actual) - 2013 Excess DB (actual)

1. SOP03-1 (2013 actual) = 165*1.04+.3125*345-25 = 254.4
OR
2. SOP03-1 (2013 actual) = 165*1.04+.3135*235-25 = 220.28

(c) Calculate the estimated gross profits in 2013 based on projected cashflows. Show all work.

Commentary on Question:
Only 21% of candidates were able to correctly provide the complete formula:

EGP = NII - Interest Credited + COI + Surrender Charges - (Death Benefits - AV Released On Death) - Maintenance expenses - Change in SOP Reserve.

Based on the two possible answers from (a):
1. EGP = 210 + 50 + 80 - 20 - 100 - (300 - 260) - (239.72 - 165) = 105.28
OR
2. EGP = 210 + 50 + 80 - 20 - 100 - (300 - 260) - (207.92 - 165) = 137.08

(d)

(v) Outline the purpose for the shadow adjustment on the DAC.

(vi) Calculate the DAC at 12/31/2013 using projected cashflows assuming unrealized capital gain of 100.

(vii) Explain how the DAC estimated above may differ from actual reported DAC.

Commentary on Question:
(i) A few candidates incorrectly characterized the problem as an asset-liability mismatch. In fact, both the asset values and the DAC are on the asset side of the balance sheet. Candidates were expected to identify the following key concepts:
(ii) This question provided less information than is required to provide a numerical solution. The top candidates recognized this. Also, most candidates missed the fact that, in this calculation, the EGP is increased by the assumed unrealized gain.
(iii) Most candidates misinterpreted this question. The information given was insufficient to provide a complete determination of the "actual reported DAC". Therefore, the question requires a general description of why the actual reported DAC may differ from a prior estimate.

8. Continued

(i)

- Assets classified as Available For Sale (AFS) are marked to market. This creates volatility in the balance sheet.
- The Shadow DAC is designed to mitigate this volatility.

(ii)

- The unrealized gain of 100 increases the EGP(2013) of 105 (or 137) by 100 to 205 (or 237).
- DAC (2013) = DAC (2012) * (1 + i) - k * EGP(2013).
- k = PV(DAE) / PV(EGP), where both PVs are at issue. Since PV(DAE) is not given, there is insufficient information to determine k. Consequently, a numerical result for DAC (2013) is unavailable.

(iii)

- Several factors could determine the relationship between the estimated DAC and the actual reported DAC. The actual reported DAC could be higher or lower than the estimate.
- If the company performs retrospective unlocking (true-up) at the end of the year, then revising the past results could cause the actual reported DAC to differ from the estimate. In particular, if the actual unrealized gain/loss is other than 100, the actual reported DAC might differ from the estimate.
- If the company performs prospective unlocking at the end of the year, then revising assumptions as to the future could cause the actual reported DAC to differ from the estimate.

9. Learning Objectives:

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

Learning Outcomes:

(2c) Calculate liabilities for life and annuity products and their associated riders under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

(2d) Calculate DAC assets for life and annuity products and their associated riders under the standard: U.S. GAAP.

Sources:

US GAAP for Life Insurers, 2nd Edition, Ch. 7

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Determine the DAC Balance at the end of Year 1.

Commentary on Question:

Many candidates started out by noting that the benefit reserve accrues at the crediting rate and the net GAAP liability accrues at the break-even interest rate. That was a good start, but a lot of candidates then ran into problems when they tried to solve the problem by discounting cash flows. There is a much easier way to solve the problem using recursive formulas, as illustrated in the model solution. The discounted cash flow approach works but is more complicated.

Under FAS 91, the benefit reserve is the liability on the balance sheet and is equal to the account value.

The benefit reserve net of DAC (or the net GAAP liability) accrues at the break-even interest rate.

The break-even interest rate is the rate that causes the present value of all future cash flows to exactly equal the insurer's cash position at issue.

