

CSP-IU Model Solutions

Spring 2013

1. 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.

Learning Outcomes:

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

Sources:

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

Fair Value of Liabilities: The Financial Economic Perspective, NAAJ, Jan. 2002

http://www.soa.org/library/journals/north-american-actuarial-journal/2002/january/naaj0201_2.pdf

Commentary on Question:

The question was trying to test the candidates' knowledge in fair value of liabilities by identifying the advantages and disadvantages of different methods, also by utilizing the knowledge by applying them in calculations. Part (a) can be given maximum points by listing the various advantages and disadvantages. Part (b) and (c) can be given maximum points by presenting the full calculation steps which requires deep thought in the derivations of fair value concepts. Most candidates did well in part (a) as only listings are required. But for part (b) and (c), very few candidates got full or substantial points as most of them used the wrong formulas.

Solution:

- (a) Describe the advantages and disadvantages of the following methods of calculating the fair value of liabilities:
 - (i) Direct method
 - (ii) Indirect method
- (i) Direct Method
Advantages:
 - Simpler to implement
 - More reliable assessment of the risk of financial leverage

1. Continued

Insurance risks can be accommodated by adjusting discount rates or expected cash flow

Disadvantages:

Hardly used in setting of exit prices
Issue of credit risk is front and center

(ii) Indirect Method

Advantages:

More easily related to exit prices
Implicitly reflect liquidity
Own credit risk does not appear to enter into the process

Disadvantages:

More complex to implement

- (b) Calculate the required profit that enables the firm to earn its cost of capital assuming expenses of 15 at the end of year 1. Show all work.

$$\begin{aligned}MVA_0 &= (MVA_1 + A_1) / (1 + r + \theta_A) \\ &= (0 + 1200) / (1 + 0.1 + 0.03) \\ &= 1061.95\end{aligned}$$

$$\begin{aligned}DDE_0 &= (DDE_1 + DE_1) / (1 + r + \theta_K) \\ &= [0 + (1200 - 20\% \times 5000 - 15)] / (1 + 0.1 + 0.09) \\ &= 155.46\end{aligned}$$

$$\begin{aligned}\text{Indirect FVL}_0 &= MVA_0 - DTL_0 - DDE_0 \\ &= 1061.95 - 0 - 155.46 \\ &= 906.49\end{aligned}$$

$$\begin{aligned}RP &= (\theta_K - \theta_A) \times (MVA_0 - FVL_0) \\ &= (0.09 - 0.03) \times (1061.95 - 906.49) \\ &= 9.32\end{aligned}$$

- (c) Calculate the quantity Z used in the certainty equivalent approach assuming no expenses and using the approaches defined in “Fair Value of Liabilities, the Financial Economic Perspective.” Show all work.

$$\begin{aligned}S &= [p Su + (1 - p) Sd] / (1 + r + \lambda\sigma) \\ &= [0.2 \times 5000 + (1 - 0.2) \times 0] / (1 + 0.1 + 0.09) \\ &= 840.34\end{aligned}$$

$$\begin{aligned}[p Su + (1 - p) Sd - Z] / (1 + r) &= [p Su + (1 - p) Sd] / (1 + r + \lambda\sigma) \\ [0.2 \times 5000 + (1 - 0.2) \times 0 - Z] / (1 + 0.1) &= 840.34 \\ Z &= 75.63\end{aligned}$$

2. 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.

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

Sources:

ILA-C100-07: Financial Reporting Developments Accounting for Derivative Instruments and Hedging Activities: A Comprehensive Analysis of FASB Statement 133 (Overview and Appendix C only)

Commentary on Question:

This question tested the candidate's understanding of how FAS 133 impacts the recognition and measurement of derivatives and hedging activities.

Solution:

- (a) Briefly define the three types of hedging, as described in FAS 133.

Commentary on Question:

Candidates generally did well on this part.

Fair value hedges are used to hedge exposure to changes in fair value. Cash flow hedges are used to hedge exposure to variability in expected future cash flows. Hedges of net investments in foreign operations are used to hedge translation exposure to changes in foreign exchange rates.

- (b) Recommend the type of hedging that Mod Life should use for each product. Justify your answer.

