CSP-IC Model Solutions
Spring 2012

1. **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:

(5b) Explain and distinguish the roles of capital from the perspective of capital, from the perspective of regulators, investors, policyholders and insurance company management.

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

Sources:

Multi-Stakeholder Approach to Capital Adequacy (exc. Appendix)

Commentary on Question:

This question tested the candidates' understanding of the differing perspectives and needs of various stakeholders in determining capital adequacy and of a technique that integrates those perspectives.

Solution:

(a) Explain why the FRRRT approach might be useful to ABC for assessing capital adequacy.

Commentary on Question:

Areas where candidates performed well:
- Stating that a multi-stakeholder approach is required
- Recognizing regulators and rating agencies have different objectives
- Stating the 3 dimensions: financial variables, risk threshold, time horizon
- Importance of thresholds and recognizing the consequences of a rating downgrade

1. Continued

Common errors/omissions:
- Not identifying and discussing stakeholders other than regulators and rating agencies
- Not stating FRRRT requires measurement across the 3 dimensions and is a tool to rank priorities

Why the FRRRT approach might be useful to ABC for assessing capital adequacy:
- Capital adequacy management requires balancing sometimes conflicting requirements and objectives
- Economic and regulatory capital metrics typically reflect the risk tolerances, horizons, and preferences of specific, but not all, stakeholders
- With respect to capital, stakeholders are concerned with different financial variables, time horizons, and risk tolerances
- FRRRT evaluates capital adequacy across these 3 dimensions and is a tool to rank priorities
- With respect to time horizon, risks interact differently over time. Risks correlate and diversify differently over various time horizons. Capital adequacy as function of time may change
- Capital adequacy process must align needs of primary stakeholders of ABC
- ABC is experiencing rapid growth, and capital needs will change over time

(b) Identify and explain the steps for implementing the FRRRT.

Commentary on Question:
Areas where candidates performed well:
- Recommending dynamic/stochastic model
- Stating that distribution of results by financial variable, risk threshold, and time horizon is required

Common omissions:
- Not listing all 4 steps
- Not stating that process is iterative
- Not stating that results are presented in matrix form by financial variable, risk threshold, and time horizon
- Not stating need to map estimated point of downgrade point to CAR threshold

Step 1
- ABC needs a dynamic (stochastic) model to project the distribution of financial variables over 5 years.

1. Continued

- Calculate a distribution of results for each financial variable, risk threshold, and time horizon combination.
- ABC will evaluate RBC and CAR over each of the 5 future years, resulting in 10 separate estimates of capital
- ABC needs to map the estimated point of a downgrade to a CAR threshold.

Step 2
- Use model to calculate the probability of each of the financial variables falling below the risk threshold quantity in each year

Step 3
- Determine the probability of the company's S&P rating transitioning from the current rating to a rating at or below the mapped threshold, using external financial rating transition matrices to develop the probabilities

Step 4
- Iteratively adjust current capital to the point where the probability of falling below the risk threshold (step 2) in the projections equals the probability of the rate transitioning to a worse level in the transition matrices (from step 3).
- Repeat for all financial variable, risk threshold, and time horizon combinations
- A matrix of capital sufficiency/deficiency by time period and financial variables summarizes the results.

2. **Learning Objectives:**

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

Learning Outcomes:

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

Sources:

ILA-C114-07: Life Insurance Forecasting & Liability Models (exclude appendix)

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Define the following with respect to forecast model validation:
- (i) Known Error Measurement
- (ii) Unknown Error Measurement

Commentary on Question:

This section was well answered by most candidates.

(i) Known error just means deviation between model and a known quantity

(ii) Unknown error arises from model simplification

(b) Define static and dynamic validation of models, and list their advantages and disadvantages.

Commentary on Question:

This section was well answered by most candidates.

Static validation compares known and modeled values as of the date from which the model projects, e.g. compare annualized gross premiums, face amount and reserve. It is analogous to a balance sheet validation.

Advantages of static validation are that if results compare favorably, the model can be trusted and if results do not compare favorably, we can be certain that there is a problem with the model.

Disadvantages of static validation is that a ratio of 1 does not guarantee a perfect model, the validation ratio only looks at one point in time and only one variable, it fails to capture the effect of interaction among variables.

2.   Continued

There are two types of **Dynamic validation.** Prospective compares trend in actual historical with model's projected results and retrospective starts with current portfolio and runs model backward through time. It is analogous to an income statement validation.

Advantages of dynamic validation are that it is more robust than static and looks at many assumptions at once and their interaction.

Disadvantages of dynamic validation are that it is not always possible and reliable, historical data is not always available.

(c)   Analyze the results and recommend a model simplification. Justify your recommendation.

Commentary on Question:
In general, the candidates did not give enough details on their calculation steps and did not specify well why they rejected each model; they only focused on the one that they suggested. Most of the candidates did not average the two components to derive the known and unknown errors.

Error = (Base Value − Model Value) / Base Value
Must use absolute value
Take average of premium and stat reserve for average unknown error
Take average of PV profits and value-based reserve for average unknown error

ERRORS	Annual Premium	Current Statutory Reserve	Average Known Error	Present Value of Future Profits	Value-Based Reserve	Average Unknown Error	Annual Savings ($)
Base	-	-		-	-		-
Scenario 1	2.0%	2.4%	2.2%	2.2%	1.9%	2.1%	0.80
Scenario 2	1.0%	2.0%	1.5%	1.7%	1.9%	1.8%	1.60
Scenario 3	9.0%	7.0%	8.0%	10.0%	7.1%	8.5%	1.80
Scenario 4	0.4%	1.0%	0.7%	15.0%	11.9%	13.5%	3.20
Scenario 5	0.0%	2.5%	1.3%	1.7%	2.4%	2.0%	2.88
Scenario 6	0.0%	3.0%	1.5%	3.3%	4.3%	3.8%	3.39

2.   Continued

Model 1
Fairly accurate, introducing only a 2% error rate
Cost savings are only 10%, therefore giving up a fair amount of accuracy for only 10%

Model 2
Substantial savings (20%) for less than 2% error rate
Shows that a large number of age bands doesn't necessarily lead to a better model

Model 3
Very large error
Follow the more common pattern that the fewer the age bands the more the error

Model 4
Data count dramatically reduced leads to large savings
But not worth the savings when results would lack credibility

Model 5
Known error is now 0
Give away very little on unknown error
1.28M in additional savings

Model 6
Only 0.5M in additional annual savings
Error rates are doubled

Recommend model 5
Highest savings
Low error rates

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.

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

Sources:
Life and Health Reinsurance, Chapter 5 and 6

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

ERM Specialty Guide, Chapters 1-6

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   For each method:

  (i)   Explain the allocation of risk between reinsurer and ceding company if the net amount of risk decreases.