The net GAAP liability at issue equals the insurer's cash position at issue and is equal to the premium less the deferrable acquisition costs:

NGL at issue = 100,000 - 6,000 = 94,000

9. Continued

The net GAAP liability at the end of Year 1 can be determined recursively using the NGL at issue, the break-even interest rate (BER) and the Year 1 cash flows:

NGL(1) = (NGL at issue) x (1 + BER) – Year 1 maintenance expenses – Year 1 surrender benefits

Year 1 surrender benefits can be determined by accruing the premium at the crediting rate to the end of the year, and then applying the Year 1surrender rate and the Year 1 surrender charge:

Year 1 surrender benefits = 100,000 x 1.065 x 0.1 x (1 – 0.04) = 10,224

Hence:

NGL(1) = 94,000 x 1.073904 – 25 – 10,224 = 90,698

The benefit reserve (i.e., account value) at the end of Year 1 can be determined by accruing the premium at the crediting rate and then applying the Year 1 surrender rate:

BR(1) = 100,000 x 1.065 x (1 – 0.1) = 95,850.

The DAC Balance at the end of Year 1 can then be determined by subtracting the net GAAP liability from the benefit reserve:

DAC Balance(1) = BR(1) – NGL(1) = 95,850 – 90,698 = 5,152

(b) Prepare the GAAP balance sheet as of the end of Year 1 using the minimum investment rate such that the contract will not realize a loss in Year 1.

Commentary on Question:
The model solution reflects the simplest way to solve this problem. An alternative but longer way is to solve for the amount of investment income that will result in no gain or loss in year 1. The amount of gain or loss = premium + investment income – surrender benefits – deferrable acquisition costs – maintenance expense – change in benefit reserve + change in DAC balance. Once investment income is solved for, invested assets can be determined and the balance sheet can be completed. Invested assets = premium + investment income – surrender benefits – deferrable acquisition costs – maintenance expense.

Balance sheet consists of Assets, Liabilities and Surplus, where Assets = Liabilities + Surplus.

9. Continued

The DAC Balance is an asset and equals 5,152 from part (a).

The only liability is the benefit reserve and equals 95,850 from part (a).

Surplus = 0 since we have no first year gain or loss per the question.

Assets must equal 95,850 (Liabilities + Surplus). Assets = Invested Assets + DAC Balance, therefore, Invested Assets = 95,850 – 5,152 = 90,698.

Balance Sheet

Assets

Invested Assets	90,698
DAC Balance	5,152
Total Assets	95,850
Liabilities	95,850
Surplus	0

10. Learning Objectives:

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

Learning Outcomes:

(2a) Describe and differentiate between valuation assumptions under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

Sources:

LFV-802-07: US Tax Reserves for Life Insurers: Ch. 2 Tax-Based Reserves and Ch. 7 Section 807(f)

Valuation of Life Insurance Liabilities, Chapter 10

Commentary on Question:

The question was designed to test basic tax reserve knowledge retrieval and then utilize both stat reserve and tax reserve knowledge to solve a simplified near real-world problem. See the commentary below for each portion of the question.

Solution:

(a) Before calculating reserves, you ask an actuarial student to help analyze reserving rules.

(i) State three criteria for a transaction to be allowed for tax purposes.

(ii) The actuarial student has made the following statement:

"*The tax reserve may be higher than the stat reserve; however, we must be careful that the reserve calculation method we choose does not maximize tax benefits.*"

Critique this statement.

Commentary on Question:

Some candidates answered (a)(i) correctly; however, candidates commonly didn't realize the question asked for <u>general</u> criteria for a transaction to be allowed for tax purposes rather than a <u>specific</u> list of tax-deductible reserve or expense charges or reinsurance transactions applicable to a life insurance company. The wording attempted to point toward a very broad answer.

10. Continued

Most candidates indicated correctly in (a)(ii) that stat reserve forms a "cap" for tax reserve. The reported tax reserve may never exceed the reported stat reserve. Some candidates were less certain about whether a company is allowed to maximize tax benefits. Within the stat "cap" mentioned previously, as long as applicable rules and regulations are followed for both stat and tax reserve the company may maximize tax benefits. In practical terms this is accomplished in the form of making stat reserve and tax reserve as near to each other as possible with stat reserve ≥ tax reserve.

(i) In general a transaction will be respected for tax purposes if:

- It has economic substance compelled by business or regulatory realities
- It is imbued with tax-independent considerations
- It is not shaped solely by tax-avoidance features that have meaningless labels attached

(ii)

- The statement is false
- Tax Reserve ≤ Stat Reserve
- Company may calculate the tax reserve using a method that maximizes tax benefits as long as it meets the requirements of section 807 and the benefits provided by the contract have economic substance.

