CSP-IU Complete Illustrative Solutions
Spring 2011

1.

Learning Objectives:

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

Learning Outcomes:

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

Sources:

Life Insurance products and Finance, Ch. 14, Financial Modeling

ILA-C114-07: Life Insurance Forecasting and Liability Models

Commentary on Question:

Solution:

(a) List the positive effects of testing interest rate scenarios using asset/liability modeling (ALM).

- Make the company more aware of any significant risk it is taking.
- The company may change its investment strategies to reduce its exposure to certain risks.
- The company may change the products it offers to reduce its exposure to certain risks.
- The company may limit the total amount of certain kinds of business it will accept, in order to limit the aggregate risk.
- The company may increase certain kinds of business in order to better balance and diversify its risks.
- By knowing the risk up front, the company can educate stakeholders and minimize any collateral damage.
- Help to predict investment income and test crediting strategy.
- Help risk management and decision making.

1. Continued

(b) Evaluate the approach used by a life insurance company in validating ALM models.

- The current validation is static validation which compares the model results to actual values at one point of time.
- Validating modeled results on a static validation approach does not guarantee a perfect model since it only compares one point in time.
- Also static validation only looks at one variable and fails to capture the effect of interaction among variables.
- Dynamic validation can be used to check the reasonability of the model going forward since it validates values over a period of time.
- Dynamic validation looks at many assumptions at once and measures accuracy of their interaction.
- Prospective dynamic validation can be used to compare the trend in actual historical results with the model's projected results.
- Retrospective validation or back-testing is another type of dynamic validation which starts with the current portfolio of business and runs the model backwards through time.
- Back-testing is more robust than prospective validation, the back-test result is directly compared to the actual historical data.
- The company could improve its model validation approach by using static validation for the start point of the model and use the dynamic validation in checking the projected modeled results over a period of time.

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:

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

Sources:

Life Insurance Products and Finance, Chapter 16

Commentary on Question:

The question was trying to test considerations for the purchase of a block of business and how to calculate the Embedded Value for a block of business. The students both did well and had trouble calculating the Embedded Value.

Solution:

(a) List prerequisites Settlers Life should consider before entering into the sale.

The seller must have a use for the capital from the sale and the sale must be likely to improve the seller's earnings.

(b) Calculate the embedded value of this block of business. Show all work.

Assume Assets = 30
Purchase Value (PV) = Solvency Reserve (0) – Assets (0) = 40 – 30 = 10

Tax (0) = (SolvRes(0) – TaxRes(0) – PV – Transactions Costs) * Tax Rate
= (40 – 40 – 10 – 2) * .35 = -4.2

Embedded Value (EV) = PV + Tax(0) + TransCosts + Required Capital (0)
= 10 – 4.2 + 2 + 3 = 10.8

Candidates could also assume assets = 45

Purchase Value (PV) = Solvency Reserve (0) – Assets (0) = 40 – 45 = -5

Tax (0) = (SolvRes(0) – TaxRes(0) – PV – Transactions Costs) * Tax Rate
= (40 – 40 – (-5) – 2) * .35 = 1.05

Embedded Value (EV) = PV + Tax(0) + TransCosts + Required Capital (0)
= -5 + 1.05 + 2 + 3 = 1.05

2. Continued

(c) Recommend whether Beaumont Life should proceed with the purchase.

The recommendation is to go ahead with the purchase as the Embedded Value is greater than zero and therefore will add value to the company.

3. 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:

(1d) Explain fair value accounting principles.

Sources:

An Approach to Fair Valuation of Insurance Liabilities Using the Firm's Cost of Capital

Commentary on Question:

Parts (a) and (b) tested the candidate's understanding of fair value calculation under two different approaches: direct and indirect methods. Overall, candidates did a fair job of answering part (a) but did a poor job in part (b). Many candidate left part (b) blank.

Part (c) tested the candidate's application of the direct method of calculating fair value liability. Most candidates did very well in calculations. Some were able to answer the question without knowing the direct method formula but by using first principles. Common errors were missing the premium and commission, assuming annual premiums, assuming premium and commission at end of first year instead of beginning, and forgetting 1% credit risk premium.

Part (d) tested the candidate's understanding of the sensitivities to the fair value liabilities. Most candidates did very well in answering (i) and (ii) since they were able to determine the direction of the fair value liability changes based on first principles. Many candidates had trouble answering (iii) since they could not relate the cost of equity capital change to the risk premium.

Solution:

(a) Explain the following approaches to Fair Value Liability valuation:

(i) Direct Method

- Discount liability cash flows using the risk-free interest rate with mechanism to adjust risk: $FVLt\text{-}1 = (FVLt + Lt + Et)/(1+rt+\theta)$
- More reliable assessment of risk of financial leverage
- Insurance risks (mortality or morbidity) can be accommodated by adjusting either the discount rate or the expected future cash flow
- Not used to set exit prices
- More simplistic, straightforward method

3. Continued

(ii) Indirect Method

- Discounts future free cash flows at appropriate risk-adjusted cost of capital
- Deducts discounted distributable earnings and an amount for the deferred tax liability from the market value of the assets of the firm: FVLt = MVAt - DTLt – DDEt; MVA = Market value of the assets, DDE = Discounted Distributable Earnings, DTL = Deferred tax liability
- DDEt-1 = ((DDEt + DEt)/(1+r+θ); DE = distributable earnings
- DTLt =T[(MVAt - TVAt) - (FVLt - TVLt)]; TVA = Tax value of the asset, TVL = Tax value of the liability
- (r+θ) is the cost of capital expressed as the risk-free rate plus a risk premium
- More easily related to exit prices
- Methodology can become excessively complex

(b) Identify the conditions under which the Fair Value Liability using the Indirect Method will equal the Fair Value Liability using the Direct Method.

- Assumptions need to be set so they are consistent between the two methods
- Introduce a new term Required Profit which is the profit required from the product that will result in the firm earning exactly its cost of capital
- Direct method's liability risk premium (expected excess return) must be based on asset portfolio earned rate and a charge for required profit on capital
- The liability spread is equal to the asset risk premium minus ratio of required profit over the fair value of liabilities

(c) Calculate the Fair Value Liability at policy issue using the Direct Method.

FVLt-1 = (FVLt + Lt + Et)/(1+rt+θ)

Premium = 600
Commission and other acquisition expenses = Premium * .4 = 600 * .4 = 240
Et = 0 for t = 1,2,3

Death Benefit cash flow: Face amount * tPx * Qx
L1 = 100000*(.01) = 1000
L2 = 100000*(1-.01)*(.02) = 1980
L3 = 100000*(1-.01)*(1-.02)*(.03) = 2910.6

rt+θ = .05 + .01 = .06

3. Continued

FVL3 = 0
FVL2 = (0 + 2910.6)/1.06 = 2746
FVL1 = (2746 + 1980)/1.06 = 4458
FVL0 = (4458 + 1000)/1.06 – 600 + 240 = 4789

Fair value liability at policy issue is 4789.