          Commentary on Question:
          This part (a) tests the understanding of the calculation of the reinsurance retention on a YRT reinsurance basis using the three methods of Pro Rata, Level/Constant Retention and Constant Risk Reinsured.

          1. For Pro Rata the net amount at risk (NAR) is a constant proportion between the ceding company and the reinsurer. As the NAR decreases both the ceding company and the reinsurer share in the decrease in the same constant proportion.
          2. For Level/Constant Retention all of the NAR decrease is allocated to the reinsurer

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3. **Continued**

        3. For Constant Risk Reinsured the ceding company absorbs the decrease in the NAR.

    (ii)   Calculate the amount retained by the ceding company at time 5. Show all work.

        1. Pro Rata
          NAR(5) = Face − Reserve(5) = 100,000 − 25,000 = 75,000
          Constant Percent Reinsured = 80,000/100,000 = 80%
          Retained amount at time $5 = 100,000 − .8 \times 75,000 = 40,000$
        2. Level/Constant Retention
          Retained amount at time 5 = Retained amount at time 0
          = 100,000 − 80,000 = 20,000
        3. Constant Risk Reinsured
          Retained amount at time 5 = Face − Reinsured Amount at time 5
          = 100,000 – 75,000 = 25,000

(b)   Comment on the appropriateness of each statement from Random Life's perspective and recommend changes needed before is finalized.

    Commentary on Question:
    This part (b) tests the understanding of what provisions are appropriate to be in a reinsurance treaty.

    (i)   Neither party may unilaterally terminate the existing reinsurance agreement. Either party may terminate the treaty with respect to new business upon proper notification.

        This provision is appropriate but a termination option should be added in the event of failure of the ceding company to pay premiums or the reinsurer to pay claims.

    (ii)   Active lives are recaptured, disabled lives are not recaptured.

        This provision is not appropriate as all risks should be recaptured.

    (iii)   Once the recapture process has begun, the ceding company may not stop it.

        No change is needed as this provision is appropriate.

    (iv)   If the reinsurer raises rates, Random Life has the right to recapture and seek reinsurance with another company.

        No change is needed as this provision is appropriate

3. **Continued**

        (v)   Recapture is required if Random Life becomes insolvent.

               This provision is not appropriate as it is discouraged by regulators.

(c)   Explain the results of the model.

Commentary on Question:
This part (c) tests the understanding of how reinsurance impacts the costs flowing between the ceding company and the reinsurer.

If claims are below the 90th percentile of the claim distribution, premiums paid to the reinsurer are greater than the claims received by the ceding company, which has a negative impact on the ceding company's asset balance.

If claims are above the 90th percentile of the claim distribution, premiums paid to the reinsurer are less than the claims received by the ceding company, which has a positive impact on the ceding company's asset balance.

(d)   Explain how the use of reinsurance is reflected in each of the following four themes of the ERM process as discussed in the ERM Specialty Guide:
    (i)   Risk Control
    (ii)   Strategic Risk Management
    (iii)   Catastrophic Risk Management
    (iv)   Risk Management Culture.

Commentary on Question:
This part (d) tests the understanding of how reinsurance impacts the Risk Management process.

    (i)   Primary objective of Risk Control is to maintain the risks that have been retained by the enterprise at levels that are consistent with the company risk appetite. Risk is transferred through the reinsurance process.
    (ii)   Strategic Risk Management is the process of reflecting risk and risk capital in the strategic choices that a company makes. Potential reinsurance programs can be evaluated against other strategic options in economic capital, in risk adjusted pricing and in capital budgeting.
    (iii)   Catastrophic Risk Management is the process of envisioning and preparing for extreme events that could threaten the viability of the enterprise. Through trend analysis and stress testing, the impact of events on the company is identified with and without reinsurance. Reinsurance is used to transfer the catastrophic risk.
    (iv)   Risk Management Culture is the general approach of the company to dealing with its risks. A positive Risk Management Culture incorporates ERM thinking into all decision making. Reinsurance is reflected in risk assessment as potential reinsurance is considered.

4. **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.

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

Sources:

ILA-C121-08: Economic Capital Modeling: Practical Considerations

A Multi-Stakeholder Approach to Capital Adequacy

Economic Capital for Life Insurance Companies.

Commentary on Question:

The goal of the question is for the candidates to demonstrate that they understand the role of capital and the considerations of building an Economic Capital model. For part (a), the candidate is required to demonstrate knowledge of the role of RBC. In part (b), the candidate should consider whether each statement is valid and also whether alternatives exist to the given suggestions; the candidate should explain why the company may want to consider other alternatives.

The candidates did relatively well on this question, but could have provided more details, more justification

Solution:

(a)   Evaluate each of the statements:

    (i)   "The purpose of RBC is to provide a "cushion" that will enable a company to survive over the short term"

        Generally a correct statement
        Purpose of RBC is a tool for regulators to identify weakly capitalized companies
        RBC focus on risk that were an immediate threat to solvency
        Factors are based on providing enough capital to absorb PV of greatest loss over the limited projection horizon for given risk

4. **Continued**

      (ii)   "RBC should not be used as the sole basis for determining Magnificent's target surplus"

            Generally a correct statement
            RBC is a minimum capital threshold
            It is not company specific
            Many companies set target surplus as multiples of RBC
            RBC calculations are not intended to be precise; it is only a screening mechanism
            Target surplus should be designed to meet needs of multiple stakeholders – regulators, policyholders, investors, agencies

      (iii)   "Even if Magnificent's RBC ratio falls to 140%, Magnificent is in good shape financially"

            Incorrect
            RBC between 100% and 150% falls into the Regulatory Action Level
            Triggers the commissioner to issue an order specifying corrective actions to be taken

(b)   Evaluate each of the statements:

      (i)   "We should use Value at Risk (VaR) to measure our risk because it is adequate from our shareholders' perspective"

            The company should also consider Tail VaR or CTE, they are better at measuring low frequency high severity events, because it takes into account the shape of the tail of the distribution
            From shareholder point of view VAR is adequate because once the net worth has been exhausted, they have lost the value of their shares and are not interested in the severity of further loss, but from the regulator point of view, the severity of losses is significant, because it will determine the losses to policyholders
            VaR is however simple to use and understand and is widely known in the banking industry and in Solvency II in Europe

4. Continued

(ii) "Since life insurance liabilities have long-term risk exposure, it is best to use a multi-year liability runoff approach"

The company should also consider using a one year time horizon, it can help the company avoid complex and time consuming stochastic modeling, most regulators appear to be in favor of the one year time horizon, it is easier to explain, easier to include new business and it takes into account management actions (such as raising capital and hedging of risks). Runoff approach can give deeper understanding to long term liabilities, but may ignore management actions to some extent.

(iii) "The Economic Capital model will consider all of our risks and allow us to always have much lower capital requirements due to the diversification effect."

