CSP-IC Complete Illustrative Solutions
Fall 2011

1. Learning Objectives:

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

Learning Outcomes:

(7g) Describe the roles of rating agencies, analysts and regulators together with their methods and impact on insurance companies.

Sources:

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

Commentary on Question:

Part (a) of this question tests the ability of the candidate to apply the S&P ERM Criteria to mortality risk. Part (b) tests the candidate's knowledge of what constitutes an adequate ERM rating and how an adequate ERM rating can be upgraded to strong.
Cognitive levels include Retrieval and Knowledge Utilization.
To receive maximum points the candidate needs to describe how each of the S&P ERM criteria relate to mortality risk for part (a). To receive maximum points for part (b) the candidate must explain why this company was rated as adequate thoroughly and then separately identify the steps the company could take to improve the rating to strong.
Some candidates stated considerations in the ERM criteria but did not apply these to mortality risk as part (a) requested. Some candidates did not separate part (b) into two sections and talked generally about strong and adequate ratings, not how to improve ratings from adequate to strong, and why the rating would only be adequate.

Solution:

(a) Identify the most favorable indicators for mortality risk control

Risk Identification:

ABC needs to be aware of mortality risk as well as associated risks. These associated risks include:

- Risk of underpricing
- Risk of misclassification
- Risk of concentration

1. Continued

Risk Monitoring:
ABC can monitor mortality risk through mortality studies performed with standard frequency and timing. Actual mortality rates can be compared to pricing assumptions and industry studies.

ABC can monitor claims risk through monitoring actual mortality rates to expected mortality rates.

ABC can monitor concentration risk through a chart showing new business distribution by policy size, underwriting class, age of insured, etc.

It's important to give feedback from the monitoring process to pricing, underwriting, and claims departments.

Risk Limits and Standards
Retention limits may be used to limit the amount of insured offered on a single policy.

Underwriting standards are clear and consistent. ABC expects its closely tied sales forces to participate in underwriting as a significant prescreening step.

The amount of insurance ceded to any single reinsurer could be limited.

Risk Limit Enforcement
Underwriters need to be trained on underwriting standards. ABC must monitor and enforce compliance with these standards.

An auditing process for reviewing risk classification decisions such as self-review, peer-review, supervisory review, and independent internal/external review is required.

Insurer follows compliance failures with retraining, limits to authority, compensation limits and/or terminations.

Risk Management
Reinsurance is the primary tool for managing mortality risk. ABC's retention limit for individual lives should be tied to their overall risk tolerance.

An objective process should be used for reinsurer selection and distribution of reinsurance.

Securitization can also provide for a transfer of risk in extreme events.

1. Continued

Risk Learning
Underwriting standards and pricing should be aligned with company and industry experience.

Processes should be developed that extend current mortality trends.

Processes should be developed that subdivide experience into new or developing classifications.

(b) S&P issued an Adequate ERM rating of ABC.

(i) Evaluate the above aspects of ABC's ERM program that contribute to the Adequate rating.

Reasons why ABC's ERM program is rated adequate:
ABC's ERM programs has fully functioning risk control systems in place for all major risks, however they lack an overall risk tolerance and lack a clear vision of their overall risk profile.

ABC's ERM process is solid, classical, and silo-based. Risk limits for various risks have been set independently.

ABC lacks robust processes for identifying and preparing for emerging risks, and for optimizing risk-adjusted returns.

(ii) Recommend improvements ABC Life could make to its ERM program to improve its rating to Strong.

Recommendations to improve ABC's ERM program rating to strong:
ABC must exceed the adequate criteria for risk control. Ways to achieve this would be:

- Creating a vision for overall risk profile and an overall risk tolerance
- Having a goal of optimizing risk-adjusted returns
- Developing robust processes to identify and prepare for emerging risks.

2. Learning Objectives:

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

Learning Outcomes:

(4d) Apply methods of valuation to business and asset acquisitions and sales.

Sources:

ILA-C106-07: Mergers and Acquisitions, Chapter 4 (Sections 4.1-4.6)

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) List adjustments a buyer may make to a seller's analysis to develop its own actuarial appraisal.

Commentary on Question:

This part of the question was trying to test the candidate's understanding of the adjustments that may be made by the buyer to the seller's actuarial appraisal of its company.

This cognitive level of this part of the question is retrieval of information from the pertinent study material in the syllabus.

Candidates should elaborate on each item that they list to demonstrate their understanding of adjustments which may be made by one company to an actuarial appraisal developed by another company.

In general, candidates did not perform well on this part of the question. Most candidates just listed "key words" rather than disclosing the significance of the items they listed as adjustments to an actuarial appraisal.

A buyer may make the following adjustments to a seller's analysis to develop its own actuarial appraisal:

1. Reflect buyer's own view of the discount rate.
2. Adjust experience and product management assumptions in actuarial appraisal to fit buyer's assessment.

2. Continued

3. Actuarial appraisal may be adjusted for specific structure anticipated by buyer with regard to tax benefits or costs associated with the transaction and capital structure.
4. Adjust values with respect to new business based on buyer's view.
5. Adjust for anticipated benefits due to anticipated synergies, cost savings, and/or one-time acquisition costs.

(b) You are preparing the best estimate mortality assumptions for the actuarial appraisal of Alta Life Co's business.

Evaluate the appropriateness of:

(i) Using Alta Life's experience

(ii) Using SLH Life's experience

Commentary on Question:
This part of the question was trying to test the candidate's understanding of how to select an appropriate mortality assumption for developing an actuarial appraisal.

The cognitive level of this part of the question was knowledge utilization of the pertinent study material on the syllabus.

Candidates must demonstrate an understanding of the criteria for selecting a mortality assumption to be used in the development of an actuarial appraisal.

Most candidates were able to state the appropriateness of using either company's mortality assumption, but they had difficulty supporting their evaluation. There were a number of candidates who failed to state the appropriateness of either company's mortality experience and these candidates lost some "easy" points. It's important for the candidate to understand that when they are asked to make a recommendation that they should make a recommendation and then provide support for their recommendation. Valuable points are lost when this is not done.

2. Continued

Using Alta Life's mortality experience in the actuarial appraisal of Alta Life's business would be appropriate if:

1. Alta Life's mortality experience is credible provided its mortality experience is significant.
2. Alta Life's mortality experience is reflective entirely of its own company experience.
3. Alta's Life mortality experience is relevant provided there is no change to the nature of the business after it is sold to SLH Life.

Using SLH Life's mortality experience would not be appropriate because of the following differences underlying the products in SLH Life's portfolio relative to Alta Life's portfolio:

1. Types of underwriting.
2. Distribution of sales.
3. Treatment of substandard risks.
4. Mortality anti-selection due to policyholder's lapsation.
5. Assumed improvement in future mortality.
6. Different mortality risks from premature death as opposed to longevity risk.

(c) Calculate the Actuarial Appraisal Value for Alta's closed block on December 31, 2010.

Commentary on Question:
This part of the question was testing the candidate's ability to calculate an actuarial appraisal value.

This part of the question was testing the candidate's comprehension of how to perform a calculation covered in the study material on the syllabus.

For the candidate to receive maximum points on this part of the question, the candidate must show all of his/her work including formulas "in words" as well as numerical formulas.

In general, candidates performed well on this question. But, many candidates failed to show all formulas "in words" and as a result, lost some points. Also, many candidates erroneously did not include the deduction of the cost of required capital as part of the formula for the Value of Inforce Business and instead included this item as part of the formula for the Actuarial Appraisal Value. Fortunately, even with this mistake, the candidate was able to get the correct final result, but failed to demonstrate the proper understanding of the Value of Inforce Business.