(b) Calculate the difference between the tax reserve and the stat reserve at issue. Show all work.

Commentary on Question:
While a few candidates answered correctly, candidates generally provided poor answers for the part (b) calculation. Many answers did not demonstrate adequate understanding of the CARVM SPDA example in the study material that this question was meant to examine on either a stat or a tax basis. The range of answers in round numbers for stat reserve was from -5,000 to +400,000 with a chunk of answers also around +20,000 and the few correct ones around +95,000. Even without specialized annuity knowledge, it is unreasonable to think a stat reserve immediately after a single premium of 100,000 is paid to be outside the range of approximately 80,000 – 120,000 (80% - 120% of the single premium).

Significant partial credit for various building blocks of the CARVM calculation was available and many candidates received varying levels of partial credit when on at least somewhat the right track.

10. Continued

It is worth mentioning in general a few of the main "dead ends" along with their misinterpretations that lead candidates to those dead ends:

**For Stat Reserve = -5,000 a candidate had to think Reserve = PV(Future Benefits) – PV(Future Premium) and then think incorrectly there is 100,000 of <u>additional</u> future premium. The entire premium has already been paid so reserve calculation simplifies to Reserve = PV(Future Benefits) - 0.*

**For Stat Reserve = +20,000 a candidate had to think that the benefit is a 5,000 (from 0.05 * 100,000) a year immediate annuity payment for five years.*

**For Stat Reserve = +400,000 a candidate had to think that the benefit is a 100,000 a year immediate annuity payment for five years.*

"No settlement options other than cash surrender" as given in the question means it is a deferred annuity. It is also obviously a deferred annuity from the fact that there is a surrender charge schedule and no annuity payments were mentioned. Immediate annuities generally don't have surrender charges.
A few candidates didn't realize the question defined the product as a non-life contingent annuity and tried to also apply some kind of mortality. No mortality table was provided or mentioned anywhere in the question.

Some candidates applied the 5% guaranteed credited interest for two years rather than for one year when accumulating values.

Some candidates assumed the contract had its highest value at maturity (as the book example did) and did not check for full surrender at the end of each year.

Some candidates applied the surrender charge for values at the very end of the fifth contract year (instead of realizing that end of year values are really "end of year + an infinitely small amount" values. "At issue" or "time 0" is really the moment after the single premium is received and the contract is considered issued. Similarly "end of contract year 1" or "time 1" is really the moment after the end of contract year one. "End of contract year 5" or "time 5" is really the moment after the end of contract year five thus the surrender charge would have expired.

If a comment in the model solution below is preceded by "Note:" it is not a scoring part of the solution, merely a further explanation for some portion of the model solution.

10. Continued

Interest Rates by Year	1	2	3	4	5
Guaranteed Credited Interest Rate (GUAR-I)	5.0%	2.0%	2.0%	2.0%	2.0%
Prevailing State Assumed Interest Rate (PSAR)	3.5%	3.5%	3.5%	3.5%	3.5%
Applicable Federal Rate (AFR)	2.5%	2.5%	2.5%	2.5%	2.5%
Stat Reserve Interest Rate	3.5%	3.5%	3.5%	3.5%	3.5%
Tax Reserve Interest Rate	5.0%	3.5%	3.5%	3.5%	3.5%

Stat Reserve Interest Rate $_n$ = PSAR $_n$
Tax Reserve Interest Rate $_n$ = Max (GUAR-I $_n$, PSAR $_n$, AFR $_n$)
Note: *The Tax reserve interest rate is described in section 807 (c) (3): Amounts Discounted at Interest Only to Satisfy Insurance & Annuity Contract Obligations. Generally, tax will be calculated at a higher interest rate than stat and result in a lower reserve, ↑ Interest Rate used for PV purposes = ↓ PV(Benefits).*

	AV	CV	Stat Reserve Candidate	Stat Reserve$_0$	Tax Reserve Candidate	Tax Reserve$_0$
0	100,000	95,000	95,000		95,000	
1	105,000	99,750	96,377	**96,377**	95,000	**95,000**
2	107,100	101,745	94,980		93,623	
3	109,242	103,780	93,604		92,266	
4	111,427	105,856	92,247		90,929	
5	113,655	113,655	95,695		94,328	