It is not always true that the capital requirements will be lower since some risks may not be independent. Risk correlations can behave differently in extreme scenarios. The company may want to use copulas to model dependency between risks. Rating agencies have been skeptical about giving full credit for diversification.

5.

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 including explaining and applying the methods and principles of embedded value.

Sources:

Embedded Value: Practice & Theory, SOA, Actuarial Practice Forum, 2009

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)   Identify the similarities and differences between AAV and EV.

Commentary on Question:

Generally this section was reasonably well answered - those that fared poorly simply did not list enough points

Similarities
- Both discount future cash flows
- Both consider the in-force business and required capital

Differences
- AAV considers new business, EV does not
- AAV expense assumptions are more market-oriented, EV's are more Company specific

(b)

    (i)   Identify each of the following statements as a characteristic of the explicit or implicit recognition of debt:

    Commentary on Question:
The average for this section was approximately that of a random selection of the two elements.

5. **Continued**

1. Can be expanded to include other sources of capital

   Implicit (either accepted)

2. Risk discount rate is the weighted average cost of capital

   Implicit

3. Spread over the after-tax rate of return on invested assets is used

   Explicit

(ii) List the conditions that need to be satisfied for the results of the two methods to be identical.

Commentary on Question:
Candidates that did poorly simply did not provide the proper criteria.

Conditions for explicit to equal implicit
- Fair values for equity and debt are used in the weighted average cost of capital
- Debt stays at a constant percentage of the present value of distributable earnings throughout the projection period

(iii) Recommend a method for recognition of debt if only the book values of debt and equity are available and the value of debt is expected to fluctuate. Justify your recommendation.

Commentary on Question:
A number of candidates who did poorly listed points without making a recommendation or, similarly, made a recommendation without listing any justification.

Explicit recommendation of debt is recommended
- Due to the fluctuation in the value of debt
- Because implicit recognition requires the fair values of debt and equity

5. **Continued**

(c)   Calculate the target IBV for 2011. Show all work.

Commentary on Question:
This was generally well answered. Those who did poorly typically only wrote down one or two parts of the solution. A number of candidates skipped this section.

Target IBV(t) = NB EIBV(t) + IFB EIBV(t)
NB EIBV(t) = VNB(t) × (1+RDR)^.5 − BP(t)
               = 10,000 × (1.05^.5) − 2000
               = 8,247
IFB EIBV(t) = [IBV(t−1) × (1+RDR)−BP(t)] + [(RDR−i(t)) × RC(t−1)]
IFB EIBV(2011) = [250,000 × 1.05−8000] + [(.05−.03) × 30,000]
               = 255,100
Then Target IBV(2011) = 255,100 + 8,247 = 263,347

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

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

(7c)   Describe and evaluate the other risks an insurance company faces including operational, marketplace and expense risks.

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

Sources:
ERM Specialty Guide

ILA-C124-10: S&P's Insurance Criteria: Refining the Focus of Insurer ERM Criteria

ILA-C116-07: Mapping of Life insurance risks

Commentary on Question:
The question was attempting to test general knowledge of ERM, application of risk management to a specific product and then to a specific event in a company. The question had a relatively even mixture of retrieval (a), comprehension (b) and knowledge utilization (c).

Solution:
(a)   List and explain four objectives for pursuing ERM.

   Commentary on Question:
   Most candidates reasonably described several objectives of ERM. Some candidates saw just the "R" for Risk and focused solely on describing lists of risks rather covering Enterprise Risk Management. A few candidates wrote little more than four short lines and skipped the explain portion.

   Want four of the following six objectives that organizations hope to achieve with ERM:
   1.   Competitive Advantage
       • ERM treats all risks as a combined portfolio and manages them holistically, instead of as independent risks.
       • Holistic approach agrees with Modern Portfolio Theory, where a reasonably safe portfolio may be constructed even if it contains a number of uncorrelated high-risk investments.

6.   Continued

- ERM passively engages risk controls and actively pursues risk optimizations, further translating into value creation.

2.   Strategic Goals
- Organization needs both offensive and defensive strategies.
- Organization needs to understand risk it is accumulating as being a market pioneer (early to market) might pave the way to being a market leader (no example to follow).
- ERM can influence strategies by identifying opportunities and risks.
- ERM provides a way for senior executives to translate vision into sound strategies.
- Organizational effectiveness can be maximized by aligning ERM resources and actions with strategies.
- Risk process can be carried out in context of where organization is headed, rather than just where it is today.

3.   Shareholder Value
- ERM can help organization achieve its objectives and maximize shareholder value.
- Risk management supports overall economic growth by lowering cost of capital and reducing uncertainty.
- Organizations that develop ERM process for linking critical risks with strategies can add value for shareholders.

4.   Transparency of Management (Reduction of Agency Costs)
- ERM involves setting risk appetite and policy, determining organizational structure, and establishing corporate culture and these tasks are closely allied to the work of the board.
- With ERM in place, risk appetite and policy and corporate culture and values can more easily be communicated to employees
- Senior executives with a significant portion of wealth tied to stock and options have an interest in the success of these incentives, results in alignment of management and shareholder interests.
- Risk management provides managers with job security and protects their financial interests, which reduces agency costs.

5.   Decision-Making
- Senior managers need to evaluate business opportunities based not only on total returns, but also on risk-adjusted returns.
- ERM requires integration of risk management into the processes of an organization.

6. Continued

- ERM is not just a defensive approach used to control downside risk and earnings volatility. It is also an offensive weapon used to support and influence pricing, resource allocation, and other decisions.

6. Policyholder as Stakeholder
   - Issuer normally incurs investment costs at issue and needs to keep policies inforce to help recover costs.
   - ERM improves risk transparency for regulators and ratings agencies.
   - Timely and effective communication and reporting assures policyholders that appropriate risk management strategies are in effect.
   - Policyholders will have more confidence in organization's ability to meet future obligations and are less likely to lapse.

(b) Lake Shore Life offers a variable annuity product with a GMDB (Guaranteed Minimum Death Benefit). The company currently monitors changes in account values caused by volatile equity markets.

Commentary on Question:
Many candidates did not seem to fully understand what a Guaranteed Minimum Death Benefit (GMDB) rider is when sold as a rider on a deferred variable annuity and then answered with lists of risks that were either not relevant to this product (e.g. underwriting) or contrary to the product (e.g. longevity, disintermediation). It is important to tailor the answer to the product being discussed as different risks apply to different products.

For monitoring, many candidates overemphasized hedging and underemphasized simpler reporting that is readily available. GMDB benefits are frequently not hedged. Monitoring is designed to illuminate any developing problem, not necessarily to solve it.

(i) Identify and explain other risks associated with this type of product.