(d) Predict whether the Fair Value Liability increases or decreases for each of the following scenarios.

(i) The credit risk premium increases.

- An increase in credit risk premium will cause an increase in the discount rate
- Therefore, fair value liability will decrease from an increase in the discount rate

(ii) An epidemic increases the mortality rate in policy year three.

- An increase in the mortality rate will cause an increase in the benefit
- Therefore, fair value liability will increase because of an increase in the benefit

(iii) The cost of equity capital increases.

- An increase in cost of equity will reduce the firm's credit risk premium which will cause a decrease in discount rate
- Therefore, fair value liability will increase from a decrease in the discount rate

4. 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.

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

Sources:

ILA-C125-10: Insurance Risk Management Response to the Financial Crisis, CRO Forum, April 2009, Pgs 7-9

Specialty Guide on ERM Chapter 2

Commentary on Question:

The purpose of this question was test the candidate's understanding of enterprise risk management in practice. As well, the candidates were asked to identify different risk control processes that could be applied to different situations

Part (a) requires the candidate to apply the Enterprise Risk Management principles from the syllabus as they apply to each of the 6 statements. This question was worth 5 points, which required candidates to really give some thought to the statements, and explain why they were appropriate/not appropriate with respect to Enterprise Risk Management. Overall, candidates did not include enough in their responses for this question. It is important that candidates make sure to elaborate on their responses, and really demonstrate that they understand the implication of each statement.

Part (b) requires that the candidates identify which risk control process is being used in each example. Many candidates didn't carefully read the question, or didn't recognize that this was what was being asked of them for this question. The candidates who understood what was being asked were able to do very well on the question.

Solution:

(a) Assess the appropriateness of each of the following statements regarding this program.

(i) The risk management function will be done at the business unit level.

Inappropriate. The risk management function must be comprehensive and done at the enterprise level. Risk management at the business unit level can miss the potential for cumulative risk.

4. Continued

(ii) Risk officers report to the pricing officer of each business unit.

Inappropriate. Risk management should be independent of business unit functions. All risk officers should report to the Chief Risk Officer who holds a seat at the highest level of management.

(iii) A checklist will be developed to help the risk management officers assess product risks.

Inappropriate. Integrated Risk Management should never be a static "check the box exercise." Checklist would need to be dynamic, and should allow companies to identify and asses emerging risks

(iv) The Board of Directors will be advised as risk issues arise.

Inappropriate. The board of directors must take ultimate responsibility for supervising a company's risk management framework, including the company's overall risk tolerance.

(v) Risk management will be rules-based.

Inappropriate. Rules-based regulation tends to foster a culture of blind compliance rather than risk awareness, principles-based economic regulation is recommended.

(vi) Compensation will continue to reflect the volume of sales.

Inappropriate. Compensation based solely on sales does not take into account risk/return relationships. Incentives should reward risk-adjusted performance.

(b) Determine the parts of the Risk Control Process described in the Society of Actuaries' "Enterprise Risk Management Specialty Guide" that the company should follow for each of these recommendations.

(i) Risk Transferring. Reinsuring the LTC business transfers part of the risk to the reinsurer. Careful analysis is required to determine the level of risk that should be retained, and the significance of the counter-party risk.

(ii) Risk Offsetting. By entering the Fixed Annuity market, the company will be taking on longevity risk, which will offset some of its existing mortality risk. Selling both of these products is a form of mortality hedging.

4. Continued

(iii) Risk Avoidance. Eliminating risky assets from company's investment portfolio is an example of avoiding risk.

(iv) Risk Monitoring. Introducing a CRO and developing a centralized risk reporting process is an example of risk monitoring.

(v) Risk Evaluation. Based on information augmented by the judgment of management, frequency and severity of risks are evaluated, and risks are ranked to determine highest priority.

5. Learning Objectives:

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

Learning Outcomes:

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

Sources:

ILA-C112-07: ALM for Insurers

Valuation of Life Insurance Liabilities, Ch 13

Life Insurance Products and Finance, Ch 14 Financial Modeling

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

Commentary on Question:

All commentary is listed below the components of the question.

Solution:

(a) Assess the advantages and disadvantages of using deterministic scenarios in this analysis.

Commentary on Question:

With few exceptions, candidates' answers to this question reflected the material in the second study note only. Because the answer came from various sources, it was difficult for the candidate to express mastery of material.

Advantages

- Easy to describe the scenarios and easy to communicate results
- Less time-consuming and resource-intensive than stochastic projections
- The results of certain pre-defined deterministic scenarios (e.g., NY7) are of interest to regulators

Disadvantages

- Large set of scenarios needed for statistical credibility
- Deterministic scenarios tend to produce more favorable results than would be expected statistically (outliers are omitted)
- Disagreement over probability of given scenario

5. Continued

Disadvantages

- Deterministic scenarios do not capture tail risk
- Companies have discretion to make assumptions that reduce rigor of testing
- Ability to modify tests to meet regulatory standards compromises usefulness as check & balance (easily manipulated)

(b) Compare the use of immunization versus cash flow matching.

Commentary on Question:
In general, candidates were able to retrieve the requested material.

Cash Flow Matching – Beginning with the final liability cash flow, purchase assets whose cash flows will exactly offset the liability and work back to present time so that all cash flows are exactly offset for the length of the projection.

Pros

- Completely eliminates interest rate risk

Cons

- Uncertainty of liability cash flows (due to policyholder behavior or timing of mortality) and asset cash flows (due to defaults or prepayments) make cash flow matching difficult to achieve in practice and may lead to rebalancing.
- Cash flow matching reduces the insurer's flexibility to invest in assets that earn higher yields than those needed for exact matching.
- Exact matching of cash flows can only be done in rare instances.

Immunization – Protects against interest rate risk by matching the durations of assets and liabilities.

Pros

- Can eliminate interest rate risk for small, parallel changes in the yield curve

Cons

- Requires constant monitoring and periodic rebalancing, which can be impractical and expensive
- Duration matching is not accurate for large or non-parallel changes in interest rates
  - Can be remedied by matching convexity, which helps cover a wider range of interest rate movements
- Can be perfectly immunized but have big discrepancies in the timing of asset and liability cash flows

5. Continued

(c) Calculate the present value of cash flows using a Modified Duration approach and a discount rate of 6.5%.

Commentary on Question:
Candidates were able to get most of the points in this section. This section of the entire question was where the candidates received the majority of their points.

Modified Duration = Macaulay Duration / 1+i
Mod Duration = 9.86/1.06 = 9.3019
Change in %PV = - Mod Duration * Change in i
= 9.3019 * (6.5 – 6) % = -.0465
New PV = PVCF * (1+ Change in %PV)
= 1450 * (1-.0465) = 1382.561

(d)

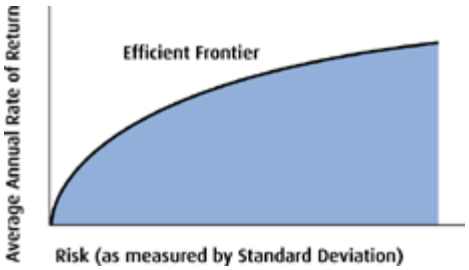
(i) Explain efficient frontier analysis.