Explanation of the calculated table values (Note: *This product is a very simplified SPDA with no life contingencies, no partial withdrawals, and no settlement options*):

AV_0 = Single Premium = 100,000
$AV_n = AV_{n-1} * (1 + \text{Guaranteed Credited Interest Rate}_n)$

$CV_n = AV_n * (1 – \text{Surrender Charge}_n)$.
Note: *Surrender Charge $_5$ = 0*

$Stat_n = CV_n / (1 + .035)^{\wedge n}$
Stat Reserve$_0$ = Max (Stat Reserve Candidate $_n$)

10. Continued

$Tax_1 = CV_1 / (1 + .050) \wedge 1$
$Tax_n = CV_n / [(1+ .050) * (1 + .035) \wedge n-1]$
$Tax\ Reserve_0 = Max\ (Tax\ Reserve\ Candidate_n)$

Note: *For time 0 values, even though there are no withdrawals allowed in the first contract year, the CV_0 would be 95,000 and as there is no time to accumulate or discount that amount it forms the minimum stat reserve and tax reserve. Alternatively, if CV_0 is considered undefined due to no withdrawals allowed in the first contract year then Stat Reserve Candidate$_0$ and Tax Reserve Candidate$_0$ are undefined and the question is still answerable. The "no withdrawal in the first contract year" provision was to avoid any continuous vs discrete issues or other timing problems between accumulating and discounting.*

Difference between stat reserve and tax reserve = 96,377 – 95,000 = **1,377**

Note: *Stat Reserve ≥ Tax Reserve.*

11. Learning Objectives:

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

Learning Outcomes:

(4c) Explain and create a product line "gains by source" analysis.

(4e) Explain and apply methods and approaches of surplus management and earnings management.

Sources:

Life Insurance Products and Finance, Atkinson and Dallas, Ch. 16

"Strategic Management of Life Insurance Company Surplus," TSA XXXVIII (pages 105-116)

Sources of Profit Paper, 1996 Val Act Symposium (pages 147-162)

Commentary on Question:

In general, the candidates did very well on this question. They were asked to discuss ways for a company to manage its earnings, perform a gains by source analysis, and demonstrate their understanding of when a company creates or destroys economic value and creates or consumes free cash flow. Some candidates even provided very creative answers to resolving various issues associated with the topics covered by the question. Credit was given for any reasonably acceptable answer provided.

Solution:

(a) Describe three ways a company can manage its earnings.

Commentary on Question:

The candidates did not do as well on Part (a) as they did on other parts of this question. It is distinctly possible that the question in Part(a) was not very specific and as a result, various answers were provided by the candidates. Credit was given to any candidate who provided reasonably acceptable responses to the question that was posed to them. More points were given if candidates provided explanations rather than just listing different possibilities.

The three ways a company can manage its earnings is as follow:

1. Product Management
   a. Adjusting inforce products by changing dividends, premiums, credited interest rates, or cost of insurance rates as well as other non-guaranteed assumptions.
   b. Through the pricing of new products, a company can increase profit margins, introduce product features, or to reduce risk.

11. Continued

c. Reinsurance can be used to transfer risk, or to gather underwriting information from reinsurers based on their extensive experience to enhance the pricing of new products.

2. Asset Management
   a. Investment strategies can be used to increase average yields or shifting to riskier investments, or a company can focus on reducing the volatility of earnings.
   b. Reinsurance may be used to adjust the timing of earnings.via surplus relief or other financial reinsurance arrangements.
3. Expense Management
   a. Companies with lower expenses usually have higher profits. Methods to attain this goal include "across the board" cuts, "surgical incisions", "start-up" view, "slash and burn", cost benefit analysis, process automation, reorganization, outsourcing, etc.
   b. Reinsurance can be used to reimburse companies for some of their expenses to help lower expenses through expense allowances.

(b) Critique the appropriateness of the Chief Actuary's statement.

Commentary on Question:
Most candidates did very well on this question. Most candidates understood that the explanation for earmings should be derived from a "gains by source" analysis. However, there were a few candidates who fell into the same trap as the "Chief Actuary" and attempted to analyze earnings from what was directly given in the income statement. Most points were given for the former and minimal points were given for the latter.