2. Continued

Actuarial Appraisal Value = Adjusted Book Value + Value of Inforce Business + Value of New Business

Value of New Business = 0 because Alta Life's business is a closed block.

Adjusted Book Value = 100

Value of Inforce Business = Present Value of After-Tax Statutory Earnings discounted at the discount rate of 10% - Cost of Required Capital.

Cost of Required Capital = 5.84

After-Tax Statutory Earnings = Pre-Tax Statutory Earnings – Taxes

Pre-Tax Statutory Earnings for 2011 = 800
Pre-Tax Statutory Earnings for 2012 = 700

So, After-Tax Statutory Earnings for 2011 = 800 – Taxes
After-Tax Statutory Earnings for 2012 = 700 – Taxes

Taxes = Taxable Income x Tax Rate

Tax Rate = 35%

Taxable Income = Pre-Tax Statutory Earnings + Change in Statutory Reserves – Change in Tax Reserves

Taxable Income for 2011 = 800 + (-155) – (-100) = 745
Taxable Income for 2012 = 700 + (-250) – (-200) = 650

So, Taxes = Taxable Income for 2011 x Tax Rate
Taxes for 2011 = 745 x 35% = 260.75
Taxes for 2012 = 650 x 35% = 227.50

So, After-Tax Statutory Earnings = Pre-Tax Statutory Earnings - Taxes
After-Tax Statutory Earnings for 2011 = 800 – 260.75 = 539.25
After-Tax Statutory Earnings for 2012 = 700 – 227.50 = 472.50

So, Value of Inforce Business = Present Value of After-Tax Statutory Earnings discounted at the discount rate of 10% - Cost of Required Capital
Value of Inforce Business = 539.25 / (1+0.1) + 472.50 / (1+0.1)^2 – 5.84
Value of Inforce Business = 490.23 + 390.50 – 5.84 = 874.89

2. Continued

Thus, Actuarial Appraisal Value = Adjusted Book Value + Value of New Business + Value of Inforce Business

Actuarial Appraisal Value = 100 + 0 + 874.89 = 974.89

(d) SLH Life is looking at other methods to determine the value of this block of business.

Commentary on Question:
This part of the question requires the candidate to demonstrate an understanding of two methodologies to appraise the value of a block of business and discuss their differences.

The cognitive level of this part of the question is knowledge utilization of the pertinent study material on the syllabus.

For the candidate to receive maximum credit for this part of the question, the candidate must describe each of the two appraisal methods and then discuss their differences. In addition, the candidate must recommend a preference as to which of the two appraisal methods should be used to develop an appraisal value for a block of business and then support his/her recommendation.

Candidates, in general, did not do well on this part of the question. They had difficulty describing each of the two appraisal methods and very few candidates compared the two appraisal approaches. Almost all candidates recommended an appraisal method to use for determining the appraisal value of a block of business, few were able to support their recommendation adequately.

(i) Contrast an Actuarial Appraisal with a Comparable Transaction Analysis.

Actuarial Appraisal Method

1. Discounted cash flow analysis
2. Contains projection of statutory earnings
3. May involve sensitivity analysis
4. Need for assumptions to be used in projections
5. Examples of projection assumptions include mortality, lapse, discount rates, morbidity, investment return, expenses

Comparable Transaction Analysis

1. Review financial data (price-to book ratios, price to earnings ratios, or embedded values) of targeted acquisitions
2. Compare to comparable recent insurance transactions
3. Review what other companies would pay for similar blocks of business

2. Continued

4. Adjustments must be made to ensure value multiples are converted to equity multiples

Actuarial Appraisal Method (AA) Versus Comparable Transaction Method (CTA)

1. CTA is not on U.S. GAAP basis, AA is.
2. CTA is available publicly, AA is prepared by seller.
3. CTA doesn't involve projections or sensitivity analysis while AA does.

(ii) Recommend which of the two appraisal methods SLH should choose.

SLH Life should choose the Actuarial Appraisal Method because

1. Of the difficulty finding similar comparable transactions.
2. Either method requires adjustments and cannot be used directly.

3. Learning Objectives:

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

Learning Outcomes:

(3a) For traditional and financial reinsurance, explain the consequences and evaluate the effect on both ceding and assuming companies with respect to:
- (i) Risk transfer
- (ii) Cash flow
- (iii) Financial statement presentation
- (iv) Tax impact, and
- (v) Reserve credit requirements.

Sources:

Life and Health Reinsurance, Ch. 4 Basic Methods of Reinsurance

Life and Health Reinsurance, Ch. 5 Advanced Methods of Reinsurance

Life and Health Reinsurance, Ch. 6 The Reinsurance Treaty

Commentary on Question:

This question tested knowledge and application of modified coinsurance and appropriate methods of reinsurance in general. For full credit, it was important to show proper use of Mod-Co Adjustment formula, income statement components, and making multiple valid recommendations for the non-admitted reinsurer concern.

Candidates did well revising the income statement for the reinsurance, and listing the advantages/disadvantages of Mod-Co. Candidates did not do as well recommending the use of an insolvency clause in the reinsurance agreement.

Solution:

(a) List the advantages and disadvantages of this reinsurance arrangement.

Advantages:

- Life Co will get surplus relief from the regulatory capital requirements that are transferred to the reinsurer.
- Life Co has more control over its investments and maintains the policy reserves.

The main disadvantage is that it is more complicated to administer due to the Mod-Co adjustment calculation.

3. Continued

(b) Determine the impact on Life Co's capital, at the end of 2011, as a result of the Mod-Co agreement.

Income Statement for Life Co (Revised to include Mod-Co agreement)

Revenue		
Net Premium	150	[250 * (1 – 40%)]
Reinsurance Allowance	5	[250 * 40% * 5%]
Expense Allowance	20	[250 * 40% * 20%]
Investment Income	13.13	[7% * (150+5+20-105-50-5-20+180+200)/2]

Mod-Co Adjustment = ending policy reserves – beginning policy reserves – "interest" on beginning policy reserves

Mod-Co Adjustment	2.96	[40%*(200-180-180*7%)]
Total Revenue	191.09	[150+5+20+13.13+2.96]
Benefits & Expenses		
Net Claims	105	[175 * (1 – 40%)]
Expenses	50	
Commissions	5	
Reserve Increase	20	
Total Benefits & Expenses	180	[105+50+5+20]
Gain from Operations	11.09	[191.09 – 180]
Surplus	511.09	[500 + 11.09]

Expected Additional Capital = Surplus at end of 2011 (with treaty) - Surplus at end of 2011 (without treaty)

Expected Additional Capital	-2.91	[511.09 – 514]

(c) Recommend appropriate reinsurance methods and approaches that could be used to optimize Life Co's tax and reported income position.

Modified Coinsurance is an appropriate reinsurance method in this situation. Mod-Co eliminates the reserve credit problem that coinsurance would have when the reinsurer is not admitted.

Life Co should consider the use of trusts, escrow accounts or letters of credit. A trust is considered a true transfer of ownership and is less suspect in the eyes of tax and regulatory authorities. Life Co can take reserve credit if it is properly structured.

3. Continued

Finally, Life Co should include an insolvency clause in the reinsurance agreement. This is needed for the ceding company to take the statutory financial statement credit.

4. Learning Objectives:

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

Learning Outcomes:

(8c) Identify and apply actuarial standards of practice relevant to financial reporting and valuation.