Commentary on Question:

On this part, few candidates received full credit, but most candidates received partial credit. Many candidates did not recognize that Product A falls outside the scope of FAS 133 due to the insurance exclusion. For Product B, the model solution recommends a cash flow hedge, but if the candidate recommended a fair value hedge, credit was given if the candidate provided a sound reason. In either case, no credit was given for a recommendation without a sound reason.

2. Continued

Product A:

This product does not fall within the scope of FAS 133. The insurance exclusion applies since only the death benefit is adjusted for inflation.

Product B:

The choice is limited to either a fair value hedge or a cash flow hedge, since the nature of the risk to be hedged is unrelated to foreign operations. Fair value hedges address risks that arise due to prices, rates or terms that are fixed or known. Cash flow hedges address risks that arise due to prices, rates or terms that are variable or unknown. A cash flow hedge is recommended, since Mod Life wants to manage the unknown impact of inflation on future benefit payments.

- (c) Identify the significant criteria your recommended type(s) of hedging must meet to qualify for hedge accounting treatment under FAS 133.

Commentary on Question:

On this part, few candidates received full credit, but most candidates received partial credit.

The significant criteria are as follows:

- The relationship between the derivative instruments and the hedged item must be formally documented.
 - The risk management objective and strategy for undertaking the hedge must be formally documented.
 - The hedging relationship is expected to be highly effective in offsetting changes in cash flows or fair value.
 - The hedged item presents an exposure to changes in cash flows or fair value that could affect reported earnings.
 - The hedged item is not related to an asset or liability that is or will be re-measured with changes in fair value attributable to the hedged risk reported currently in earnings.
 - The hedged item is not related to an investment that is or will be accounted for by the equity method.
- (d) Describe the impact your recommendation would have on reducing volatility in Mod Life's GAAP earnings.

Commentary on Question:

On this part, few candidates received full credit, but most candidates received partial credit.

2. Continued

Product A:

The insurance exclusion precludes hedge accounting treatment under FAS 133. The gain or loss on the derivative instruments (i.e. the change in fair value of the derivative instruments) would be reported in earnings, resulting in earnings volatility.

Product B:

If the candidate recommended a cash flow hedge in Part (b):

If the hedge qualifies for hedge accounting treatment under FAS 133:

- The effective portion of the gain or loss on the derivative instruments would be reported in OCI and reclassified into earnings when the hedged item affects earnings.
- The ineffective portion of the gain or loss on the derivative instruments would be reported in earnings.
 - The ineffective portion equals the cumulative change in fair value of the derivative instruments minus the cumulative change in the present value of expected cash flows of the hedged item, but not less than 0.
 - Earnings would be volatile to the extent that the ineffective portion is greater than 0.

If the hedge does not qualify for hedge accounting treatment under FAS 133, the gain or loss on the derivative instruments (i.e. the change in fair value of the derivative instruments) would be reported in earnings, resulting in earnings volatility.

If the candidate recommended a fair value hedge in Part (b):

If hedge qualifies for hedge accounting treatment under FAS 133:

- The gain or loss on the derivative instruments (i.e. the change in fair value of the derivative instruments) would be reported in earnings.
- The offsetting loss or gain on the hedged item (i.e. the change in fair value of the hedged item) would be reported in earnings.
- Earnings would be volatile to the extent that the gain or loss on the derivative instruments is not exactly offset by the loss or gain on the hedged item.

If the hedge does not qualify for hedge accounting treatment under FAS 133, the gain or loss on the derivative instruments (i.e. the change in fair value of the derivative instruments) would be reported in earnings, resulting in earnings volatility.

3. Learning Objectives:

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

Learning Outcomes:

- (3a) Describe the considerations and evaluate the appropriate form of reinsurance from the ceding and assuming company perspectives.
- (3b) 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) Reserve credit requirements.

Sources:

Life and Health Reinsurance, Third Edition, 2005 by Tiller, Chapter 4, Basic Methods of Reinsurance.

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

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Explain the key differences between YRT reinsurance and Coinsurance.

Commentary on Question:

The candidates, in general, did well on this part.

1. YRT reinsurance premiums are not related to the direct premiums that the insured pays whereas Coinsurance reinsurance premiums use the reinsurance quota share percentage applied to the direct premiums that the insured pays.
2. YRT reinsurance usually has a 100% expense allowance applied to the YRT reinsurance premium scale in the first policy year only whereas Coinsurance reinsurance has a varying percentage by policy year applied to the direct premiums that the insured pays.
3. YRT reinsurance typically only cedes the mortality risk whereas Coinsurance reinsurance cedes all policy risks.