"Gains By Source" Analysis:

Premium Loading = Gross Premiums – Net Premiums
Premium Loading (2012) = 50,200 – 36,750 = 13,450
Premium Loading (2013) = 52,140 – 41,430 = 10,710
Impact to Earnings Change Due to Premium Loading = Premium Loading (2013) – Premium Loading
(2012) = 13,450 – 10,710 = 2,740

Gain from Interest = Actual Interest – Expected Interest
Gain from Interest (2012) = 3,450 – 3,400 = 50
Gain from Interest (2013) = 3,500 – 3,450 = 50
Impact to Earnings Change Due to Gain from Interest = Gain from Interest (2013) – Gain from Interest (2012) = 50 – 50 = 0

11. Continued

Gain from Mortality = (Expected Death Rate – Actual Death Rate) x (Death Benefit – End-of-Period Reserve)
Gain from Mortality (2012) = (0.02 – 0.03) x (75,000 – 70,000) = - 50
Gain from Mortality (2013) = (0.02 – 0.03) x (97,000 – 90,000) = -70
Impact to Earnings Change Due to Gain from Mortality = Gain from Mortality (2013) – Gain from Mortality (2012) = -70 – (-50) = -20

Gain from Surrender = Expected Surrenders – Actual Surrenders
Gain from Surrender (2012) = 4,500 – 4,500 = 0
Gain from Surrender (2013) = 4,300 – 4,250 = 50
Impact to Earnings Change Due to Gain from Surrender = Gain from Surrender (2013) – Gain from Surrender (2012) = 50 – 0 = 50

Gain from Expenses = Expected Expenses – Actual Expenses
Gain from Expenses (2012) = 9,000 – 9,500 = -500
Gain from Expenses (2013) = 12,500 – 12,420 = 80
Impact to Earnings Change Due to Gain from Expenses = Gain from Expenses (2013) – Gain from Expenses (2012) = 80 – (-500) = 580

Analysis of Gains by Source Results:

The Chief Actuary's statement that "a significant increase in death claims and expenses is clearly driving the earnings decrease" is not correct.
The impact of mortality to the decrease in earnings is only 20 between 2012 and 2013, which is minimal.
The impact of expenses was actually an increase to earnings of 580 between 2012 and 2013.
The key driver to the decrease in earnings was premium loading with a significant decrease to earnings of 2,740.

(c) Analyze the above results and recommend changes to the allocation of capital in order to create economic value.

Commentary on Question:
Candidates also did well on this part of the question. Most candidates understood what it meant when the ROE was greater/lesser than the equity growth rate and/or the cost of capital. However, there were some candidates who got confused where to include the 2% dividend into their analysis and unfortunately, provided less desirable solutions.

11. Continued

If ROE > Company Cost of Capital, then Economic Value is created.
If ROE > Company Equity Growth Rate, then Free Cash Flow is created.

For Profit Center A, ROE (7%) < Company Cost of Capital (10%) and ROE (7%) < Equity Growth Rate (10%)..
Thus, Profit Center A is not creating Economic Value nor creating Free Cash Flow. This is a cash sink. The company should explore ways to improve the Profit Center's ROE or minimize the amount of capital flowing to it.

For Profit Center B, ROE (18%) > Company Cost of Capital (10%) and ROE (18%) > Equity Growth Rate (9%).
Thus, Profit Center B is creating Economic Value and creating Free Cash Flow. Since the profit center's ROE far exceeds the company cost of capital, then a larger portion of the capital should be allocated to this profit center.

For Profit Center C, ROE (14%) > Company Cost of Capital (10%) and ROE (14%) < Equity Growth Rate (16%).
Thus, Profit Center C is creating Economic Value and not creating Free Cash Flow. In this situation, it would be best to leave the allocation of capital to Profit Center C as it currently is.

From a total company perspective, ROE (10%) = Company Cost of Capital (10%) and ROE (10%) < Company Equity Growth Rate (11%).

Thus, the company is not creating Economic Value nor creating Free Cash Flow. And, the company's growth rate of 11% cannot be supported by its earnings, especially with the 2% dividend payment, since the company's ROE is only 10%. The Company's growth rate should be no more than 8% to afford the 2% dividend payment (10% ROE – 2% Dividend).