(8d) Explain the actuary's professional responsibilities to stakeholders including obligations under Sarbanes-Oxley.

Sources:

Actuarial Aspects of SOX 404, Financial Reporter, Dec 2004

ILA-C126-10: KPMG SEC Guidance on Internal Control Over Financial Reporting, June 2007

Commentary on Question:

Question 4 tested the candidate's understanding of risk assessment under the COSO control framework.

The cognitive level required for part (a) is comprehension since the candidate is required to identify the risks of the Diversity 2010 reserving process under the four areas. Overall, the candidate did a fair job in answering part (a). Some candidates were given marks for points that were not in the grading outlines but were valid e.g. suggesting password protection or write protection on spreadsheet in the actuarial valuation system section. Some candidate did a poor job of answering the compilation process section because they either did not have an understanding of the compilation or confused it with the actuarial valuation system.

The cognitive level required for part (b) is knowledge utilization since the candidate is required to make a recommendation on which control that will most likely fail in the reserving process. Overall, the candidate did a fair job of answering the question. The common mistakes made were assuming that automation of the reconciliation of inputs/outputs or junior IT staff perform the reconciliation will contribute to greater risk than complexity of sampling.

Solution:

(a) Evaluate the Diversity 2010 reserve process for the following four risk areas:

(i) Data

- There is a high risk the data is inaccurate or incomplete
- Was not validated against the administration system (or not independently validated)

4. Continued

(ii) Actuarial valuation systems

- How was the spreadsheet reviewed or validated
- Risk that assumptions were used to project the account values are not correct

(iii) Compilation process

- Was the manual entry checked/verified for accuracy
- Did the adjustment go through the financial statement process correctly

(iv) Management review process

- Risk that the adjusted reserve is too low, understating the balance sheet.
- Does the CFO have the proper knowledge to recommend the adjustment

(b) Identify which control is more likely to fail

The sample testing control is more likely to fail for the following reasons:

- Sampling is a manual process and infrequent
- Sampling is brand new; it is unknown if it is effective
- Sampling is much more complex than data reconciliation
- Senior actuarial consultant is more competent than IT person, but doesn't mitigate other risks

5. Learning Objectives:

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

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

Learning Outcomes:

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

(1c) Compute the basic taxable income of a life insurance company.

(1e) Describe and critique the framework and principles used in the calculation of reserves under a Fair Value approach.

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

Sources:

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

ASOP #23 Data Quality

ILA-C102-07: Actuarial Review of Reserves and Other Annual Statement Liabilities"

July 2010 Exposure Draft - Insurance Contracts, IASB, pages 19 to 84

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Identify concerns addressed by establishing a liability for this benefit from the perspective of GHPF.

Commentary on Question:

This question was intended to start the candidate thinking about the basic purposes of a reserve - that the reserve is designed to address both solvency and financial reporting issues.

- Fund will help ensure there is money available to pay potential claims
- Not having fund would overstate current income - purchase price might be booked into income in one financial period while claims might show up in another
- Concern as to whether this fund will be recognized in tax reporting

5. Continued

(b) Explain the actuary's considerations using *ASOP 23* (*Data Quality*) in using this data to establish the liability.

Commentary on Question:
This part was testing the candidate's knowledge of the actuary's responsibilities under ASOP 23 with application to the situation. Candidates who did poorly on this part missed the need to disclose the reliance on others or did not reference the situation as outlined in the question.

- What information is available on the purchase records
- Can this information be relied on
- Does GHPF have other sources of information
  - If so, what would be the cost of acquiring that information
- Under ASOP 23 the actuary may rely on this information subject to a review
  - This review should be looking for inconsistencies in the data
  - It should determine whether the data has material limitations
  - The actuary is not required to investigate for fraud
  - Any material limitations need to be disclosed
- Has the auditor already reviewed the records
- Is there some way of enhancing the data
- The actuary must disclose his reliance on these records
- If the records are inadequate and there is nothing else he should refuse the assignment

(c) Propose a methodology for calculating this liability which satisfies the requirements of the *International Financial Reporting Standard's Exposure Draft* on insurance contracts.

Commentary on Question:
This part was testing the candidate's knowledge of the Proposed IFRS reserving method. Candidates who missed out on grading points usually did not mention discount rates or expenses. Partial points were also given to those candidates who treated the liability as a short term arrangement.

- We need to come up with best estimate cash flows
- May need to determine how much of the purchase price goes for insurance
- Then get best estimate of claims and expenses
- Only incremental expenses are included (i.e. no overhead)
- Then we need to add a risk margin for the uncertainty of these cash flows
- Flows are discounted at the current risk-free rate for the expected period
  - With an adjustment for illiquidity
- No gain is possible at issue - if the present value of inflows less outflows is positive we need to set up a residual margin that reduces the gain to zero

5. Continued

- Losses are allowed to flow through (i.e. no negative residual margins)
- The residual margin is run off over the period of the contract
- Using the initial discount rate
- In future periods the discount rate is the rate current at that time - it's not
- locked in
- May need ruling as to whether liability is insurance or a warranty
  - Warranties are outside the scope of this draft

6. Learning Objectives:

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

Learning Outcomes:

(1a) Develop, use and recommend methods for performing actuarial reviews of reserves.

Sources:

ILA-C102-07: Actuarial Review of Reserves and Other Annual Statement Liabilities

Commentary on Question:

Candidates had a lot of trouble answering part (c). There were very few candidates who provided the answer specified for this particular question.

Solution:

(a) List the categories for actuarial reserve review techniques.

Spot checks (test calculations, transactional checks, policy traces)
Independent Full Recomputations
Tests of aggregate progress of reserves from one 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

(b) Recommend items to review in validating this 40% reserve increase. Support your recommendation.

Split the traditional life reserves and the purchased in-force block of term business
Spot check reserve calculations
Test reserve assumptions vs. Assumptions used to purchase the block
Tests of aggregate progress of reserves from one period to the next
Tests of relationship of reserve items to other financial items, and reasonableness of trends in that relationship over time
Can the 40% increase be attributed to MCL's original block or the new block in particular?

(c) Evaluate the audit considerations of following the CFO's suggestion.

CFO thinks no auditable actions can be taken, however, even estimates should have a process backing them.
There should be a check of the policy or contract language to see if reserving methods are proper and all-inclusive.

6. Continued

Spot checks should be performed with the selection of elements to be tested paying attention to sample stratification, systems changes, method changes, and new plans of insurance.

There are two types of validation, static validation and dynamic validation. Static validation encompasses validation of invested assets, face amounts of life insurance in-force, statutory reserves, and other balance sheet items. Dynamic validation speaks to the alignment of income statement items with historical company results.

7. Learning Objectives:

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

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

Learning Outcomes:

(1d) Explain fair value accounting principles.

(7a) Identify, categorize and evaluate potential sources of risk in products including but not limited to mortality, morbidity and lapse.

(7b) Identify, categorize and evaluate potential sources of risk in investments including but not limited to credit risk, liquidity and asset-liability matching.

(7e) Describe and apply methods of risk mitigation and hedging and to understand the limitations of such methods.

Sources:

ERM Specialty Guide, Chapters 1-6

ILA-C116-07: Mapping of Life Insurance Risks, AAA Report to NAIC

Stochastic Analysis of Long Term Multiple-Decrement Contracts, Clark and Runchey, Jan 2008 (Excl. Appendices)

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

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Define key elements of the ERM process as outlined in the *ERM Specialty Guide* (*May 2006*) of the ERM Working Group of the Society of Actuaries Risk Management Section.