Commentary on Question:
Most students had very little to say about the Efficient Frontier. Looking at the study note, it was a very small section in a much larger paper. Even if they didn't have too many points on section (i), some were able to answer part (ii), possibly from study material from this exam or other exams.

- Efficient Frontier analysis provides the framework to pick investment strategy
- Seeks to maximize expected returns subject to risk tolerance
- Represents a continuum of portfolio choices
- Represents most favorable tradeoff between risk and reward
- Can move onto frontier by reallocating without penalty
  - Same return but lower risk
  - Same risk but higher return
- Risk measured by standard deviation
- Return measured by Expected Economic Value

5. Continued

- The graph of efficient frontier would be:



(ii) Construct a portfolio that will achieve a 12.5% GAAP equity growth target with a 90% likelihood of compliance using the Change in Surplus Test.

Commentary on Question:
Three of the most typical solutions are listed below.

Current portfolio fails both return and risk tolerance goals. Need to review the other portfolios to see which two (or more) portfolios achieve the growth target with a 90% likelihood of compliance. Any combination of portfolios that achieve the targets are considered correct.

Solution #1: Exact

- Try using Portfolio B, whose change in equity is lower than 12.5% but probability of failure is less than 10%, and Portfolio C, whose change in equity is higher than 12.5% but probability of failure is greater than 10%.
- Solve for x (Portfolio B %):
  - 12.1% * x + 13.6% * (1-x) = 12.5%
  - x = 73.333% for Portfolio B and 26.667% in Portfolio C.

5. Continued

- Confirm probability of failure compliance :
  - 8% * 73.333% + 14% * 26.667 = 9.6% which is less than 10% of probability of failure.

Solution #2: Estimate

- Try using Portfolio B, whose change in equity is lower than 12.5% but probability of failure is less than 10%, and Portfolio C, whose change in equity is higher than 12.5% but probability of failure is greater than 10%.
- Estimate percentage in Portfolio B using 70%
  - 12.1% * 70% + 13.6% * (1- 70%) = 12.55% which is greater than the target of 12.5%
- Confirm probability of failure compliance :
  - 8% * 70% + 14% * 30 = 9.8% which is less than 10% of probability of failure.

Solution #3: Adjust existing Portfolio

- Portfolio B is closest the 12.5% target with its probability of failure lower than the target of 10%.
- The asset allocation of Portfolio B can be altered to somewhat increase return rates while only increasing ruin risk minimally

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:

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

Sources:

ILA-C100-07: Financial Reporting Developments Accounting for Derivative Instruments and Hedging Activities: A Comprehensive Analysis of FAS 133, Overview and Appendix C only.

Commentary on Question:

Solution:

(a) Explain the general disclosure requirements of SFAS 133 with respect to hedging.

Objectives and strategies for holding or issuing derivatives
Preparation and description of a risk management policy
The amount of gain or loss recognized in earnings during the period due to hedge ineffectiveness

(b) Compare accounting treatment differences between a fair value hedge and a cash flow hedge under SFAS 133.

Fair value hedges require that the gain or loss on the hedging instrument and the offsetting gain or loss on the hedged item be recognized in earnings during the current period.

For cash flow hedges the effective portion of the gain or loss on the derivative instrument is reported as a component of other comprehensive income. It will be reclassified into earnings in the same period the hedged transaction affects earnings.

The difference between the change in value of the derivative and the hedged item is forced through earnings.

(c) Explain the potential impacts of the accountant's proposal.

The accountant wants to use cash flow hedge accounting since the change in the value of the derivative will go through other comprehensive income and not earnings.

6. Continued

However, to the extent that the change in value of the derivative is 300% of the change in fair value of the hedged item the excess change in the derivative's value will likely go through the income statement regardless of whether the hedge is classified as a cash flow hedge or a fair value hedge.

Although some amounts will be accounted through other comprehensive income most of the amounts will likely still go through the income statement. Changing to cash flow hedge accounting will not reduce the large amounts still going through regular income.

The primary issue is that the company is exposed more to the interest rate swap than is necessary to hedge its liabilities. To reduce the impact on the income statement from the interest rate swap, the company should reduce its exposure to the interest rate swap not necessarily change its classification of the hedge as a cash flow or fair value hedge.

7. Learning Objectives:

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

Learning Outcomes:

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

Sources:

Economic Capital for Life Insurance Companies, Chapter 3, Pros and Cons of Existing EC Methodologies

Commentary on Question:

The question is asking the Candidate to explain and apply the concept, approaches and methods for determining Economic Capital.

The Cognitive level of the question was Retrieval and Analysis.

Solution:

(a) Define the Liability Runoff and the one-year Mark-to-Market approaches for Economic Capital.

Commentary on Question:

For the most part, candidates either knew the definitions or did not. Some candidates talked about the methods, but did not include appropriate definitions.

The Liability Run-off approach: Economic Capital represents the current market value of assets required to pay all future policyholder benefits, and associated expenses at the chosen security level, expressed on a VaR or CTE basis, less the current value of liabilities, typically defined on a mean or best estimate basis.

The One Year Mark to Market approach: Economic Capital represents the current market value of assets required to ensure that the market consistent value of liabilities can be covered in one year's time at the chosen security level, expressed on a VaR or CTE basis, less the current value of liabilities, typically defined on a mean or best estimate basis.

(b) Explain the steps a company would take to calculate Economic Capital using the one-year Mark-to-Market approach.

Commentary on Question:

Most candidates had difficulty explaining all the steps required to calculate Economic Capital. They knew a few of the points, but not many.

7. Continued

The required steps are as follows:
The available capital at t=0 measured on an economic basis is the difference between MCA(0) and MCL(0).
MCA: Market Consistent value of Assets; MCL: Market Consistent value of liabilities.
Assets at time 0 and Liabilities at time 0 are projected one year, at which point MCA(1) and MCL(1) are valued to provide a projected economic capital balance sheet at t=1.
MCL(1) is the average PV of liability cash flows, bases on best estimate assumptions over some number of stochastic scenarios, projected over the life of the contracts.
((MCA(1)-MCL(1)) is then discounted to t=0, using the projected earned investment return over the year.
The steps described above are performed for a large number of stochastic scenarios, perhaps 1,000 or more, given the higher security levels.
This gives a distribution of required assets by scenario, from which the overall level of required assets can be determined, i.e., by calculating VAR(99.5%).
The Economic Capital requirement is then determined by deducting MCL(0) from the required assets calculated in the prior step.

(c) Explain challenges of using the Liability Runoff approach for Economic Capital for this company.

Commentary on Question:
In general, the candidates knew several of the specific challenges for the Liability Runoff approach, but answered more in general terms for UL and VA products.