3. Continued

(b)

Commentary on Question:

The candidates, in general, did well on the mathematical calculations. However, on part (ii), the candidates had difficulty in providing reasons for selecting each particular reinsurance arrangement.

(i) Calculate the Net Present Value (NPV) at policy inception of future cash flows, assuming no other cash flow items, for two reinsurance arrangements shown in the exam question. Show all work.

1. YRT

a. Reinsurance premiums for policy years 1, 2 and 3 are as follows:

$$\text{Policy year one} = 1,000,000 * .7 * 0/1000 = 0$$

$$\text{Policy year two} = 900,000 * .7 * 3.4/1000 = 2,142$$

$$\text{Policy year three} = 800,000 * .7 * 3.6/1000 = 2,016$$

b. Reinsurance claims for policy years 1, 2 and 3 are as follows:

$$\text{Policy year one} = 2,000,000 * .7 = 1,400$$

$$\text{Policy year two} = 1,980,000 * .7 = 1,386$$

$$\text{Policy year three} = 1,920,000 * .7 = 1,344$$

$$\text{c. NPV} = 0 + (2,142 - 1,400)/1.05 + (2,016 - 1,386)/1.05^2 - 1,344/1.05^3 = 117$$

2. Coinsurance

a. Reinsurance premiums net of expense allowance for policy years 1, 2 and 3 are as follows:

$$\text{Policy year one} = 3,000 * .5 * (1 - .4) = 900$$

$$\text{Policy year two} = 2,700 * .5 * (1 - .1) = 1,215$$

$$\text{Policy year three} = 2,400 * .5 * (1 - .1) = 1,080$$

b. Reinsurance claims for policy years 1, 2 and 3 are as follows:

$$\text{Policy year one} = 2,000,000 * .5 = 1,000$$

$$\text{Policy year two} = 1,980,000 * .5 = 990$$

$$\text{Policy year three} = 1,920,000 * .5 = 960$$

$$\text{c. NPV} = 900 + (1,215 - 1,000)/1.05 + (1,080 - 990)/1.05^2 - 960/1.05^3 = 358$$

(ii) Describe factors to consider when determining which reinsurance arrangement, if any, to accept.

1. Since the NPV of ceded cash flows for YRT are lower than the Coinsurance, the cash flows net of reinsurance for the direct company will be higher if reinsurance is done on a YRT basis.
2. NPV alone does not provide enough information.
3. Consider LPT's risk strategy.
4. Consider LPT's capital relief needs
5. Consider new business strain

3. Continued

(c) The following approach is proposed to evaluate reinsurance arrangements:

Commentary on Question:

The candidates had much difficulty explaining the relationship of reinsurance to economic capital.

Step 1: Calculate Gross Economic Capital (EC) for the underlying block of business

Step 2: Calculate Reinsurance % = Ratio of Reinsurance Premium to Direct Premium

Step 3: Reinsurance Economic Capital credit is equal to Gross EC * Reinsurance %

Critique this approach to evaluating reinsurance arrangements.

1. Under the proposed method, the Reinsurance Economic Capital credit is always proportional to premium, which is not appropriate.
2. Reinsurance Economic Credit should be a function of the amount of risk transferred as risk transferred is not necessarily proportional to premium.
3. Method may be effective for comparing different coinsurance reinsurance arrangements, but does not work for YRT reinsurance.
4. A better method would be to reflect the reinsurance structure directly in a stochastic model.

4. 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:

- (4a) Describe and calculate basic performance measures.

Sources:

Embedded Value: Practice and Theory, SOA, Actuarial Practice Forum, March 2009
<http://www.soa.org/library/journals/actuarial-practice-forum/2009/march/apf-2009-03-frasca-lasorella.pdf>

Commentary on Question:

Most candidates demonstrated sound knowledge of EV and scored reasonably well in part (a) and (b). Some candidates did, however, miss the intention of the questions. For example, for part (b) (ii), the question was looking for differences between PVDE and IBV. But some mis-interpreted and explained components of EV instead. For part (c), candidates struggled with the detailed inclusions and exclusions of IBV and ANW.