Commentary on Question:

In order to receive full credit, candidates needed to not only list the 4 elements of the ERM process but also explain what each of those elements involved.

1. Risk Control
   - Identify, monitor, limit, or avoid risks; offset and transfer risks

7. Continued

2. Strategic Risk Management
   - Reflect risk and risk capital in strategic choices
   - Calculate economic capital for the actual risks
   - Use risk adjusted product pricing
   - Use risk adjusted performance measures

3. Catastrophic Risk Management
   - Envision and prepare for extreme events; develop contingency plans
   - Use trend analysis, stress testing, active catastrophic management; look at events post-mortem

4. Risk Management Culture
   - Incorporate ERM in all decision-making
   - Identify best practices
   - Senior management support
   - Communication through risk reporting

(b) Your company has a large closed block of a traditional whole life insurance business. Identify risks.

Commentary on Question:
Most candidates did well on this part and were able to identify a variety of risks that could affect this product.

- Asset/Liability Matching Risk
- Credit, liquidity, interest rate, duration risk
- Pricing/Underwriting risk
- Reserve adequacy risk
- Economic environment
- Net retention; insufficient capital
- Mortality/morbidity/longevity risk
- Lapse risk

(c) Due to the size of the whole life block, you have been asked to perform a stochastic analysis of the associated mortality risk:

(i) List considerations in performing a stochastic analysis of the mortality risk.

- Need to derive a scenario generator to produce a set of scenarios
- Consider stochastic mortality factors:
  - Underwriting error – best estimate may be wrong
  - Volatility – depends on the size of the population

7. Continued

- Catastrophe – difficult to calibrate
- Trend – not a critical component

- Stochastic processes can be used to generate a mortality rate for each period

(ii) Calculate CTE(70) for the above two elements of mortality risk.

Commentary on Question:
The majority of candidates were able to calculate CTE(70). One common error was combining the scenario results for u/w and catastrophe before calculating the CTE.

Scenarios should be sorted from best to worst; for death benefits, a higher PV is "worst."

CTE(70) = average of the worst 30% of scenarios = average of 3 highest scenarios

U/W: Worst 3 scenarios
Scen 10 = 4.25
Scen 1 = 4.75
Scen 3 = 5.25

CTE(70) = (4.25 + 4.75 + 5.25)/3 = **4.75**

Catastrophe: Worst 3 scenarios
Scen 9 = 6.95
Scen 2 = 7.55
Scen 8 = 8.95

CTE(70) = (6.95 + 7.55 + 8.95)/3 = **7.82**

(d) As part of your risk analysis of the whole life block, you will calculate the fair value liability.

(i) Explain the steps you would take to calculate the fair value liability, using the direct method.

Insurance risks are accommodated by adjusting either the discount rate or the expected future cash flows.

1. Generate a set of stochastic economic scenarios
2. For each scenario, model the expected liability cash flows

7. Continued

3. Discount the cash flows directly with some mechanism to adjust for risk

The formula is:

FVL(t-1) = (FVL(t) + L(t) + E(t))/(1 + r(t) + Theta(t))
FVL(N) = 0

Time period: t = 1 to N
FVL = Fair Value Liability
R(t) = risk free interest rate
Theta(t) = interest rate spread
L = expected policy cash flows
E = expected expense cash flows

(ii) Explain the advantages and disadvantages of the direct method to calculate fair value liability.

Advantages:
- Simple approach
- Provides a reliable assessment of the risk of financial leverage

Disadvantages:
- Not used by companies to set an exit price
- Liquidity may not be reflected
- May not reflect company's credit risk

8. Learning Objectives:

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

Learning Outcomes:

(5a) Compute RBC for a life insurance company, including:
- (i) Identification of significant risk components
- (ii) Identification of specialized product RBC requirements
- (iii) Interpreting results from a regulatory perspective

(5c) Explain and apply the concepts, approaches and methods for determining Economic Capital.

Sources:

Economic Capital: The Controversy at the Watercooler, Financial Reporter, Fall 2006

ILA-C121-08: Economic Capital Modeling: Practical Considerations, Milliman White Paper

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Explain common decisions an insurance company must consider when implementing a risk capital methodology.

Commentary on Question:

Many candidates recalled a list of considerations other than the one from the study note listed under Sources. Those who did recall the correct list, often did not include additional details beyond the main bullet points.

- New Business
  - Inclusion can increase or decrease the level of capital needed
  - Regulatory calculations often exclude new business
- Tail Definition
  - Popular approaches: Value at Risk and Tail VAR
  - VAR uses a defined value in the tail of the distribution
- Confidence Level
  - Higher rated companies need higher levels of capital
  - The confidence level selected will drive different absolute and relative levels of capital
- Aggregation Techniques and Assumed Risk Correlations
  - Common approaches are correlation matrices and copulas
  - These approaches require the parameterization of the relationship between risks

8. Continued

- Scenario Generation
  - This always presents a problem
  - Scenario calibration will drive different capital results
- Double Counting
  - A recurring implementation issue

- Period-to-Period Reconciliation
  - One way is to roll capital forward from period to period and to reconcile changes over time

(b) Determine the key type of risk for each of the above items.

(i) Uncertainty risk –policyholder behavior risk
(ii) Extreme events risk –claims risk
(iii) Operational risk – people risk
(iv) Credit risk –counter-party risk
(v) Volatility risk –claims risk

(c) During a risk committee meeting, the Chief Risk Officer asserts that the company should consider diversification benefits in calculating economic capital.

(i) Explain the arguments for and against incorporating diversification benefits in an economic capital calculation.

Commentary on Question:
Many candidates simply stated that the benefit of diversification was to lower capital instead of focusing on better reflecting the risks the company was undertaking with its product portfolio.

1. Arguments <u>for</u> incorporating diversification
   - Lots of data exists to support the analysis of correlations between various market risks
   - Significant analysis and modeling has been done on this topic
   - Correlation is supported by well-established economic theory
   - Insurance groups with diverse businesses will benefit by the extent to which their different businesses have non-correlated risks
2. Arguments <u>against</u> incorporating diversification
   - Copula functions are hard to apply in practice because there are multiple methods to assess goodness of fit of copulas to sample data points
   - Rating agencies have been historically skeptical about giving full credit for diversification

8. Continued

- The problem of tail dependencies suggests that a rigorous approach to understanding risk dependencies is necessary in order to take full credit for aggregation benefits

(ii) Recommend whether the company should incorporate diversification in its economic capital calculation.

Commentary on Question:
Many candidates failed to make a recommendation of any kind. Those who did make a recommendation often failed to provide any sort of justification for their recommendation.

The company should use diversification benefits in the EC calculation. The company's two main products (Fixed Annuity and Term Insurance), will benefit due to product diversification (specifically mortality/longevity risk). Geographic diversification should be considered since the company is international. Diversification factors must be applied carefully, since product mixes change over time. Follow the CRO forum's proposal by doing a "Solo Entity Solvency Test" and a "Group Solvency Test."

9. Learning Objectives:

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

Learning Outcomes:

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

(6b) Apply a model office process and make appropriate recommendations.

(6c) Analyze and explain actual vs. projected differences.