The challenges of this approach are as follows:
Often only considers those risks relating to the existing portfolio, with a limited number of years' of new business included.
The liability runoff approach can give insufficient recognition to the fact that an organization's principal ability to control risk in the short term is through trading assets and/or liabilities, including through reinsurance and portfolio/business transfer.
The liability runoff approach aims to build longer-term management actions into the stochastic model, although in practice this can be difficult to perform comprehensively.
Stochastic projections of longer-term risk emergence and management thereof can be less clear and more difficult to analyze.
In an environment where management changes can occur fairly frequently, making assumptions as to management actions over the longer term can be considered speculative.
This can result in a timing mismatch with short-term performance being compared with risk and capital assessments based on a longer-term horizon.

7. Continued

Complexities with respect to model assumptions, risk interactions and management actions can make this approach to EC relatively difficult to explain and hence easily misunderstood.
Model complexity can lead to longer implementation timeframes and add to the opaqueness of the process.
Calibrating EC to a target security level under a liability runoff approach to an external data source is more difficult.
The liability runoff approach will implicitly assume that short term losses on one line can be offset against longer term profits on another.
Justifying this, and the consequent diversification benefits, can be challenging.

8. Learning Objectives:

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

Learning Outcomes:

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

Sources:

ILA-C112-07

ILA-C113-07

Atkinson & Dallas Chapter 14 and 15

Commentary on Question:

- Focus of question:
  - Predict impact of rising interest rates on SPDA contracts
  - Calculate change in value of assets for given change in interest rates
  - Identify embedded options in assets and liabilities
- Most candidates performed very well on part (b); performance for parts (a) and (c) was much weaker

Solution:

(a) Explain the impact this yield curve shift would have on each of the following:

(i) Asset cash flows of the portfolio

Commentary on Question:

- Candidate performance was average.
- Many recognized that calls and prepayments apply only if interest rates fall.
- While not specified in the question, some candidates noted effect on fixed versus variable rate instruments.
- Common errors:
  - Discussion of effect on market value instead of cash flows.
  - Stating that calls and prepayments increase as market rates increase.
  - Not noting effect of increased surrenders on cash outflows.
  - Not noting effect on timing of cash flows.

8. Continued

- Future cash flows may be contingent on future events, so timing/amount can't be predicted with certainty.
- Calls and prepayments apply only if interest rates fall.
- If insurer does not keep rate competitive, large cash outflows will occur.
- Insurer may be forced to liquidate assets at depressed prices to fund surrenders.
- In times of high rates, liquidity restricted and less funds available to reinvest at favorable rates.

(ii) Statutory liability values

Commentary on Question:

- Candidate performance was poor.
- Common errors:
  - Stating that liability value decreases as interest rates rise

- Current statutory liability values do not change when the market interest rate changes.
- Future liabilities will change as lapse rates increase.

(iii) Policyholder behavior

Commentary on Question:

- Candidate performance was average.
- Most recognized that holder has incentive to lapse and reinvest elsewhere.
- Less commonly noted points:
  - Increased use of loans and partial withdrawals
  - Mitigating effects of surrender charges and MVA

- Policyholders will be more likely to lapse.
- Disintermediation will occur.
- Surrender charges and market value adjustments will help protect company.

(b) Determine which of the asset classes above has the largest impact to the market value of the asset portfolio following the yield curve shift.

Commentary on Question:

- Performance of calculations was very good overall.
- Common errors:
  - Not including ½ in convexity term.
  - Omitting convexity term.

8. Continued

- Switching signs on terms in equation.
- Using 1% or 0.2% instead of 2% for change in i.
- Using whole number instead of percentage/decimal for change in i)
- Not squaring change in i in convexity term.

% change = - ModDuration * (change in i) + 0.5 * convexity *(change in i) ^2 in value

Callable bonds	=	10,000,000 * [-3 * 0.02 + 0.5 * 4 * (0.02) ^ 2]
	=	(592,000)
Mortgages	=	10,000,000 * [-10 * 0.02 + 0.5 * 15 * (0.02) ^ 2]
	=	(1,970,000)
Mortgages	=	10,000,000 * [-7 * 0.02 + 0.5 * 25 * (0.02) ^ 2]
	=	(1,350,000)

Mortgages will have the largest impact on the value of the portfolio.

(c) Identify the embedded asset and liability options in this block of business.

Commentary on Question:

- Candidate performance was average.
- Many noted embedded asset options (bond calls and mortgage/MBS prepayments) and minimum guaranteed crediting rate.
- Less commonly noted points:
  - Policyholder can halt or continue at end date.
  - Company can adjust renewal credited rates.
- Common errors:
  - Confusion with respect to option type.
  - Not identifying surrender right as put option.

- Policyholder has put option: The right to surrender contract at any time for account value.
- Minimum guaranteed credited rate is an interest rate floor.
- Company holds option to adjust credited rates at renewal dates.
- Bond issuers hold call options to retire bond principal early.
- Mortgage and MBS issuers have prepayment option that allows mortgagors to pay down principal early.

9. Learning Objectives:

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

Learning Outcomes:

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

Sources:

Study Note: ILA-C102-09

Actuarial Review of Reserves and Other Annual Statement Liabilities, Ed Robbins

Commentary on Question:

The intent of this question was to test the candidate's ability to apply methods used to test the aggregate progress of actuarial reserves from one fiscal period to the next including the use of Spot Checking Techniques in the reserve review process

In general, candidates did reasonably well on this question. To do well, candidates needed to understand the idea of Tabular Cost including the factors that could affect it over time; as well as how it is calculated. Candidates were also expected to recall and outline the spot check techniques used in the review of actuarial reserves.

Solution:

(a)

(i) We need the Tabular Cost in each of 2009 and 2010 expressed as a fraction of the average Net Amount at Risk (NAAR) in each year.

Tabular Cost = $_0M - _1M + P + I - V_D - V_T$

where
$_0M$ and $_1M$ are respectively the opening and ending reserves during the year
P is the valuation net Premium
I is Tabular Interest
V_D and V_T are the reserves released by death and other terminations

Yr 2009; 2,367,000 - 2,578,500 + 1,425,000 + 125,500 - 119,000 - 60,000 = 1,160,000

Yr 2010: 2,578,500 - 2,200,000 + 1,100,000 + 150,000 - 115,000 - 55,000 = 1,458,500

9. Continued

Average NAAR = .5*($NAAR_{t-1}$ + $NAAR_t$)

NAAR Yr 2009: ((52,500,000- 2,367,000) + (55,125,000- 2,578,500))/2 = 51,339,750
NAAR Yr 2010: ((55,125,000- 2,578,500) + (57,000,000- 2,200,000))/2 = 53,673,250

Average Tabular Mortality Rate = Tabular Cost/Average NAAR

Average Tabular Mortality Rate for Yr 2009: 1,160,000/ 51,339,750 = .02259
Average Tabular Mortality Rate for Yr 2010: 1,458,500/ 53,673,250 = .02717

Change in tabular mortality rate in 2010 is over 20%, a sharp increase over prior years.