Solution:

- (a) You are given the following statements:

- EV is an accounting basis applied primarily to life insurance business that provides an alternate means of measuring the value of such business at time of issue.
- Companies use EV for such purposes as profitability analysis, statutory reporting and acquisition purchase prices.
- EV is a measurement of the value that shareholders own in an insurance enterprise comprised of capital, surplus, and the present value of earnings.

Evaluate the above statements and provide any corrections as necessary.

Commentary on Question:

For part (a), candidates did well. To get full credits, candidates need to outline other uses of EV.

1. False. EV can be applied to any long-duration insurance business. It measures the value of business at any point in time.
2. False. EV cannot be used for statutory reporting. In addition to profitability analysis and acquisition purchase prices, it can also be used for performance measurement for executive compensation and assessment of return for capital allocation purposes.

4. Continued

3. False. EV is a measurement of the value that shareholders own in an insurance enterprise, comprised of capital, surplus, and the present value of earnings to be generated from the existing business. It does not consider new business.

- (b) EV is expressed as $EV = IBV + ANW$, where:

IBV: In-force Business Value

ANW: Adjusted Net Worth

- (i) Explain these two components as they pertain to the company's book of business.
- (ii) Describe the difference between the calculation of present value of distributable earnings (PVDE) and IBV in terms of capital distribution.

Commentary on Question:

For part (b), most candidates demonstrated a knowledge of the components within the formula for IBV and ANW; however, to get full credit for this part, candidates needed to connect the details to the specific case in the question.

- (i) EV measure the value that shareholders own in Evergreen Life, comprised of capital, surplus, and the present value of earnings to be generated from the existing UL and VA business.

IBV:

- PV of after-tax statutory book profits (PVBP) less PV of Cost of Capital (PV COC) using BE assumptions at valuation date and risk discount rate.
- Book profits include: sum of (premiums, investment income, capital gains, charges from UL policies and fee income from VA policies) less sum of (claims, surrenders, maturities, expenses, increase in statutory reserves, and taxes).
- Cost of capital for an accounting period is the amount of investment earned on the capital at the beginning of the period at the Risk Discount Rate (RDR) in excess of the after-tax investment rate of return.
- Intangible assets are not included since they are not distributable.

4. Continued

ANW:

- Consists of realizable (i.e. distributable) value of capital & surplus.
- Evergreen Life's statutory capital and surplus should be adjusted to include liabilities from UL & VA that are allocation of surplus (e.g. Asset Valuation reserve that comes from assets backing these businesses).
- Not the entire amount is distributable. Two approaches can be used to determine ANW: (1) Only free surplus is marked to market and tax effected, and (2) Both required/statutory capital and free surplus are marked to market and tax effected.

- (ii) PVDE is calculated with a starting level of required capital and includes the distribution of that capital.

IBV does not include distributions of capital, but includes an adjustment for the cost of the capital.

$$IBV = PVDE - RC$$

- (c) Calculate the EV assuming all assumptions are up-to-date and no changes in prospective assumptions. Show your work.

Commentary on Question:

Most candidates scored the ANW section well but did poorly on IBV calculation. They were expected to demonstrate knowledge of the components of ANW and IBV, with their inclusions and exclusions. However, many failed to do so. For example, ANW does not include intangible asset and IBV does not include cost of capital. On the other hand, most candidates realized that the given IBV was an opening value and needed adjustments.

ANW does not include intangible asset. IBV does not include cost of capital.

$$EV = ANW + IBV$$

$$ANW = \text{required capital} + \text{surplus} = 20.0 + 3.3 = 23.3$$

Revised IBV

= starting IBV + model corrections

= starting IBV + AVR correction + investment income correction + experience refund correction

$$= 40 + (1.4 - 2.5) + (33.0 - 40.0) + (12.0 - 8.0)$$

$$= 40 + (-1.1) + (-7.0) + 4.0$$

$$= 35.9$$

4. Continued

$$\begin{aligned} &\text{Ending IBV} \\ &= \text{revised IBV} + \text{expected contribution from New Business and In-force Business} \\ &\quad + \text{experience gains/loss} \\ &= 35.9 + 0.8 + 21.5 + 3.5 \\ &= 61.7 \end{aligned}$$

$$\text{EV} = \text{ANW} + \text{IBV} = 23.3 + 61.7 = 85.0$$

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 including actual vs. projected differences
 - (v) Recommend appropriate strategies
- (6c) Explain limitations of models and possible sources of error:
- (i) Quality of data
 - (ii) Granularity of the model