Sources:

ILA-C112-07: ALM for Insurers

ILA-C114-07: Life Insurance Forecasting and Liability Models (excl. appendices)

Commentary on Question:

Part (a) and (b) of the question was memorization.
Part (c) of the question required more comprehension.
Candidates did well on the memorization part of the question, but most did not answer the question thoroughly enough to get full marks. Students had difficulty explaining model validation

Solution:

(a) Explain the modeling approach with respect to:

- Model simplification
- Model validation

Model simplification:
- Model similar policies together
- Ensure the model captures key variables
- Watch that grouping does not distort the results of the modeling
- Trade-offs of modeling simplification:
  - Known and unknown errors
  - Modeling cost is traded off against error

9. Continued

- Model simplification should undergo static and dynamic validation
    - Static validation: model results are compared at the starting point or time zero, but not validated over time
    - Dynamic validation: check how the model progresses through time
        - Check the reliability of the model going forward
        - This can be done by comparing prior year actual results to what model would have produced

Model validation – should be tested to determine that:

- Assets and liabilities have been properly grouped into represented cells
- Data in extract files and plan description files is accurate and being assessed correctly by calculation routines
- Formulas in calculation routines have been programmed correctly

(b) List challenges of cash flow matching as an Asset Liability Management technique.

- Assets are uncertain due to defaults or early prepayments, throwing matching out of balance
- Liability cash flows can deviate significantly from expected
- Policyholder optionality requires re-estimates of cash flows
- Premium paying products generate positive cash flows and future cash flows will be used for future asset purchases (these won't be known until purchased)
- Need to work with investment experts to ensure rebalancing

(c) Identify modeling assumptions that may need to change due to this interest rate change.

Need to consider whether the model reacts appropriately to the change in the interest rate environment:

- Asset optionality: does the model reflect the possibility of bond calls or prepayments on mortgages as rates drop
- Policyholder behavior assumption: are policyholder behavior reflected in the model
- Lapse assumption: as interest rates drop, the guarantee becomes more valuable so policyholders may be less likely to lapse
- Reinvestment rate – may change in a low interest rate environment
- Model should be tested under a significant number of interest rate scenarios to understand model behavior
- If the models do not reflect some of the above, will likely need to revisit and rebuild models
- Ideally, models would already take this all into account, especially if used for regulatory purposes or other management decision making

10. Learning Objectives:

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

Learning Outcomes:

(3b) Describe the considerations and evaluate the appropriate reinsurance form from the ceding and assuming company perspectives.

Sources:

Life and Health Reinsurance, Ch. 6, The Reinsurance Treaty

Commentary on Question:

This question was reasonably well answered by most of the candidates. Candidates who did poorly did not address enough of the issues - particularly the near insolvency of the ceding company or had an incorrect grasp of one or more of the issues.

Solution:

(a) Evaluate the proposed treaty parameters from the perspective of the reinsurer.

Reinsurer's problems with the parameters:

- Ceding company is close to insolvency - they may soon be under regulatory supervision
- All the parameters are slanted in favor of the ceding company
- Funds Withheld Coinsurance means the ceding company will be managing the investments backing the liabilities - can we trust them to do this properly
- 99% Coinsurance limit - what incentive is there for the ceding company to properly underwrite the business without much "skin in the game"
- Automatic basis: we get the risk without being able to assess the business - are the retention and other limits appropriate
- Bulk administered on an annual basis - ceding company is doing the administration
- A year is much too long not to be aware of emerging experience
- Guaranteed Premiums - usually reinsurance premiums are only guaranteed if the policy premiums are guaranteed (and not always even then)

(b) Propose changes and additions to the requested treaty parameters that reduce the risk to the reinsurer of entering into this reinsurance transaction.

- First drop the percentage insured to a more reasonable level - no higher than 90%
- Have treaty preclude reinsurance of the retained portion
- This will encourage proper underwriting on the part of the ceding company
- Consider structuring the deal as straight coinsurance - this would allow us to administer our share of the assets

10. Continued

- Set a coverage limit above which policies would have to be submitted on a facultative basis
- Use strict wording for policies to qualify as automatic
- Consider jumbo limits
- If using bulk administration switch to quarterly or monthly basis particularly since ceding company is so close to insolvency
- Don't guarantee the reinsurance premiums - this is an innovative product with no track record
- Include an insolvency clause in the treaty
- Insist on a right to offset cash flows
- Consider having a trust set up or obtain a letter of credit

11. Learning Objectives:

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

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

Learning Outcomes:

(1e) Describe international accounting standards

(2a)

(i) Describe Valuation Methods

(ii) Recommend appropriate valuation assumptions.

Sources:

CIA Consolidated Standards of Practice – Section 2100, 2300, 2500 – Dec 2009

CIA Research Paper: Changes in Accounting Policies under IFRS

Commentary on Question:

The intent of this question is to test the candidates knowledge of prescribed interest rates used for the CALM and then compare those interest rates to those used under IFRS.

In general candidates did average on defining and calculating the short term and long term rates in part (a) and (b) but did poorly on part (c).

Solution:

(a) Define the components of the base scenario used for interest rates under CALM.

- For the first 20 years after the balance sheet date
  - Use the forward interest rates implied by the equilibrium risk free market curve at balance sheet date.
- Between the 20th & 40th anniversary
  - Use the forward risk-free interest rates that would be determined using a uniform transition.
- At or after the 40th anniversary from the balance sheet date
  - Use the interest rates equal to the sum of [(1/2 of 60-month moving average) and (1/2 of 120-month moving average)] of historic long-term Canadian risk-free bond yields, annualized and rounded to the nearest 10 basis point.

11. Continued

(b)

(i) Determine the prescribed range for short term and long term Canadian risk free rates for the ultimate forecast period at 12/31/2009 and 12/31/2010.

- Prescribed range for short term Canadian risk free rates calculated as:
  - Lower bound = min {3%; 90% x 1/2 x (60-month moving average of historic 91-day Canadian risk-free interest rate + 120-month moving average of historic 91-day Canadian risk-free interest rate)}
  - Upper bound = max {10%; 110% x 1/2 x (60-month moving average of 91-day Canadian risk-free interest rate + 120-month moving average of 91-day Canadian risk-free interest rate)}

- 60-month moving average of historic 91-day Canadian risk-free interest rate:
  - At 12/31/2009: 4.4%
  - At 12/31/2010: 1.5%
  - At 12/31/2010: 1.5%
- 120-month moving average of historic 91-day Canadian risk-free interest rate:
  - At 12/31/2009: 4.8%
  - At 12/31/2010: 2.1%
  - At 12/31/2010: 2.1%

- Bounds at 12/31/2009 =
  - Lower bound = min { 3%; 90% x 1/2 x (4.4% + 4.8%) } = min (3%;4.14%} = 3%
  - Upper bound = max { 10%; 110% x 1/2 x (4.4% + 4.8%) } = max (10%;5.06%} = 10%
  - Range = [3%, 10%]

- Bounds at 12/31/2010 =
  - Lower bound = min { 3%; 90% x 1/2 x (1.5% + 2.1%) } = min (3%;1.62%} = 1.62% => rounded to 1.60%
  - Upper bound = max { 10%; 110% x 1/2 x (1.5% + 2.1%) } = max (10%;1.98%} = 10%
  - width of the band is > 7% => Need to adjust the upper bound to 8.60%
  - Range = [1.60%; 8.60%]

11. Continued

- Prescribed range for long term Canadian risk free rates calculated as:
  - Lower bound = min { 5%; 90% x 1/2 x (60-month moving average of historic long-term Canadian risk-free interest rate + 120-month moving average of historic long-term Canadian risk-free interest rate) }
  - Upper bound = min { 12%; 110% x 1/2 x (60-month moving average of historic long-term Canadian risk-free interest rate + 120-month moving average of historic long-term Canadian risk-free interest rate) }
  - long-term => Term-to-maturity > 10 years