(ii) Possible Drivers

- Change in mix of business
- Change in Valuation Assumptions
- Corrections to Reserves

(b) Spot Checks

- Tests of calculations including assumptions and methods
- Transactional checks
  - Check for appropriate treatment of policies surrendered near to valuation date
  - Compare direct reserves to ceded reserves
- Policy trace

10. 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:

ASOP #21: Responding to the Auditor

ASOP #41: Actuarial Communication

Commentary on Question:

The question was trying to test the candidates' understanding of disclosure requirements under ASOP 21 and the communication requirements under ASOP 41.
To receive maximum points, candidates needed to determine the level of disclosure needed for a new valuation methodology and its assumptions.
In general, many candidates were able to identify the sections that should be addressed under each ASOP. However, many candidates did not fully assess whether each section was appropriately or completely addressed in the memo. Candidates' scores could also be improved by providing examples of information that is missing in the memo.

Solution:

Assess the appropriateness and completeness of the memo per the guidance of ASOP 21 (Responding to the Auditor) and ASOP 41 (Actuarial Communication).

Commentary on Question:

In general candidates identified that not enough information on the data and assumptions was provided. Less candidates provided examples of what type of information or assumptions were missing.
The new methodology was described in the memo, however, candidates also received points if they justified that the description of the methodology was inadequate.

It was important for candidates to note that the memo did not state reasons why the methodology changed. Many candidates noted that the impact of the change needs to be presented, however, they could have been more specific about what type of impacts should be included.

ASOP 21:

The memo did not describe the data used in the model, for example, the memo could have sourced the historical equity data used in the random scenario generator.

10. Continued

The memo did not describe the basis for most of the assumptions used, for example, the basis for the corridor for the distribution of scenario results. The best estimate spread assumptions are the same basis as before, however, they should be provided or reviewed.

The memo described the new methodology but did not state reasons for the change. For example, was the change in methodology to comply with new standards? Is the DAC expected to increase or decrease as a result of the change in methodology?

Commentary on Question:
Many candidates commented on the timeliness and identification of the responding actuary. Points were given to candidates for stating memo was not produced in a timely manner or if the responding actuary was not clearly identified if they gave justification (for example, the responding actuary should include his/her name, title, etc.).

Although candidates stated that the memo did not mention any reliance, candidates could have elaborated further and gave examples on what sort of information the actuary would have relied upon.

ASOP 41:

The memo was produced in a timely manner (6 days) and clearly stated that the memo was from the valuation actuary at Coastal Life.

The scope of the memo has been defined. The form of the memo is also appropriate.

The memo did not state any reliance on others, such as who developed the scenario generator. Was the scenario generator validated or checked for reasonableness?

The memo did not mention any compliance with valuation standards.

11. 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:

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

(2c) Calculate liabilities under U.S. statutory, U.S. tax, U.S. GAAP, and DAC assets under U.S. GAAP for the following products:
- (i) Traditional life insurance
- (ii) Term life insurance
- (iii) Universal life insurance
- (iv) Universal life insurance with secondary guarantees

Sources:

ILA-C807-09: market value Margins for Insurance Liabilities in Financial Reporting and Solvency Applications, E&Y October 2007 (up to page 65)

US GAAP For Life Insurers, Second Edition, Ch 3 – Expenses and Capitalization (excl 3, 11)

Commentary on Question:

The intent of this question was to test the candidate's understanding of various financial accounting bases and ability to calculate life insurance policies under different reporting bases for life insurance products.

In general, candidates did reasonably well on this question. For part (a) the questions asked for the BEL calculations for all years following the payment of premium, but the majority of candidates only provided the BEL calculation for the first year.
To do well on this question, candidates needed to know and understand the different formulae used to calculate the policy liabilities under fair value accounting and US GAAP accounting.

Solution:

(a) Calculate the fair value of the insurance liability immediately following the payment of the premium. Show all work.

- Fair Value Liability (FVL) = Best Estimate Liability (BEL) + Market Value Margin (MVM)
- BEL(t) = PV of cashflows at time t

11. Continued

- MVM(t) = Sum of PV of Annual Cost Of Capital.

Calculate BEL(t):

- Amount of benefit paid = # of deaths * Benefit:
  t1 = 30 * 500,000 = 15,000,000,
  t2 = 29.1 * 500,000 = 14,550,000,
  t3 = 28.2 * 500,000 = 14,113,500

- PV of Benefit paid at 6% discount rate = (Benefit paid) * (1 + 6) ^ t
  t1 = 15,000,000/ (1.06) = 14, 150,943
  t2 = 14,550,000 / $(1.06)^{\wedge 2}$ = 12, 949, 448
  t3 = 14,113,500 / $(1.06)^{\wedge 3}$ = 11,849,967

- BEL = PV cash flows discounted to t
  t1 => 38,950,358 = 14,150,943 + 12,949,448 + 11,849,967
  t2 => 26,287,380 = 14,550,000/(1.06) + 14,113,500/$(1.06)^{\wedge 2}$
  t3 => 13,314,623 = 14,113,500/(1.06)

Calculate MVM(t):

- Capital Base = Internal required capital – BEL
  t1 => 48,000,000 - 38,950,358 = 9,049,642
  t2 => 33,000,000 - 26,287,380 = 6,712,620
  t3 => 16,000,000 - 13,314,623 = 2,685,377

- Cost of capital = capital base * cost of capital rate (10 %)
  t1 => 904,964
  t2 => 671,262
  t3 => 268,538

- MVM = sum PV of annual cost of capital at 6%
  = 853,740 + 597,421 + 225,469 = 1,676,630

- Calculate Fair Value Liability:
  FVL = BEL + MVM
  FVL0 = 38,950,358 + 1,676,630 = 40,626,988

11. Continued

(b) Explain the steps, you would take to calculate the insurance liability at the end of Year 1 under:

(i) Fair Value Accounting

Approach under fair value method:

1. Internal economic capital models need to be updated and re-run based on new view of mortality => This will give new required capital values at the beginning of years 2 and 3.

2. Evaluate existing assumptions and see if they are still appropriate under fair value accounting.

3. Recalculate, at the end of year 1, other components of the liability calculation:
   - New death benefit cash flows
   - New BEL values

4. Use the formulae in part (a) to ultimately arrive at MVM

5. Recalculate FVL: FVL = BEL + MVM

(ii) U.S. GAAP

- FAS 60 applies for term insurance product.
- Calculate liability factors (or schedules) based on locked-in assumptions at issue which involves the following steps:

1. Do a gross premium valuation as of the end of year 1 using new best estimate assumptions.

2. If net liability, benefit reserve - DAC, exceeds the gross premium valuation reserve (GPV) then it is fine using the original benefit reserve factors and keeping the DAC at the current level.

3. If the test in #2 fails, loss recognition occurs => write down the DAC until the net liability is greater than the GPV.

4. If DAC write-down still doesn't get to the gross premium valuation reserves, need to establish premium deficiency reserves.

12. 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 and Annuity Reinsurance, Chapters 5, 10 and 13

Commentary on Question:

This question tested candidates' ability to understand and explain the statutory regulations surrounding the use of reinsurance, to understand and explain and how companies can take reinsurance credit if their treaty is disallowed by the state regulator, and to understand the USGAAP view as detailed by FAS 113.