1. Product design risk – Fees should cover benefits, expenses and profit.
   - If equity return↓ then AV↓ Fees↓ Benefits↑ Profits↓. GMDB has equity market risk.
   - Mortality is considered not correlated with equity returns. GMDB has mortality risk.
   - GMDB has minimal or no: underwriting, longevity, interest or disintermediation risk.

6. Continued

2. Policyholder behavior risk
   - Lower partial withdrawals and lapses may increase or decrease gains depending on product design and market situation.
   - Behavior risk from benefit election rates and asset allocation choice.
   - Insufficient experience exists for most products of this type to provide much assumption-setting guidance.

3. Risk modeling risks
   - Models are not as robust as reality and investment alternatives available to the policyholder may have variations that are too complex to model.
   - Financial markets do not always behave as modeled.

4. Financial reporting risk
   - Short-term financial statement recognition of gains and losses may be different between embedded policy options and hedges
   - Gains and losses from hedging program that are based on market values or economic value of risk may have financial statement treatment that is different from embedded policy options

5. Large variable annuity losses may arise from:
   - Significant underpricing of guaranteed benefits
   - Failure to offset or hedge embedded options exposing organization to losses above risk tolerance.
   - Product designs that cannot be hedged.
   - Failure to recognize the potential volatility of revenue streams based on equity portfolio value can lead to losses.

(ii) List additional ways the company can monitor its equity risk.

Other potential items to monitor:
- Amounts of guaranteed benefits outstanding
- Degree to which potential risks of underlying base revenues are hedged
- Degree to which guaranteed benefits are hedged
- Sources of gains and losses
- Benefits categorized by level of in-the-moneyness
- Volumes of policies in extreme situations due to uneconomic base policy provisions
- Asset allocations
- Metrics such as VaR, CTE, and various sensitivities through the "Greeks"

6. Continued

(c) Lake Shore Life recently experienced a large systems failure, which led to numerous customer complaints. Recommend a plan of action to help the company control these types of risks in the future.

Commentary on Question:
Most candidates answered this section reasonably well and higher scores were available if the answer was tailored to the specific issue mentioned. Some candidates mentioned outsourcing or reinsurance, which were both inappropriate actions for this much more immediate situation.

1. Risk Identification - Use company or industry experience to identify risks
   - May use top-down (risk management staff, operational management) and bottom-up processes to identify risks
   - Focus on highest priority risks depending on severity of exposure and resources available

2. Risk Monitoring – Use key risk indicators (such as transaction counts, expected loss) that are summarized and reported to management

3. Risk Limits and Standards – Establish and document standards of company practice for each risk
   - Perform training on standards and then monitor compliance with the standards

4. Risk Management – Identify a high-level manager to own each risk; manager is responsible for reporting successes and failures as well as identifying weaknesses for future improvement
   - A compliance officer may be appointed
   - Document IT strategy and procedures, as well as checks on systems security, data integrity, new systems testing, backup facilities
   - Develop a policy for data access, distribution and communication security
   - Establish plans to provide service continuity under a wide range of business disruption scenarios
   - Practice emergency scenario testing of business continuity disruptions
   - Establish procedures to minimize impact of computer viruses on the company's operating environment
   - Identify sources and consequences of possible reputation risks; will crossover with other risk areas
   - Establish crisis management procedures, including media training

6. Continued

    5.   Risk Learning - Analyze the losses from this incident and identify the causes of it
- Use lessons learned from this incident to update procedures

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

Learning Outcomes:
(2b)	Calculate liabilities for the following products:
	(i)	Traditional life insurance
	(ii)	Term life insurance
	(iii)	Universal life insurance
	(iv)	Deferred annuity
	(v)	Payout annuity
	(vi)	Segregated Funds with guaranteed minimum death benefits
	(vii)	Segregated Funds with guaranteed living benefits
	(viii)	Riders

Sources:
CIA Education Note: Best Estimate Assumptions for Expenses – Nov 2006

CIA Education Note: Margin for Adverse Deviations (MfAD) – Nov 2006

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)
	(i)	Determine the best estimate for the total Administration Expense to be used in the calculation of life insurance liabilities.

		Commentary on Question:
		This part required the student to determine which of the listed items should be included in a best estimate expense. Many students did not include the depreciation of capitalized expenses in their expense, but otherwise generally did well on this part.

		Expenses to be excluded:
		- Development of new EV reporting
		- Total investment in admin system migration
		- Capitalized portion of Admin system migration
		- Regulatory reporting requirements
		- Legal expenses allocated to corporate
		- Salary costs of temporary IT staff
		- New privacy legislation implementation

7.   **Continued**

Expenses to be included:
- Policy Service (7,700,000)
- Outsourced premium collection and claims payments (4,000,000)
- Reinsurance Administration (1,400,000)
- Financial Reporting (800,000)
- Depreciation of past capitalized expenses (12,000,000 / 3 = 4,000,000)
- Direct Legal Expenses (1,500,000)
- Salary Costs of permanent IT Staff (600,000)

Total Administration Expense = 7.7 + 4.0 +1.4 + 0.8 + 4.0 + 1.5 + 0.6
= 20 million

(ii)   Recommend a Margin for Adverse Deviation for expenses and the estimate the Provision for Adverse Deviation.

Commentary on Question:
This part of the question required students to consider the presence of low or high margin indicators and recommend a MfAD. In addition, the question asked the student to estimate the PfAD. Many students recommended an MfAD but failed to include the present value factor in the calculation of the PfAD.

Low Margin Indicators:
- Outsourcing at known cost may allow use of lower margin than minimum
- Expenses are reviewed regularly
- Allocation is an appropriate basis for the best estimate expense assumption

High Margin Indicator:
- Future reductions in unit expenses is assumed

Low and high MfADs are 2.5% and 10% respectively
As both Low and High Margin indicators are present, recommend an MfAD in the somewhere in the middle (an MfAD from 5% to 7% was acceptable)
Provision for Adverse Deviation
Annual expenses = 20 million
Mfad = 6%
Estimate of Provision = Annual expense x MfAD x PV Factor
= 20 million $\times$ .06 $\times$ 8 = 9.6 million

7.   Continued

(b)   Calculate the impact on the income statement and balance sheet of this decision in 2012 assuming inflation is offset by normal productivity gains. Show all work.

Commentary on Question:
Part (b) was poorly done, in part because the question was misunderstood. The question states that you decide an expense improvement of 6 per policy can be projected with confidence; however (you also decide), that for 2012, only 4 of the 6 per policy expense reduction will occur.