- 60-month moving average of historic long-term Canadian risk-free interest rate:
  - At 12/31/2009: 5.7%
  - At 12/31/2010: 7.9%

- 120-month moving average of historic long-term Canadian risk-free interest rate:
  - At 12/31/2009: 3.7%
  - At 12/31/2010: 5.3%

- Bounds at 12/31/2009 =
  - Lower bound = min { 5%; 90% x 1/2 x (5.7% + 7.9%) } = min (5%;6.12%} = 5%
  - Upper bound = max { 12%; 110% x 1/2 x (5.7% + 7.9%) } = max (12%;7.48%} = 12%
  - Range = [5%; 12%]

- Bounds at 12/31/2010 =
  - Lower bound = min { 5%; 90% x 1/2 x (3.7% + 5.3%) } = min (5%;4.05%} = 4.05% => rounded to 4.10%
  - Upper bound = max { 12%; 110% x 1/2 x (1.5% + 2.1%) } = max (12%;4.95%} = 12%
  - Width of the band is > 7% => Need to adjust the upper bound to 11.10%
  - Range = [4.10%; 11.10%]

- Short term range goes from [3%, 10%] to [1.60%, 8.60%]
- Long term range goes from [5%; 12%] to [4.10%; 11.10%]

11. Continued

(ii) Explain the implications for the prescribed interest rate scenarios when the prescribed ranges from 12/31/2009 are replaced with the prescribed ranges from 12/31/2010.

- The prescribed scenarios apply to debt instruments acquired or sold after the balance sheet date.
- For a prescribed scenario if the net cashflow for a period is positive then repay the outstanding balance of borrowing and the excess is reinvested in debt or non-debt instruments at lower returns.
- For a prescribed scenario if the net cashflow for a period is negative then assets with higher returns are disinvested and/or cash is borrowed at lower borrowing cost.
- Default premium may increase.
- Net impact result is lower future investment returns.
- Higher amount of supporting assets is required at the balance sheet date.
- Reserves would increase.

(c) Compare the approach used to determine the discount rate under IFRS (*July 2010 Insurance Contracts Exposure Draft*) and CALM.

<u>Similarities</u>

- Time value of money
  - Both IFRS and CALM reflect/require the time value of money.

- Currency of the instruments used
  - Scenario for a foreign country's interest rates would be formulated independently of that for Canadian interest rates unless their positive historical correlation is expected to continue.

- Inflation
  - Both IFRS and CALM include the effect of inflation.

<u>Differences</u>

- Current market rates
  - IFRS: the guidance is not specific to what current market interest rate would be.
  - CALM: prescribed scenarios provide guidance on interest rates for sales and purchase of investments.
    - The prescribed ranges are based on moving average of historic risk-free rates. A base scenario.
    - Nine prescribed scenarios in a deterministic application.

11. Continued

  - Ranges which comprehend each of the prescribed scenarios in a stochastic application.
  - Other scenarios appropriate for the circumstances of the insurer.

- Liquidity Adjustment
  - IFRS: liquidity is explicitly adjusted for.
  - CALM: liquidity is not explicitly included in the interest rate scenario.

- Default risks
  - IFRS: Exclude any factors that influence the observed rates but are not relevant to the insurance contract liability.
  - CALM: Premium is required for each asset subject to default.

- Investment strategy
  - IFRS: No explicit reflection of the insurer's current investment strategy in the discount rates.
  - CALM: Includes the impact of the insurer's current investment strategy in interest rate assumptions.

12. Learning Objectives:

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

Learning Outcomes:

(5a) Describe the MCCSR/RBC regulatory framework and the principles underlying the determination of Regulatory RBC.

(5b) Compute MCCSR for a life insurance company, including:
- (i) Identification of significant risk components
- (ii) Identification of specialized product MCCSR requirements
- (iii) Interpreting results from a regulatory perspective

(5c) Explain and apply the concepts, approaches and method for determining Economic Capital

Sources:

Economic Capital for Life Insurance Companies, SOA Research Paper, Feb 2008, Chapters 1, 3, 4, 5, and 6

ILA-C606-11: OSFI: Guideline Minimum Continuing Capital and Surplus Requirements for Life Insurance Companies 1-5, 8 (Dec 2009)

ILA-C628-10: OSFI: Framework for New Standard Approach to Solvency, November 2008

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

Commentary on Question:

This question tested if candidates could calculate component of MCCSR, could compare EC versus MCCSR and could assess which one would be higher. Need to be able to calculate, compare and assess.
In general, candidate did very well in the part (a) which is the calculation part and relatively well in part (b).

Solution:

(a) Calculate the Minimum Continuing Capital and Surplus Requirement (MCCSR) mortality risk component for this block of policies.

Mortality component = volatility + catastrophe

Volatility = 2.5 * A * B * E / F
Where A = standard deviation of next year's expected death claims = 425,000
B = max (ln (D), 1) for renewable term product NOT adjustable
= max (ln(13.45),1) = 2.60

12. Continued

E = total net amount at risk = 200,000,000
F = total net face amount = 225,000,000
Volatility = 2.5 * 425,000 * 2.6 * 200,000,000 / 225,000,000 = 2,454,290

Catastrophe = a * C * E / F
Where a = 0.1 because renewable term is NOT adjustable

C = nest year's expected death claims
Catastrophe = 0.1 * 10,000,000 * 200,000,000 / 225,000,000 = 888,889

Mortality Component = 2,454,590 + 888,889 = 3,343,480

(b)

(i) Compare methodologies and models for economic capital and MCCSR.

MCCSR uses a factor based approach for each risk component
Total capital required is the sum of the component
Does not account for diversification
Purpose is to ensure solvency of the company
Minimum target ratio is established at 150%
Considers catastrophic and volatility risk
MSSCR is formula based
Time horizon considered is the full term of the liability

EC is company specific
Purpose is to measure economic risk of a company
Takes diversification into consideration
EC model considers: catastrophic risk, volatility risk, miss-estimation risk and trend risk
EC uses stochastic modeling
EC is 1 year mark to market approach
EC capital needs to cover VAR 99.5 event

(ii) Assess whether the mortality risk component under the economic capital framework will be higher or lower than that of the MCCSR mortality component.

EC would produce lower capital requirement than MCCSR because EC may recognize correlation benefits with other lines of business, EC takes diversification into consideration and EC is tailored to company's risk profile while MCCSR is formula based.

13. Learning Objectives:

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

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

Learning Outcomes:

(1e) Describe international accounting standards

(4b) Perform basic financial analysis by product line and total company

(4g) Explain and apply the methods and principles of embedded value

Sources:

IFRS and the Canadian Actuary, PD-6, September 2009

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

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

Commentary on Question:

Solution:

(a) Determine the most likely financial measurement basis used for each of the three graphs.

Graph A could represent IFRS with residual margin >= 0
Graph B could represent either IFRS with residual margin >= 0 or CGAAP
Graph C represents Embedded Value

(b) Explain the aspects of the financial measurement bases that lead to the earnings patterns shown in each graph.

Graph A
IFRS

(i) The initial value of contracts should either be zero (for profitable at time 0 contract) or be recognized as an expense (for unprofitable at time 0 contract).
(ii) The graph in this case illustrates the present value fulfillment cash flows is less than zero and a residual margin is added to eliminate any gain at inception. The initial recognition is zero.
(iii) Profit will emerge overtime: an insurer shall recognize the residual margin determined at initial recognition as income in profit.