Parts (a) and (b) required knowledge retrieval, while part (c) required candidates to utilize their knowledge of FAS 113 to recommend changes to reinsurance treaties.

Candidates' performance on parts (a) and (b) was stronger than on part (c).

- On part (c), candidates needed to make clear recommendations and justify the reason for the change (using the applicable USGAAP requirements to support their recommendations).

As instructed, candidates should take care to approach part (b) <u>from the ceding company's point of view</u>.

Alternate responses were accepted for part (c), where the candidate provided a reasonable justification and recommendation.

Solution:

(a) List reasons an insurance regulator would disallow the reserve credit for a treaty based on the *Life & Health Reinsurance Agreements Model Regulation*.

The following conditions prohibit a company from establishing reserve credit:

- Renewal expense allowances are not sufficient to cover anticipated renewal expenses of the portion of the business reinsured.
- Ceding company can be deprived of surplus or assets at the reinsurer's option or automatically on the occurrence of some event.
- Ceding company must repay reinsurer for losses under the agreement.
- The ceding company must recapture or terminate the reinsurance at specified points in time.

12. Continued

- The agreement involves payment by the ceding company of amounts not realized from the reinsured policies.
- The agreement fails to transfer all of the significant risk inherent in the reinsured business.
- There is significant asset risk which is not adequately transferred to reinsurer.
- Settlements are made less frequently than quarterly, and amounts due from the reinsurer are not paid within 90 days.
- Ceding company is required to make warranties not related to the business.
- The ceding company is required to make warranties on the future performance of the reinsured business.
- The agreement is principally for the purpose of surplus relief.

(b) Identify the advantages and disadvantages of each from the ceding company's perspective.

(i) Trust

Advantages

- Assets are separate and identifiable.
- Investment income can be limited to the performance of specific assets.
- If the reinsurer is not licensed or admitted in the ceding company's state of domicile, this allows the ceding company to take credit for the reinsurance.
- In the event of recapture, the assets of the trust or escrow account are used for payment, avoiding disputes on the market value of the assets.
- A trust is a true transfer of assets.
- Upon default, beneficiary may withdraw assets as a secured creditor.

Disadvantages

- Creates additional administrative expenses.
- A trust or escrow can result in restrictions on investment management.
- A trust is transfer of ownership, which may create a capital gains tax.
- The company giving up assets will see reduction is assets under management.
- Depreciation in the market value of assets could create surplus strain, should the need to reverse the asset transfer occur.

(ii) Letter of Credit with the reinsurer

Advantages

- Can be obtained for a nominal fee.
- Requires little administration.
- Ceding company may draw down the letter without warning.

12. Continued

Disadvantages

- Short duration (typically one year); renewal capacity and pricing are uncertain.
- There is concern about ability of the ceding company to withdraw funds when needed.

(c) Recommend any changes that would need to be made to each item below so the treaty meets the definition of reinsurance under SFAS 113.

(i) A direct company will establish a deposit account with the reinsurer equal to 15% of expected claims.

Justification for required change:

- For the purposes of GAAP, all elements must be matched against appropriate revenue or benefit base in a manner consistent with that required of GAAP treatment for directly issued business.
- Both amount and timing of payments should depend on and vary with the timing of claims settled under the reinsured contracts.
- 15% of expected claims is too small to qualify as reinsurance under SFAS 113.

Recommended change:

- Deposit account be set up equal to expected claims for the time period of settlement within the contract.

(ii) A reinsurer may cancel the reinsurance treaty with 30 days notice, at the end of each calendar year.

Justification for required change:

- GAAP risk transfer looks at whether transfer is temporary or permanent.
- Generally, no party may unilaterally terminate existing reinsurance under a treaty, but a treaty may be terminated with respect to new business with proper notification.
- As such, the clause would likely not qualify for risk transfer.

Recommended change:

- Reinsurer may terminate for new business with 30 days notice.

12. Continued

(iii) The reinsurer may defer payment of claims for a maximum of five years.

Justification for required change:

- SFAS 113 states that contractual provisions that delay timely reimbursement to the ceding enterprise negate the risk transfer provision.
  - Deferrals of 5 years seem excessive.
- Under GAAP, all elements must be matched against appropriate revenue or benefit base in a manner consistent with that required of GAAP treatment for directly issued business.
  - Because the timing of the benefits paid would not line up with the timing of claim payments from reinsurer, this would not meet the definition of reinsurance.

Recommended change:

- Allow claim deferral of no longer than one year.

(iv) A direct company may recapture business under the reinsurance treaty anytime after the tenth year.

Justification for required change:

- Recapture is generally allowed only after a specific period of time has elapsed following original policy cession, and then only if a retention increase has taken place.
- Consider the time period needed to recover acquisition expenses.
- 10 years may be too long, depending on the length of the contract and length of the treaty.

Recommended change:

- Recapture provisions available at end of every year (or reasonable timeframe for liability).

13. 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:

(2c) Calculate liabilities under U.S. statutory, U.S. tax, U.S. GAAP, and DAC assets under U.S. GAAP for the following products:
- (v) Traditional life insurance
- (vi) Term life insurance
- (vii) Universal life insurance
- (viii) Universal life insurance with secondary guarantees
- (ix) Deferred annuity
- (x) Payout annuity
- (xi) Variable annuity with guaranteed minimum death benefits
- (xii) Variable annuity with guaranteed living benefits
- (xiii) Equity-indexed annuities
- (xiv) Equity-indexed life insurance
- (xv) Variable life insurance with guaranteed minimum death benefits
- (xvi) Riders

Sources:

Valuation of Life Insurance Liabilities, Chapter 10, Deferred Annuities

Commentary on Question:

This question tested candidates' understanding of the CARVM calculation under AG33:

- Calculate greatest present value of lump sum distributions using principles of CARVM
- Calculate greatest present value of a settlement option under CARVM

This question tested comprehension and knowledge utilization.
Candidates received most points by performing the reserve calculations for both the surrender and the annuity streams, and showing that they had to be compared.
Most candidates knew the basic steps to calculate the CARVM under AG33.
Several candidates calculated the reserve as of issue rather than at the end of the first year as asked in the question.
Some of those students who realized that they had to calculate the present value at time = 1 dropped the time one cash surrender value and annuity benefit. The question assumes that the time 1 valuation is just before the payment of the one cash surrender value or annuity benefit and therefore these should not be dropped. This error had a very minimal impact on the mark.
Most candidates did not know how to interpret the description of the annuity benefit in the question, but provided the remainder of the solution was right, it did not affect the mark much.
Only about half the candidates knew how the return of premium benefit works.

13. Continued

Solution:

(a) Calculate the CARVM reserve for the contract at the end of the first policy year under Actuarial Guideline 33.

Under AG33 CARVM, all possible benefit streams must be identified and valued. The CARVM reserve is the greatest present value of these various benefit streams.

In this case, the policyholder can:

- Surrender the contract
- Annuitize the contract

Surrender Benefit:

Accumulate the account value and cash value at each point in time, then discount to the end of year 1.