Impact on GAAP Liabilities of non-recurring costs:
Recognize $6 per policy in valuation:
$$\$6 \times 400{,}000 \times a_x = 19{,}200{,}000$$
Subtract an amount in first year because we only recognize $4:
$$(\$6 - \$4) \times \$400{,}000 = \$800{,}000$$
Reduction in GAAP Liabilities due to expense reduction:
$$\$19{,}200{,}000 - \$800{,}000 = \$18{,}400{,}000$$
Subtract amount of uncapitalized expenses:
$$(\$14{,}000{,}000 - \$12{,}000{,}000) = \$2{,}000{,}000$$
Reduction in GAAP Liabilities due to expense reduction less uncapitalized expenses:
$$\$18{,}400{,}000 - \$2{,}000{,}000 = \$16{,}400{,}000$$

Impact on Income:
= Total investment – Amount Capitalized + Impact on GAAP Liabilities of Nonrecurring Costs – Impact of Recognizing Productivity Improvement
= –$14,000,000 + $12,000,000 – $16,400,000 + $18,400,000 = $0

Impact on Balance Sheet:
Assets:
= Total Investment less Capitalized Portion
= –$14,000,000 + $12,000,000 = –$2,000,000
Liabilities:
= Impact of Non-recurring Costs – Release from Productivity Gains
= $16,400,000 – $18,400,000 = –$2,000,000

8. **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.

Sources:
ILA-C620-09: OSFI – Guidelines E15

Commentary on Question:
The intent of this question was to test the students' knowledge of the requirements to qualify as an Appointed Actuary.
Most students knew the list of qualifications, and often immediately disqualified the candidate due to the adverse finding by a CIA disciplinary tribunal and the lack of an AA certificate.

Solution:
Critique the suitability of the actuary as an Appointed Actuary in accordance with guidelines of OSFI.

- Candidate must have worked in Canada for at least 3 of the last 6 years.
  Candidate meets this requirement.

- For at least one of those years, the candidate must have performed valuation of Canadian actuarial liabilities of an insurance company.
  Candidate meets this requirement.

- Candidate must have experience with the CIA's Standards of Practice and relevant insurance legislation and regulation.
  Candidate meets this requirement.

- Candidate should be up to date with respect to the CIA's Continuing Professional Development requirement.
  Candidate meets this requirement.

- Candidate must be in possession of an up-to-date Appointed Actuary Certificate from the CIA if, one is required by the CIA in the future.
  Candidate is in the process of applying for an AA certificate. It is not clear that a certificate is needed.

8.   Continued

- Candidate has not been the subject of an adverse finding by a CIA Disciplinary Tribunal. Where there has been such a finding, the Superintendent may nevertheless conclude that the AA is a suitable person if the circumstances of the case and other information support such a conclusion.
Candidate has been the subject of an adverse finding by a CIA disciplinary tribunal, but would not be eliminated for this reason alone. This requires further investigation.

Overall: Candidate is highly likely to be appointed, pending further review of the CIA Disciplinary Tribunal circumstances.

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

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

Sources:
Canadian Insurance Taxation
- Ch 3 Liability for Income Tax
- Ch 4 Income for Tax Purposes – General Rules
- Ch 5 Investment Income
- Ch 6 Reserves
- Ch 11 Investment Income Tax
- Ch 28 Provincial Premium Taxes

Commentary on Question:
Candidates were expected to critique each of the seven statements with respect to Canadian taxation law. All seven statements did not comply with the taxation laws and the candidate was expected to describe the proper procedure. In general, candidates did well for parts (i), (ii), (v), and (vi). In part (iii), candidates failed to identify the appropriate level of deductible doubtful debt for corporate bonds. In part (iv), candidates failed to realize there no longer is a distinction for what year a policy is issued. In part (vii), candidates failed to calculate the appropriate transition amount.

Solution:
Assess the accuracy of each of these statements.

(i) Premiums written from both Canadian and U.S. branch operations were included.

Insurer must only include premiums from its Canadian operations in the determination of taxable income.
Residency of policyholders dictates inclusion of premium in determination of taxable income.

(ii) The same premium tax rate was applied against all direct insurance premiums written less a 20% deduction for premiums which were ceded to the reinsurer on a quota share basis.

Tax is calculated on Direct Insurance Premium written within jurisdiction where policy was written.
Premium tax rate varies by province.
Premium tax is payable on 100% of Direct Insurance Premium.

9. Continued

No deduction may be taken for reinsurance as the direct writer is liable for all taxes.

(iii) For assets which are doubtful, 100% of the amounts owing were deducted.

Mortgages are 100% deductible but based on historical loss experience. The deduction should be based on homogenous block where each loan is not deemed to a large segment of the asset class.
Insurers may not claim a deduction for doubtful debts in respect of premiums receivable for life insurance policies issued in Canada.
For other lending assets, including corporate bonds, the maximum allowance for deduction is 90% of the doubtful debt allowance claimed in the financial statements.

(iv) Method used to determine Maximum Tax Actuarial Reserves (MTARs):
- Pre 1996 policies: 1.5 Yr Full Preliminary Term
- Post 1995 policies: As reported in the financial statements

As of Jan 1, 2007, there is no longer a distinction required for insurance policies written pre 1996 and post 1995.
All MTARS to be determined under Reg 1404 based on amounts included in insurers' financial statements.

(v) Any insurance policy with a negative reserve had their reserve set to zero.

Reserves are treated in the same manner regardless of their sign.
Full amount of a negative reserve must be included in the determination of taxable income and may be deducted in the following year.

(vi) For Investment Income Tax (IIT) the tax calculated using a tax rate of 10% of our Corporate Bond yield × (MTARs less Policy Loans) on all life insurance policies.

IIT is determined using Life Investment Income = prescribed yield * MTAR
Prescribed yield is based on moving average interest rate of Govt of Canada bonds.
IIT = 15% of Taxable Canadian Life Investment Income = 15% of (Life Investment Income + / − Experience Rating Refund − Amounts reported to policyholders − Canadian Life Investment Loss Carryforward)
Cansum or Prescribed yield of Government of Canada bonds may be further reduced for policies issued before March 2, 1988.

9. Continued

(vii)   The impact of Transition Properties were excluded.

Transition Amount must be determined and included into income for tax purposes.
Impact of Transition Amount must be spread out for tax purposes over 1,825 days or five years.
Impact of Transition runs from January 1, 2007.
Transition Amount = Fair Market Value of Transition Property less the Cost Amount of Same Property at the end of the Insurer's Base Year
Base Year = Year immediately preceding the Transition Year
Transition Year = Insurer's first taxation year that begins after Sept 30, 2006
Transition Amount = ($4,000,000 − $1,000,000) / 5 years = $600,000

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

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

Learning Outcomes:
(1d) Explain fair value accounting principles

(2a)
      (i) Describe Valuation Methods
      (ii) Recommend appropriate valuation assumptions

Sources:
ILA-C618-11: OSFI D-10, October 2009 (Accounting for Financial Instruments Designated as Fair Value Option)

An Approach for Measurement of the Fair Value of Insurance Contracts

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)
      (i) List the 3 techniques used to determine a reliable fair value for the Fair Value Option.