13. Continued

Graph B
IFRS

(i) The initial value of contracts should either be zero (for profitable at time 0 contract) or be recognized as an expense (for unprofitable at time 0 contract).
(ii) The graph in this case represents the present value of fulfillment cash flows is greater than zero, that amount will be recognized as an expense immediately.
(iii) Profit will emerge over time.

CGAAP

(i) Income at time of issue is the different between the premiums received, the sum of liability established at the point of sales and expenses incurred and allocated.
(ii) Liability established could be positive or negative.
(iii) At time 0, there could be a gain or loss (strain). In this case, the graph showed new business strain for this contract.
(iv) No experience gains and losses after issue as given in the question.
(v) Earning emerges as expected profits realized from the release of Provision for Adverse Deviations.

Graph C

(i) At issue, present value of all profits is realized in income.
(ii) In subsequent periods, profits are all zero at total gain that was released at issue (as long as actual = expected assumptions).

14. Learning Objectives:

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

Learning Outcomes:

(2a)

(i) Describe valuation methods

(ii) Recommend appropriate valuation assumptions.

Sources:

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

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

Commentary on Question:

The question tests the candidate's knowledge of determining appropriate valuation mortality assumptions from a Canadian life insurance company prospective.
The question asked the candidate to recall some information, to use their knowledge to assess a particular situation, and to show their understanding by solving for some requested information.

Solution:

(a) List considerations in determining the mortality Margins for Adverse Deviation (MfAD) for this product.

Commentary on Question:

This part was well answered as candidates were able to name a number of considerations that apply.

- Low credibility of the company's experience
- Recent changes in underwriting standards or methods of classification
- Anti-selection is present
- New type of benefit or new way to distribute the product
- Unfavorable medical developments have emerged
- The persistency rate of the product is low
- Cohort of risk lacks homogeneity

(b) Compare the following credibility methods:

(i) Limited Fluctuation Credibility Theory Normalized Method

(ii) Greatest Accuracy Credibility Theory

14. Continued

Commentary on Question:
This part was not well answered in general. To get maximum points, candidates had to provide commentary about the method, rather than the formulas to calculate the credibility.

Limited Fluctuation Credibility Theory - Normalized Method

- Can determine full credibility based on the size of the portfolio
- Provides a methodology to determine partial credibility by weighting the portfolio's own experience and the industry experience
- Blended A/E ratios are adjusted to reproduce the expected claims level generated by the total company blended A/E ratio
- Uses all of the information available, both total company and sub-category A/E ratios and credibility factors
- Simple to apply

Greatest Accuracy Credibility Theory (GACT)

- Better theoretical basis than normalized method
- Current industry data is not sufficiently detailed to support the use of GACT

(c) Assess whether the recommended MfAD is appropriate.

Commentary on Question:
To get maximum points, candidates had to recognize that the MfAD is too low, and support their assessment using the information provided and the impact on mortality. A recommendation on a new level of MfAD was not required. Candidates did well in general on this part. Most recognized that the MfAD was not appropriate, but the level of justification varied.

The low and high mortality MFAD are 3.75 and 15 divided by the best estimate curtate expectation of life.

The MFAD should be at least the average of the low and high margins if there is at least one significant consideration present.

The splitting of the non-smoker class into preferred and non-preferred was made recently, so the experience is not credible.

Only the healthy lives will convert from the old policies to the new preferred class, which introduces anti-selection.

The recent change in the underwriting criteria is untested and its impact to mortality experience is still to be determined.

14. Continued

An expectation of future mortality improvement beyond the valuation date does not justify the use of a lower margin for adverse deviations.

The recommended margin of 3.75 is not appropriate since it is at the low end of the range. It should be at least the average of 3.75 and 15 due to the presence of significant considerations.

(d) Calculate Actual to Expected ratios and expected number of claims for Medical and Non-Medical using Limited Fluctuation Credibility Theory Normalized Method.

Commentary on Question:
Candidates did well in general on this part. Most candidates knew how to calculate the credibility and the blended ratio. A number of candidates missed the claims at 100% of industry.

Expected number of claims @ 100% industry data = Company number of claims/Company mortality ratio

Medical: 79.2 / 55.4% = 143.0
Non-medical: 59.2 / 89.3% = 66.3
Total: 143.0 + 66.3 = 209.3

Credibility factor for p=90% and r=3%: Z = Min(srqt(number of claims/3007),1)

Z(total) = Min(sqrt(138.4/3007),1) = .21
Z(Medical) = Min(sqrt(79.2/3007),1) = .16
Z(Non-Medical) = Min(sqrt(59.2/3007),1) = .14

Blended expected mortality ratio = Z * Company mortality ratio + (1-Z) * Industry mortality ratio

Total: .21 * 70.0% + (1-.21) * 75.25% = 74.1%
Medical: .16 * 55.40% + (1-.16) * 70.10% = 67.7%
Non-medical: .14 * 89.3% + (1-.14) * 84.7% = 85.3%

Corresponding expected claims = Blended expected mortality ratio * Expected number of claims (total) @ 100% industry data

Total: 74.1% * 209.3 = 155.1

14. Continued

Expected claims of sub-categories:
Medical: 67.7% * 143.0 = 96.8
Non-medical: 85.3% * 66.3 = 56.6
Total: 96.8 + 56.6 = 153.4

Normalized the A/E ratios by multiplying them by ratio of the total expected claims from total company credibility factor and mortality ratio to total expected claims from credibility factors and mortality ratios from subcategories

Normalized blended expected mortality ratio:
Medical: 67.7% * 155.1/153.4 = 68.4%
Non-Medical: 85.3% * 155.1/153.4 = 86.2%

Expected number of claims:
Medical: 68.4% * 143.0 = 97.8
Non-Medical: 86.2% * 66.3 = 57.2

15. Learning Objectives:

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

Learning Outcomes:

(4h) Describe and apply the principles of how insurance companies create value from a financial economics perspective.

Sources:

ILA-C110-07: The Economics of Insurance: How Insurers Create Value for Shareholders

Commentary on Question:

The intent of this question was to test the candidate's understanding of the mechanics of calculating Economic Profit.

In general, candidates did not do well on this question. To do well, candidates needed to understand the logical steps that lead to the determination of Economic Profit.

Solution:

Calculate economic profit at time zero.

Economic Profit = Premiums (P_t) + Investment Income(II_t) – Claims(C_t) – Expenses (Exp_t)– Change in Economic Liabilities (EL) – Risk Capital Costs – Taxes

where Change in Economic Liabilities = $EL_t - EL_{t-1}$

EL_t = PV(Future Net cashflows after allowing for frictional Costs and Taxes)

So we need to calculate taxes and future cashflows at each time point given

Taxes = Taxable Income times Tax Rate

Taxable $Income_t = P_t + II_t - C_t - Exp_t$ – Change in Tax Reserves

Taxable Income (t=0) = 100 + 0 - 10 - 0 - (100 -0) = -10
Taxable Income (t=1) = 120 + (100+30)*.035 - 50 - 2 - (70 -100) = 102.55
Taxable Income (t=2) = 130 + (70+25)*.035 - 110 - 2 - (50 - 70) = 41.33
Taxable Income (t=3) = 0 + (50+10)*.035 - 160 - 2 - (0 - 50) = -109.90

15. Continued

Net cashflow after frictional costs & tax = $P_t - C_t - Exp_t$ – Risk Charges(at start of period) – $Taxes_t$