$AV_0 = 100{,}000$

$AV_t = AV_{t-1} * (1 + \text{credited rate})$

$CSV_t = AV_t * (1 - \text{surrender charge \%})$

PV (surrender benefit) @ t=1 = $CSV_t / (1 + \text{valuation rate})^{(t-1)}$

End of Year	Guaranteed Rate	AV	Surrender Charge	CSV	PV Surrender Benefit
1	3.5%	103,500	8%	95,220	95,220
2	1.5%	105,053	6%	98,749	94,497
3	1.5%	106,628	4%	102,363	93,737
4	1.5%	108,228	2%	106,063	92,943
5	1.5%	109,851	0%	109,851	92,117

Greatest present value for surrender benefit stream: 95,220

Annuitization Benefit:

Calculate the annuity benefit at each point in time, then discount to the end of year 1.

13. Continued

Annuity benefit$_t$ = AV$_t$ * (1 / 1.05)
PV (annuitization benefit) @ t=1 = Annuity benefit$_t$ / (1 + valuation rate) ^ (t – 1)

End of Year	AV	Annuity Benefit	PV Annuity Benefit
1	103,500	98,571	98,571
2	105,053	100,050	95,742
3	106,628	101,551	92,993
4	108,228	103,074	90,323
5	109,851	104,620	87,730

Greatest present value for annuitization benefit stream: 98,571

CARVM reserve = max (PV surrender benefit, PV annuitization benefit)
= max (95,220 , 98,571)
= 98,571

(b) Calculate the CARVM reserve at the end of the first policy year for the SPDA contract with the return of premium feature.

The return of premium feature changes the surrender benefit in the first 2 years, but does not affect the annuitization benefit stream.

New surrender benefit$_t$ = Max (100,000 , CSV$_t$)

End of Year	Surrender Benefit	PV Surrender Benefit
1	100,000	100,000
2	100,000	95,694
3	102,363	93,737
4	106,063	92,943
5	109,851	92,117

Greatest present value for surrender benefit stream: 100,000

CARVM reserve = max (PV surrender benefit, PV annuitization benefit)
= max (100,000 , 98,571)
= 100,000

14. 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 calculate 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, health & Annuity Reinsurance, Third Edition, Chapters 4, 5 and 14

Life and Health Reinsurance, Ch 14 Tax Effects on Reinsurance

Commentary on Question:

The question is trying to test the candidate's understanding of basic reinsurance concepts, the impact of reinsurance on a company's financials, and understanding of basic income statement and balance sheet items.
The cognitive levels on this question are retrieval, analysis, and comprehension.

Solution:

(a)

(i) Calculate the Gain from Operations for both ABC and XYZ for Year 1. Show all work.

Commentary on Question:

To gain maximum points for this part, the candidate must show all work, including all formulas. If formulas are not shown and the answers are correct, then the candidate receives credits for implied formulas. However, if the answers are incorrect and no formulas are shown, no credits are given.

Most candidates did well on the main calculations. Where candidates made mistakes is the inclusion of policy fee in various calculations, and the treatment of expense allowance.

14. Continued

Gain from Operations

	ABC Life	Formulas	XYZ Re
Revenue:			
Premiums:			
Gross	5,025	Premium + Policy Fee	4,000
Ceded	4,000	Premium x Coins %	0
Net	1,025	Gross - Ceded	4,000
Investment Income:			
Surplus	60	Inv Rate of Return x Initial Surplus	60
Reserves	0	Inv Rate of Return x YR0 Net Reserve	0
Total	60	Inv Inc on Surplus + Inv Inc on Res	60
Reinsurance Allowance	4,100	YR1 Expense Allowance % x YR1 Ceded Prem + Prem Tax Rate x YR1 Ceded Prem	0
Total Revenue	5,185	Net Prem + Total Inv Inc + Reinsurance Allowance	4,060
Benefits:			
Claims			
Gross	10,000	Death Benefits	8,000
Ceded	8,000	Death Benefits x Coins %	0
Net	2,000	Gross - Ceded	8,000
Surrenders	0		0
Reserve Increase:			
Gross	400	Mean Reserve - YR1	320
Ceded	320	80% x (Mean Reserve - YR1)	0
Net	80	Gross - Ceded	320
Total Benefits	2,080	Claims + Surrenders + Net Reserve Increase	8,320
Expenses:			
Commissions	4,774	YR1 Comm Rate x (Premium + Annual Pol Fee)	4,000
Acquisition	350		0
Maintenance	25		0
Premium Tax	126	Premium Tax Rate x (Premium + Annual Pol Fee)	100
Total Expenses	5,275	Commissions + Acquision + Maintenance + Premium Tax	4,100
Gain from Operation	-2,170	Total Revenue - Total Benefits - Total Expenses	-8,360

14. Continued

(ii) Determine the amount of surplus relief that ABC receives from this reinsurance agreement at the end of Year 1.

Surplus relief is the difference between ABC Life' Gains from Operation before and after reinsurance.

ABC Life's Gain from Operation before Reins = Gross Prem + Inv Inc - Gross Claims - Surrenders - Gross Increase in Reserve - Commissions - Maint Exp - Acq Exp - Prem Tax

= 5,025 + 60 - 10,000 - 0 - 400 - 4,774 - 25 - 350 - 126 = -10,590

Surplus relief = -2,170 - (-10,590) = 8,420

15. Learning Objectives:

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

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

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.

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:

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

(2c) Calculate liabilities under U.S. statutory, U.S. tax, U.S. GAAP, and DAC assets under U.S. GAAP for the following products:
- (i) Traditional life insurance
- (ii) Term life insurance
- (iii) Universal life insurance
- (iv) Universal life insurance with secondary guarantees
- (v) Deferred annuity
- (vi) Payout annuity
- (vii) Variable annuity with guaranteed minimum death benefits
- (viii) Variable annuity with guaranteed living benefits
- (ix) Equity-indexed annuities
- (x) Equity-indexed life insurance
- (xi) Variable life insurance with guaranteed minimum death benefits
- (xii) Riders

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

(5b) 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

15. Continued

Sources:
ASOP #10 Methods and Assumptions for Use in Life Insurance Company Financial Statements Prepared in Accordance with GAAP

Valuation of Life Insurance Liabilities, Ch 5 Valuation Methodologies and Approximations

Life Insurance Products and Finance, Chapter 16

Valuation of Liabilities, Ch 16 Risk-Based Capital

Commentary on Question:
The question was intended to test the Candidate's knowledge of the guidelines around Pfads and the Candidate's ability to value a business.
Part (a) was generally well written. Most candidates answered this part by calculating: NLP = Gross Premium*(PV Benefits)/(PV Premiums) which was perfectly acceptable. Those who did not do so well simply did not get the calculation correct and did not show sufficient work to get a partial credit.
A fair number of the Candidates in part (a) answered in generalities concerning Pfads rather than addressing the specific situation outlined.
In part (b) a number of Candidates recalculated a new C-1 required capital but did not take into account the residual non-C-1 required capital and came to an incorrect conclusion.