      Commentary on Question:
      Candidates were expected to list the three general techniques to determine a reliable fair value option, which they generally did. Some additional credit was given to those who provided further details on the techniques; however, the focus for part (a) was section (ii) below. Candidates were also given credit if the three techniques were referenced as level 1/2/3, the terminology used in another study note.

      1. Published price quotes for identical instruments in active 2 way markets
         • Need ability to access the reference market on the measurement date and on a regular basis
         • Market quotes should be independent and timely
         • Consider volatility of trading volume and market concentrations

10. Continued

      2.   Published price quotes for similar instruments - similar size, risk and duration
- Should only have minor adjustments

      3.   Using a valuation technique
- Inputs should be based on observable active two way market values
- Adjustments should be prudent and applied consistently from period to period
- Use recent arms-length market transactions, if available, between knowledgeable, willing parties
- Some examples: discounted cash flow analysis, option pricing models
- Calibrate the valuation technique and test for validity

(ii) Explain how proponents and opponents of fair value accounting would view each of these techniques.

Commentary on Question:
Some of the opponent and proponent arguments listed below are valid for more than one of the fair value techniques. Candidates received credit if the argument was used to describe a different technique than the one shown below, provided it was valid for that technique. The argument would only be given credit for one use.

The selection below is a sample from the syllabus material, illustrating full credit. All arguments from the syllabus received credit.

From quoted prices for identical instruments
Opponent: Mark-to-market has triggered the margin calls for many mortgage-based securities
Opponent: Fair value accounting has caused market volatility
Proponent: Volatility unveils problems
Proponent: Allows some transparency since using market values, thus increasing market confidence
Proponent: Swift write-down re-establishes stability

From quoted prices for similar instruments
Opponent: If allowed to choose between techniques, could easily lead to bias
Proponent: Easy to adopt, does not need to develop new model
Proponent: May be the only technique available
Proponent: Technique is already accepted so don't have to prove validity

10. Continued

Using a valuation technique
Opponent: Models are complex and subject to model risk
Opponent: Distorts real fair value
Opponent: Does not provide a true view of long-term value
Proponent: Flexible, can be adopted to special instruments
Proponent: Provide some transparency since model and assumption can be audited.

(b) Recommend an appropriate technique for determining a fair value for each of the following:

Commentary on Question:
Candidates were expected to judge which fair value technique was best suited for each of the three independent scenarios. Many candidates were able to identify the appropriate technique in one or more of the scenarios, but not all provided justification for their recommendation. Similar to part (a), the terminology level 1/2/3 was also accepted.

(i) A block of 5-year and 10-year coupon bonds maturing in the next 3 years.

Quoted prices for same instrument
- Accessible market
- Available on regular basis
- Available on timely basis

(ii) A block of 62-month and 124-month coupon bonds maturing in exactly 2 years.

Quoted prices for similar instrument
- Durations and risks are similar to something already available
- Arms-length transactions known from 5-year and 10-year market

(iii) A large single investment sold as a debt security, with an option to switch to an equity-based version within 3 years of maturity.

Build a model - valuation technique
- No similar market instrument
- Demonstrate that the technique provides reliable prices for market-available assets
- Test for validity
- *Alternatively, credit will be given if the candidate stated that no fair value can be reliably calculated for this instrument due to the lack of information*

10. Continued

(c) Explain the importance of the following criteria used to assess the merits of an accounting model for measurement of the fair value of liabilities for insurance contracts, based on the article "An Approach for Measurement of the Fair Value of Insurance Contracts.

Commentary on Question:
Candidates were expected to comment on the importance of each of the statements.
Candidates generally fared poor. Many candidates simply reworded the statement or simply stated "it is important to be consistent" without providing supporting evidence or explanations.

(i) Consistency between components of and between insurance contracts

- Most insurance contracts consist of a bundle of such components that can be quite difficult to measure separately other than in an arbitrary manner.
- Consistency avoids discontinuities between the liabilities for insurance contracts, financial instruments, and service contracts, as well as their various components.

(ii) Consistency between the measurement approaches used for all financial contracts

- Measurement consistency reduces the need for and importance of classifying contracts and their components as insurance contracts to achieve a particular accounting treatment.
- Consistent measurement of well-matched assets and liabilities would allow both the asset and liability sides of the balance sheet to be similarly responsive to changes in interest rates and other pertinent economic factors.

(iii) Consistency with accepted economic pricing methodologies.

- Since the fair value of a financial instrument is independent of the holder of the instrument, it should not recognize entity-specific factors, including diversification benefits and benefits of economies of scale.
- The price assumed to cover expenses and cost of capital is independent of entity's actual/projected costs
- An entity whose actual costs are less (more) than market based expense charge would have a positive (negative) impact on earnings.

11. 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 Education Note: Approximations to the Canadian Asset Liability Method, Nov 2006

Commentary on Question:

The intent of this question was to test the students' knowledge of and ability to apply the detailed CALM Roll-forward steps as described Educational note "Approximations to the Canadian Asset Liability Method (CALM)".

Most students knew the basic list of roll-forward steps for part (a) and were able to correctly assess the list of steps in (a)(i), however, fewer students were able to make recommendations to changes as required for part (a)(ii).

Part (b) required the students to apply the roll-forward steps to a numerical example. This part was not done as well.

Solution:

(a)

(i) Evaluate the appropriateness of each of the above steps with respect to the approximation of the Canadian GAAP policy liabilities.

Step 1 – correct to calculate prior quarter's CALM reserve.
Step 2 – it may not be appropriate to solve for a level vector of interest rates (level interest rate may not project future reserves accurately)
Step 3 – correct to add in liability movement
Step 4 – correct to add in the movement due to changes in reinvestment rates
Step 5 – correct to add in any change in unrealized gains and losses during the reporting period

(ii) Recommend any changes that needed to be made to the above process to ensure compliance with the approximation approaches outlined in the General Standards.

Changes recommended:
Step 2 – instead of solving for level interest rate, consider solving for a non-level interest rate vector that discounts the liability cash flows to the CALM GAAP policy liabilities

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11. Continued

Step 3 – for new business during the reporting period, adjust for the difference between the in-force interest rate vector at the end of the previous period and valuation interest rates applicable to current period's new business

Step 3 – for lapses & deaths during the period (e.g. unexpected liability movements), adjust for the differences between the interest rates at the end of the last period and the valuation interest rates applicable at the time of these movements.

Step 4 – add the liability changes that are not captured by fair value movement

Step 4 – remove changes in asset value during the quarter that do not affect policy liabilities

Step 5 – add realized capital gain/loss during the quarter

Step 6 (added) – adjust for basis changes

(b)

    (i)   Calculate the true CALM reserves at Dec 31, 2012 using cash flows and asset information given above. Show all work.