Net Cashflow after frictional Costs (t=0) = 100 – 0 -10 – 0 – (-10)*.3 = 93.00
Net Cashflow after frictional Costs (t=1) = 120 – 50 -2 – .30 – (102.55)*.3 = 36.94
Net Cashflow after frictional Costs (t=3) = 130 – 110 – 2 – .25 – (41.33)*.3 = 5.35
Net Cashflow after frictional Costs (t=4) = 0 – 160 – 2 – 0.10 – (109.90)*.3 = -129.13

EL(t =0) = -36.94*(1.035)^(-1)+(-5.35)*(1.035)^(-2)+(129.13)*(1.035)^(-3) = 75.79
EL(t =1) = (-5.35)*(1.035)^(-1)+(129.13)*(1.035)^(-2) = 115.37

Economic Profit at Issue = 100 + 0 -10 – 0 – (75.79 – 0) – 0 – (-10)*.3 = 17.21

16. Learning Objectives:

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

Learning Outcomes:

(1e) Describe international accounting standards

Sources:

CIA Educational Note: Classification of Contracts under IFRS

Commentary on Question:

Question 16 tested the candidate's understanding of classifying contracts/products under IFRS.

The cognitive level required for part (a) is retrieval since the information comes directly from the source material. Overall, the candidates did a fair job of answering part (a). Although the cognitive level was not high, it seemed that the candidate did not spend a lot of time answering part (a) since it had lower exam points from part (b).

The cognitive level required for part (b) is analysis since candidate must take a retrieval concept and apply it to a specific scenario. Overall, the candidates did a poor job of answering part (b). The question required the candidates to have knowledge of the product features of the various products and classify the product under the IFRS process. It seemed that the candidates either had difficulty in applying the knowledge and/or lacked the knowledge of the features of the products.

Solution:

(a) Summarize the process for classifying contracts under International Financial Reporting Standards (IFRS).

1. Obtain relevant information regarding the reporting entity's products and services, their associated characteristics
2. Definition of a contract for accounting purposes — Consider whether to separate or combine contracts for accounting purposes
3. Classification of stand-alone service contracts — Consider whether the contract creates financial assets or liabilities for the reporting entity in which case it may be a financial instrument, rather than solely requiring the entity to provide services for a fee
4. Classification as an insurance contract — Determine if the contract contains significant insurance risk
5. Classification as an investment contract — If it is not insurance, determine if the contract is a financial instrument (e.g., it creates financial, equity instruments, or financial assets)
6. DPFs — If the contract is an investment contract, determine if the contract contains discretionary participation features (DPF)

16. Continued

7. Service component — If IAS 39 is applicable, determine if the contract contains a service component
8. Embedded derivatives — For insurance contracts, investment contracts, and service contracts, determine if the contract contains an embedded derivative
9. Unbundling of a contract into components — For insurance contracts, determine if unbundling of a deposit component is required or permitted by the accounting guidance

(b) A life insurance company has the following products:

- Universal life insurance
- Payout Annuity
- Deferred Annuity
- Segregated Funds

Explain how each of the above products is classified under IFRS, including the product features that contribute to this classification.

Universal life insurance

- Contracts contain significant insurance (mortality) risk, therefore are classified as Insurance under IFRS 4.
- Minimum guaranteed credited interest rate: embedded derivative that is closely related to the host contract, and therefore exempt from separate fair value measurement.
- UL contract with a fixed death benefit may be unbundled.
- The deposit component of the contract, the account value, could be measured without regard to the insurance component, while the insurance component, which depends on the amount of account value, could not be measured without regard to the deposit component.

Payout Annuity

- Life contingent annuities in payout mode, with or without a term certain guaranteed period, meet the IFRS definition of Insurance.
- Annuities issued as term certain at contract inception does not meet definition of insurance contract.
- Term certain annuities from contract inception are classified as investment contracts and fall under IAS 39.
- At the date of conversion to IFRS, annuities that are for a term certain, but that were initially issued as life contingent annuities (i.e. where the annuitant died before the end of the guaranteed period), must be classified as Insurance contract.

16. Continued

Deferred Annuity

- Meet the definition of insurance contracts and falls under IFRS 4.
- The presence of mortality and interest guarantees is sufficient for the product to be classified as insurance.
- Contracts with an option to annuitize at a later date at contractually guaranteed rates transfer insurance risk at issue, and therefore meet the definition of insurance.

Segregated Funds

- Segregated funds without guarantees (e.g. GMDB, GMIB) are generally classified as investment contracts.
- Segregated funds without guarantees might contain a service component which must be unbundled and accounted for under IAS 18.
- Segregated funds with guarantees are generally classified as insurance contracts under IFRS 4.
- The guaranteed minimum return features of segregated fund contracts are embedded derivatives.

17. Learning Objectives:

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

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

Learning Outcomes:

(1d) Explain fair value accounting principles

(1e) Describe international accounting standards

(2a)

(i) Describe Valuation Methods
(ii) Recommend appropriate valuation assumptions

Sources:

ILA-C100-07: Financial Reporting Developments Accounting for Derivative Instruments and Hedging Activities: A Comprehensive Analysis of FAS 133

IFRS and the Canadian Actuary, PD-6, September 2009

"An Approach for Measurement of the Fair Value of Insurance Contracts," Actuarial Practice Forum, May 2007

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) LNZ purchased derivatives in 2010 to hedge the risk of falling equity markets.

(i) Identify the criteria to have these derivatives qualify as hedges and outline the resulting accounting treatment under SFAS 133.

Commentary on Question:

This first part of section (a) is better answered as a list as it asks for the criteria to have the derivatives qualify as hedges. It does not ask for a description of the various types of hedges.

Here is a list of requirements that need to be met for these derivatives to qualify as hedges:

- Formal documentation (including strategy and objective)
- Identify hedging instrument
- Identify item hedge

17. Continued

- How effectiveness will be measured
  - Expected to be highly effective

Also the hedged item is not related to the following:

- An investment accounted for by the equity method
- Minority interest in consolidated subsidiaries
- Equity investment in a consolidated subsidiary
- A future business combination

(ii) Distinguish the main differences in reporting for both guaranteed benefits and hedging derivatives under IAS 39 and SFAS 133.

Commentary on Question:
To answer this question, there needs to be an emphasis on both guaranteed benefits and hedging derivatives. Describing SFAS 133 and SFAS 157 without reference to those elements would not be answering the question.

1. Derivatives: The derivative would always be reported a Fair Value

2. Guaranteed Benefits:

   First you need to determine if they are Fair Value Hedges or Cash Flow Hedges.

   GMAB would be considered a Fair Value hedge.

   If the derivative does not qualify as hedging instrument, the change in Fair Value goes to income. In the other hand, if it qualifies, the gain/loss in the hedging instrument and offsetting loss/gain on hedged item are reported in the same period.

   An annuity with GMAB would be bifurcated.

   In opposition to GMAB, GMDB includes an element of insurance, so they are exempt from separate fair value measurement.

(b) Assess the impact on reserves.

Commentary on Question:
The question is about assessing the impact on reserves. The answer should focus on the impact on reserves, even if the change in credit rating will have other impacts for the company.

The change in LNZ credit rating will need to be reflected in the reserve.

17. Continued

This change in credit rating will cause the company credit spread to be reduced. The reduced credit spread, means that the reserve is calculated using a lower interest rate. This would increase the reserve.

Also, the change in rating could have an impact on the lapses. As policyholders have more confidence in the company, we might see a decrease in lapses. However, as the credit change impacted the whole industry, this might not have a significant impact.