Solution:
(a)

Net Level Premium= (PV Benefits)/(annuity factor)
PV Ben = 100,000*(0.45%)/(1.05)+100,000*(1-0.45%)*(1-10%)*(0.59%)/(1.05^2) = 908.04
annuity factor = 1+(1-0.45%)*(1-10%)/(1.05) = 1.85329
NLP = 908.04/1.85329 = 489.96
Pfads should take into account the degree to which that assumption is subject to risk but should be reasonable in the actuary's judgment.
Mortality Pfad is in the 1-3% range - since industry mortality experience is being used this is likely too low.
A 50% reduction in the lapse assumption seems excessive - particularly in view that Company experience is being used.
In any case Pfads should not make the net level premium greater than the gross premium (potentially it could be greater prior to the introduction of Pfads.

15. Continued

(b) Evaluate the adequacy of ZYX's offer.

The minimum amount of assets that need to be transferred = Policy Liabilities +required capital - EV

C1 component of required capital = 0%x1Million + 1% x 3Million + 4%x2Million = 110000

Residual required capital = 400000-11000 = 290000

C1 component is minimized if we take 1M of government bonds, 3M of Corporate Bonds and 1M of commercial mortgages.

New C1 component = 1M x 0% + 3M x 1% + 1M x 4% = 70000
New required capital = 290000 + 70000 = 360000
Then minimum assets = 5600000 + 360000 - 800000 = 5160000

ZYX has offered only 5000000 in assets - CBA should not accept the proposal.

16. Learning Objectives:

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

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

Learning Outcomes:

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

(1d) Explain the appropriate accounting treatments for such items as but not limited to:
- (i) Separate Accounts
- (ii) Embedded Options
- (iii) Derivatives
- (iv) Secondary Guarantees

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

(2b) Recommend appropriate valuation under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax
- (iv) Fair Value Accounting

(2c) Calculate liabilities under U.S. statutory, U.S. tax, U.S. GAAP, and DAC assets under U.S. GAAP for the following products:
- (i) Traditional life insurance
- (ii) Term life insurance
- (iii) Universal life insurance
- (iv) Universal life insurance with secondary guarantees
- (v) Deferred annuity
- (vi) Payout annuity
- (vii) Variable annuity with guaranteed minimum death benefits
- (viii) Variable annuity with guaranteed living benefits
- (ix) Equity-indexed annuities
- (x) Equity-indexed life insurance
- (xi) Variable life insurance with guaranteed minimum death benefits
- (xii) Riders

16. Continued

Sources:
US GAAP For Life Insurers, Second Edition, Ch 1 GAAP Objectives and Their Implications to Life Insurers

SOP 05-1: Financial Reporter Article 03/06: AICPA Releases SOP 05-1- Accounting by Insurance Enterprises for Deferred Acquisition Costs in Connection with Modifications or Exchanges of Insurance Contracts

US GAAP For Life Insurers, Second Edition, Ch 3 Expenses and Capitalization (excl. 3.11)

US GAAP For Life Insurers, Second Edition, Ch 6 Universal Life Insurance

Valuation of Life Insurance Liabilities, Ch 1 Overview of Valuation Requirements (LO#2)

Commentary on Question:
The question is trying to test the students knowledge of common practices related to US GAAP and US Statutory accounting.
Question requires some knowledge of common GAAP rules in addition to the ability to analyze a situation and recall the appropriate available guidance available to give an informed recommendation to management.
Stating that a practice is appropriate or not appropriate and then ending there got the candidate no credit. The use of the word "Evaluate" tried to get across the point that the student needed to supply good reasons for their recommendations.
US GAAP is codified in the form of the various SFASs. Citing rules in SFASs or communicating common practice is what was expected of the candidates (not walking us through their own view of how they would like to see earnings emerge).

Solution:
Evaluate the appropriateness of each of the recommendations.

(i) To simplify GAAP benefit reserve calculations, use the statutory CRVM reserve as a proxy for the GAAP benefit reserve.

Commentary on Question:
Candidate was to evaluate the use of a proxy. Stating that the two reserve methods are different but not saying why one was or was not an appropriate proxy missed the point of the question.

16. Continued

GAAP benefit reserve for all UL contracts starts with the account value. Since this is available on the administrative system, there is usually nothing complicated about getting it and there is no calculation necessary. There may also be reserve liabilities necessary such as an unearned revenue reserve or a SOP 03-1 reserve. In general, statutory accounting focuses on the balance sheet and conservatism and GAAP focuses on the income statement and the desire to give a fair picture of the earnings of the corporation. Hence, using the statutory reserve as a proxy for GAAP is not ok and your auditors would likely challenge you on it (unless it's on a very immaterial block).

(ii) Capitalize all first year expenses and commissions.

Commentary on Question:
Saying we can defer all deferrable expenses doesn't adequately demonstrate knowledge.

Only expenses primarily directly related to the acquisition of policies can be deferred. You may also capitalize commissions in excess of the ultimate commission rate. Expenses and commissions that are not capitalized go right through to the bottom line as expenses.

(iii) Build a reserve that levelizes benefits as a constant percentage of policy charges.

Commentary on Question:
The candidate was expected to recognize that the question was referring to a SOP 03-1 liability here.

In the case of products where there is a definite pattern of mortality gains followed by losses, you can set up an SOP 03-1 liability that brings claims in as a level percentage of assessments (but only in that situation). The present value of claims is divided by the present value of assessments and the liability is set based on this ratio. The ratio and the liability is unlocked periodically much like DAC and URL are.

(iv) Establish a claim fluctuation reserve to smooth annual financial results.

Commentary on Question:
Candidates were expected to recognize this is prohibited by US GAAP.

16. Continued

The purpose of GAAP is not to smooth financial results but to match obligations and revenue. Claims fluctuation or smoothing reserves like this are prohibited by US GAAP rules.

(v) Amortize DAC over 10 years to speed up the emergence of profits.

Deferrable expenses should be amortized over EGPs throughout the term of the contract / the period over which material margins emerge. It would be highly unusual to have material margins emerge over only 10 years on a UL contract. Furthermore, emerging over a shorter time period would lower early profits, not hurt them.

(vi) Use 105% of the company's experience mortality in calculating the expected gross profits.

Commentary on Question:
Candidates were expected to recognize UL business doesn't include PADs in the calculation of EGPs.

FAS 97 business uses best estimate assumptions without the use of PADs in amortizing DAC. If the company experience is not credible, using 105% of experience could be appropriate as you go through a credibility calculation. If the 5% stated is a PAD, that would be inappropriate under US GAAP.

(vii) Replace current UL policies with a higher margin product to amortize DAC at a lower rate.

Commentary on Question:
Looking for the recognition that replacements are covered using the rules of SOP 05-1.

SOP 05-1 states that we write off the existing DAC in situations where a new replacement contract is substantially changed. So more than likely, the DAC on this contract would be written off and replaced with DAC on the new contract in this situation.