        The CALM reserve is equal to the supporting assets at the balance sheet date that are forecasted to reduce the last liability cash flow exactly to zero.
To exactly match the liability cash flows, we need 500K of asset to mature on Jun 30, 2012 and 1M of asset to mature on Dec 31, 2012.
The market values of these assets at Dec 31, 2011 are 985,222 and 497,519, respectively.
The total CALM reserve at Dec 31, 2011 = 497,519 + 985,222 = 1,482,740

    (ii)   Calculate the liability movement at March 31, 2012 using the cashflow reports and the annual effective spot interest rates. Show all work.

        Liability Movement
= PV(liability CFs @ Mar 31, 2012) – PV(liability CFs @ Dec 31, 2011)

        PV(liability CFs @ Dec 31, 2011) is calculated above in (b)(i) = 1,482,740

        PV(liability CFs @ Mar 31, 2012)
$= 400,000 / (1.015)^1 + 900,000 / (1.015)^{9/12} + 500,000 / (1.01)^{3/12} =$ 1,782,853

        Liability Movement = 1,782,853 – 1,482,740 = 300,113

11. Continued

(iii) Calculate the adjustment made to reflect the changes in the interest rates during the first quarter of 2012 with respect to new business and unexpected liability movement.

For new business, we used $400,000 / (1.015)^1 = 394,089$ in the liability movement, whereas the asset we purchased had a value of 395,648. Therefore we need to add an adjustment of $395,648 – 394,089 = 1,559$ to the reserve due to the change in interest rates for new business.

For unexpected liability movement, we used an implicit $– 100,000 / (1.015)^{9/12} = –98,890$ in the liability movement, however, we were able to sell a bond with 100,000 of maturity value for 99,206. Therefore we can adjust the reserve by $–99,206 – (–98890) = –316$ for unexpected liability movements.

12. **Learning Objectives:**

1. The candidate will understand basic financial statements and reports of Can. 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 U.S. life insurance companies.

Learning Outcomes:

(1e) Describe international accounting standards.

(2a)
      (i) Describe Valuation Methods
      (ii) Recommend appropriate valuation assumptions

Sources:

ILA-C127-11: July 2010 Exposure Draft – Insurance Contracts, IASB

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

Commentary on Question:

This question was testing the student's understanding of IFRS as described in the exposure draft.

Solution:

(a) Justify why this block of policies qualifies as an insurance contract under IFRS. .

      Commentary on Question:
      Part (a) required the definition of an insurance contract.

      An insurance contract under IFRS is a contract under which one party (the insurer) accepts significant insurance risk from another party (the policyholder) agreeing to compensate the policyholder if a specified uncertain future event (the insured event) adversely affects the policyholder.

      Insurance risk is significant if, and only if, an insured event could cause an insurer to pay significant additional benefits in any scenario.

      As an example, if the policyholder dies soon after the inception of the policy, the present value of the outflows (benefit plus expense) exceeds the present value of the premiums. Therefore, the risk is significant.

      In this case, the uncertain future event is the uncertainty around the timing of death.

12. Continued

(b)   Evaluate the recommendations and suggest any appropriate changes.

Commentary on Question:
Part (b) required the student to consider how methodologies used in the current standards of practice may be used to estimate how insurance contracts should be measured as described in the exposure draft. We did not want a simple recitation of how the exposure draft says to measure insurance contracts.

Using Best Estimate Cash Flows is reasonable. The best estimate liability cash flows should be fairly close to "an explicit, unbiased and probability-weighted estimate (i.e. expected value) of the future cash outflows less the future cash inflows that will arise as the insurer fulfils the insurance contract."

Using the CALM best estimate interest rate to discount the cash flows is wrong. The discount rate should be consistent with observable current market prices for instruments with cash flows whose characteristics reflect those of the insurance contract liability, in terms of, for example, timing, currency and liquidity. CALM best estimate interest rates reflect the characteristics of the assets backing the liability and the reinvestment assumption.

It is not reasonable to have the total of all the PfADs be the risk adjustment, but the total of the Mortality, lapse and (non-investment) expense pads may be a reasonable approximation for the risk margin. The risk adjustment should reflect the effects of diversification that arise within a portfolio of insurance contracts, and using the sum of these pads would not capture the effects of diversification that arise within a portfolio of liabilities. For example, lapse and mortality may be correlated. The risk adjustment should not reflect risks that do not arise from the insurance contract, such as investment risk, asset-liability mismatch risk or general operational risk relating to future transactions.

If there is any gain at the inception of the contract, the estimate should also include a Residual Margin that eliminates any gain at the inception of the contract.

(c)   Justify which of the liability cash flows you would include as part of your best estimate cash flows.

Commentary on Question:
Part (c) required the student to state and justify which of the listed cash flows would be included as best estimate cash flows under IFRS.

Include all cash flows that are "within the boundary of an existing contract that are incremental at the level of a portfolio of insurance contracts."

12. Continued

Include
- Premiums and death benefits (relate directly to the contract)
- Premium tax and IIT (transaction based taxes and levies - arise directly from the policy)
- Policy administration, maintenance costs, and commissions (relate directly to the policy)
- 91% of the underwriting department costs (costs that can be attributed directly to the policies issued)

Exclude
- Corporate income taxes (recorded, measured separately under IAS 12)
- 9% of the underwriting department costs (may not be included because these policies were not issued)
- Reinsurance recoveries (measured and recognized separately)
- Investment returns net of expenses and defaults (measured and presented separately)
- CEO Salary, overtime for call centre support (cost does not relate directly to policies issued)

(d) Evaluate possible investment options for use in deriving a discount rate for the liability cash flows.

Commentary on Question:
Part (d) required the student to state and justify which of the listed cash flows would be included as best estimate cash flows under IFRS.

Discount rates should be consistent with observable current market prices for instruments with cash flows whose characteristics reflect those of the insurance contract liability, in terms of, for example, timing, currency and liquidity.

Government of Canada treasury bills – liquid but the duration is too short.

US treasury bonds (average time to maturity is 10 years) – time to maturity is better, very liquid, but currency does not match liabilities.

AA-rated Canadian corporate bonds (average time to maturity is 20 years) – best option – time to maturity closest to that of liability cash flows and these are very liquid assets. One may have to adjust for credit rating.

A-rated Canadian private placements (average time to maturity is 15 years) – not liquid enough (private placements), although currency and time to maturity are reasonable.

12. Continued

European High yield and distressed bonds, average duration 6 years – currency is wrong, duration is too short, liquidity may also be a problem and would have to have a big adjustment for credit.

(e)

    (i)   List reasons why your boss has suggested the confidence level approach and indicate when this approach would be appropriate.

    (ii)   Assess the appropriateness of the 90% confidence level.

Commentary on Question:
Part (e) requires the student to list advantages / disadvantages of the confidence level approach, and then to assess a 90% confidence level given the product.