Sources:

ILA-C112-07: ALM for Insurers

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

Valuation of Life Insurance Liabilities, Lombardi, 4th Edition

- Chapter 13, Cash Flow Testing

ASOP 23 Data Quality (excluding transmittal Memo and Appendices)

http://www.actuarialstandardsboard.org/pdf/asops/asop023_141.pdf

Commentary on Question:

Part (a) is retrieval. Parts (b) and (c) of the question are testing for the understanding and knowledge on the ALM process and techniques. In general, the candidates have performed well in part (a), poorly in part (b), and average in part (c). To receive full credit, the candidate should provide adequate details on the ALM tools and demonstrate an understanding on the ALM process in part (b).

Solution:

- (a) Describe the following Asset Liability Management (ALM) diagnostic tools and list the advantages and disadvantages of each:
- (i) Immunization
 - (ii) Cashflow Matching
 - (iii) Dynamic Financial Analysis

5. Continued

Commentary on Question

Most candidates were able to answer (i) and (ii), but not many were able to demonstrate understanding in DFA. To get full credit, candidates should also provide a definition/description of the tools.

Immunization

Definition:

- Matching the duration of asset and liabilities
- Impact from interest rate change on the values of the liabilities are offset by the corresponding impact on the asset values

Advantage:

- Directly/Easily calculated from the cash flows

Disadvantage:

- Does not work for large or non-parallel shifts in interest rates
- Uncertainty in liability cash flow patterns
- Requires rebalancing

Cash Flow Matching

Definition:

- Matching the asset and liability cash flows

Advantage:

- Eliminate interest rate risk

Disadvantage:

- Uncertainty in liability cash flow patterns
- Inflexibility in purchasing assets; Liability cash flows tend to have longer duration than asset cash flows, might be impossible to find assets with matching cash flows
- Unable to take advantage of the company's view in future interest rate position, resulting in lower investment income.

Dynamic Financial Analysis

Definition:

- DFA consists of 5 stages: summarizing the initial condition, construct a scenario generator, develop a financial calculator, build an optimizer to evaluate the best strategic alternative and analyzing results.

Advantage:

- Provide a multiple risk focus

5. Continued

Disadvantage:

- Complex model
- Long run time

(b) Critique the memo for completeness and appropriateness:

Commentary on Question

This section was answered poorly. The question was looking for comments and criticism with respect to the ALM process and technique. Instead most candidates focused on commenting the format of the memo based on a specific ASOP which the question did not specify.

- For the memo, we may need buy-in / approval from someone more senior than Valuation Actuary
- A successful ALM implementation requires senior management's support and commitment in the project
- Memo should ensure a clear assignment of roles and responsibilities
- ALM manager must balance the need to produce timely and actionable management information with a sensitivity towards contributors and their other ongoing responsibilities
- The memo suggests using immunization for the ALM tool. Other possible tools should also be considered, such as VaR
- Neither statutory nor gaap reporting is suitable for depicting investment risk. Recommend using economic value reporting
- ALM focus on risks at the enterprise level with a holistic approach, therefore an ALM department should be established rather than incorporating the ALM process to the valuation department.

(c) Determine the appropriateness of the data provided by the investment department and what additional information, if any, is necessary to ensure compliance with ASOP 23, Data Quality.

Commentary on Question

Most candidates had properly referred to the ASOP.

- Actuary should consider what data to use: current in-force assets, assets available for purchase, future interest rate patterns, strategy for negative cash flows.
- Additional information required on the assets: market value, timing of cash flows, quality and liquidity of the assets
- Consider the data definitions
- Consider the appropriateness of the data for the intended purpose of analysis
- Consider the sampling methods

5. Continued

- Reviewed the data for reasonableness, consistency and comprehensiveness
- Disclose reliance on data by others
- Adjust questionable data to improve quality of data
- Consider cost and feasibility of alternative data
- Actuary is not required to audit the data, determine whether the data is falsified or intentionally misleading, searching for questionable or inconsistent data
- If in the actuary's professional judgment it is not necessary to perform a review of data, then the actuary should disclose that a review was not done and disclose any resulting limitation on the use of the actuarial work product

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.
- (7b) Identify, categorize and evaluate potential sources of risk in investments including but not limited to credit risk liquidity and asset-liability matching.
- (7e) Describe and apply methods of risk mitigation and hedging and to understand the limitations of such methods.