The confidence level approach is easy to explain and simple to calculate. The confidence level approach is appropriate when the probability distribution is not skewed and does not vary significantly over time. When the probability distribution is not normal, the selection of the confidence level must take into account additional factors, such as the skewness of the probability distribution.
In addition, the confidence level approach ignores outliers (i.e. extreme losses in the tail of the distribution beyond the specified confidence level).

A confidence level of 90% may not be high enough for the following reasons:
- Uncertainty around preferred underwriting mortality
- Emerging lapse experience may change the distribution of the risk adjustment
- Product may be a low frequency / high severity type risk due to the large face amount - possibly reflects a skewed distribution of risk adjustments

13. **Learning Objectives:**
1. The candidate will understand basic financial statements and reports of Can. 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 U.S. life insurance companies.

Learning Outcomes:
(1d) Explain fair value accounting principles

(2a)
      (i)   Describe Valuation Methods
      (ii)   Recommend appropriate valuation assumptions

Sources:
An Approach to Fair Valuation of Insurance Liabilities Using the Firm's Cost of Capital, NAAJ, April 2002, pp. 18-23

CIA Education Note: Currency Risk in the Valuation of Policy Liabilities for Life & Health Insurers, Dec 2009.

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) Define the direct and indirect methods of determining Fair Value Liabilities and include the advantages and disadvantages of each method.

    Commentary on Question:
    Candidates were expected to define the two methods of determining fair value of liabilities and discuss their advantages and disadvantages. Candidates generally did not define the two methods thoroughly to demonstrate their understanding. Writing down an equation or one line answer was not sufficient to demonstrate adequate knowledge. Further clarification on the nuances of the two methods was required.

    Direct method
    • Discount the liability cash flow directly, including expenses, and adjusting for risk
    • Uncertainty of cash flows modeled stochastically (may or may not be risk-neutral)
    • If spread added, not necessarily firm's own-credit-risk premium
    • Disadvantage: rarely used in setting prices for blocks of insurance business when risk is being transferred

13. Continued

- Advantages:
  - o Provides a more reliable assessment of the risk of financial leverage
  - o Simpler to get assessment of risk of financial leverage
  - o Insurance risks can be accommodated by adjusting either discount rates or expected cash flows

Indirect method
- The market value of the assets, less the discount the free cash flow generated by the business, adjusted for risk and taxes
- Three steps
  1. Generate stochastic economic scenarios, which lead to future free cash flows (distributable earnings)
  2. Discount free cash flows at risk-adjusted cost of capital for each scenario; the present values of the scenarios are averaged to determine the Discounted Distributable Earnings (DDE)
  3. Deduct the DDE and deferred tax liability from market value of assets to determine Fair Value of Liabilities
- Advantage: more easily related to exit prices and so implicitly reflects liquidity

(b)   Determine:
    (i)   The Fair Value of Liabilities at the beginning of year 1.
    (ii)   The implied Required Profit in year 1.
    (iii)   The Market Value of Assets at the beginning of year 1.
    (iv)   The implied corporate tax rate in year 1.

Commentary on Question:
Candidates were expected to determine which formulas from the syllabus were appropriate to calculate the four requested values. Candidates generally did well with parts (i) and (iii). Candidates struggled to use the appropriate formulas for parts (ii) and (iv). Other formulas could not be used with the information provided.

Note: Part (ii) results in a negative required profit, which in turn results in a negative tax rate in part (iv). These were as a result of an error in the values in the question. Intuitively, profit and tax rates should not be negative. However, the intent of the question to test the students understanding of fair value equations was still possible.

(i) Equation (1)
$FVL_{t-1} = (FVL_t + L_t + E_t) / (1 + r_t + \theta tL)$
$= (10{,}000 + 1{,}000 + 200) / (1 + 2.5\% + 0.5\%)$
$= 10{,}873.79$

13. Continued

(ii) Equation (5)

$FVL_{t-1} = (FVL_t + L_t + E_t + RP_t) / (1 + r_t + \theta_{tA})$

$10{,}873.79 = (10{,}000 + 1{,}000 + 200 + RP_t) / (1 + 2.5\% + 0.25\%)$

$RP_t = 10{,}873.79 * 1.0275 - 11{,}200$

$= -27.18$

(iii) Recursive Market Value of Assets formula (top of page 22)

$MVA_{t-1} = (MVA_t + A_t) / (1 + r_t + \theta_{tA})$

$MVA(0) = (10{,}500 + 850) / \ 1 + .0250 + 0.25\%)$

$= 11{,}046.23$

(iv) Equation (4)

$RP_1 = (\theta_K - \theta_A)(MVA_0 - FVL_0) + (r_0 + \theta_K) \times (T / (1 - T)) * (TVA_0 - TVL_0)$

$-27.18 = ((6\% - 2.5\%) - 0.25\%) \times (11{,}046.23 - 10{,}873.79) + 6\% \times T / (1 - T) \times (18{,}966 - 12{,}000)$

$(-27.18 - 5.60) / (6\% \times 6{,}966) = T/(1 - T)$

$T/(1 - T) = -0.0784$

$T = 1/(1 - 0.0784) = -8.5\%$

(c)   Determine the Provision for Adverse Deviation for currency risk.

Commentary on Question:
Candidates were expected to demonstrate their understanding of the impact on foreign exchange rates to the valuation of liabilities using the methodology prescribed in the CIA Educational Note. Common errors included applying the standard deviation incorrectly, applying the minimum margin incorrectly, and not calculating both the adverse and minimum margin scenarios.

Project exchange rate to end of first year

$F = S \times ((1 + i_a)/(1 + i_b))^m$

F = corresponding foreign exchange rate

S = spot exchange rate, expressed as the price in currency a of a unit of currency b

i_a and i_b are the risk-free interest rates for the respective currencies

m is the common maturity in years for the forward rate and the two interest rates

$F = 0.975 \times ((1 + 2.5\%) / (1 + 1.6\%))^1$

$F = 0.984$

Liability cash flow = 1,000 at end of first year

Discounted liability cash flow = $1{,}000 / (1 + r_t)$

$= 1{,}000 / (1 + 1.6\%) = 984.25$

13. Continued

Determine base exchange rate scenario
  = Liability × Spot exchange rate / Projected exchange rate
  = 984.25 × 0.975 / 0.984 = 975.61

Determine the adverse scenario exchange rate scenario
  = Base scenario * Base projected exchange rate / (Spot rate * (1 − Standard deviation))
  = 975.61 × 0.984 / (0.975 × (1 − 0.056))
  = 1,042.64

Determine liability based on 5% minimum margin
  = Base scenario / (1 − 0.05)
  = 975.61 / (1 − 0.05)
  = 1,026.96

Liability Held is maximum of adverse scenario and 5% margin
  = 1,042.64

Provision for Adverse Deviation = Liability Held − Base Exchange Rate Scenario
  = 1,042.64 − 975.61
  = 67.03