Sources:

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

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

Commentary on Question:

The goal of this question is to test candidates' understanding of ALM strategies essential to insurance companies, including how different asset categories can be used and how they influence insurance companies' overall performance

Candidate needs to

- a) Demonstrate an understanding of general ALM Process
- b) Demonstrate an understanding of asset categories and how they are used to back insurance products
- c) Clearly communicate the advantages and disadvantages of each recommendation to mitigate the different risks

Solution:

- (a) The company backs these products with investment grade corporate bonds that are held to maturity. Within its Asset Liability Management (ALM) strategy, ABC is willing to review and modify their investment strategy and credit risk limits depending on prevailing market conditions.
 - (i) Determine if convexity is an important component of the company's interest rate risk. Justify your answer.
 - (ii) Explain potential problems with the company's approach to its ALM strategy.

6. Continued

Commentary on Question:

Overall, most candidates received partial credit for describing the importance of convexity affecting overall ALM strategy. However, to receive full credit, candidate must explain the key features of FA and UL products that produce liability convexity, not just vague points from convexity definition. Candidates should also provide supporting rationale for the appropriate conclusion.

- (i) There is convexity in liability: including but not limited to minimum guaranteed crediting rates, as well as persistency risks embedded. It is not appropriate to assess a company's risks on asset alone and conclude there is no convexity risk.
- Convexity is an important component of the company's interest rate risk, and it is second order interest rate risk.
 - There is significant convexity in liability due to the persistency risk / policyholder behavior / minimum guaranteed crediting rates in company's 2 largest products
 - There is minimal convexity in asset: the asset portfolio included public corporate bonds only, which has low or no convexity. No derivatives allowed means there will be no additional convexity in assets
 - Hence, there is significant convexity mismatch in Asset – Liability
- (ii) Credit limits should not just be on total portfolio: there should be limits on sector, geographic areas, or maximums for any one holding.
- Investment grade, \geq BBB, is not a meaningful credit limit because the range of available investments is too wide.
 - Adjusting limits to resolve limit breaches is not sound risk management.
- (b) Describe key problems with the current dynamic lapse formula and recommend changes.

Commentary on Question:

Overall, most candidates have difficulties describing the limitations of current lapse assumptions. Candidates need to provide explanation on how the recommendations address the problems associated with lapse formula.

- Model needs to be designed and calibrated independently from the risk taking function: in this case agents selling lots of policies have an incentive to understate the products' risks

6. Continued

- Models based on historical data, even with adequate data points included, may not be enough to understand extreme situations. The dynamic lapse formula is calibrated to a falling interest rate environment and assuming policyholders will act the same when interest rate rises is not appropriate.
- The company may be significantly understating additional lapses and therefore be unprepared for disintermediation risks when interest rates rise: loss of future profits, unable to recover acquisition costs, forced to liquidate bonds when prices fall, forced to obtain additional funding

Some additional comments are relevant to the problems includes:

- The modeling actuary was the only one reviewed/improved/implemented this formula - this may not be enough independent expert review or adequate control.
 - Agents may not be considered experts to have the formula calibrated to.
 - Buy-and-hold strategy means the company is not actively managing credit risks thus default risk may be important
- (c) Determine which product has higher persistency risk, using only projected profitability. Justify your answer.

Commentary on Question:

Overall, candidates did well in part (c). To receive full credit, candidate must provide clear explanation leading to the appropriate conclusion.

Universal Life has more persistency risk because

- Cost from Front End Commission is higher - can't be recovered if policy surrenders early
- Acquisition Expenses are higher - can't be recovered if policy surrenders early
- Lower surrender charges (or higher surrender values) - policyholders are less discouraged about leaving
- Higher mortality margin - from annual COI charges so profits can't be realized if policy surrenders early, since this is

7. Learning Objectives:

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

Learning Outcomes:

- (3a) Describe the considerations and evaluate the appropriate form of reinsurance from the ceding and assuming company perspectives.
- (3b) 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) Reserve credit requirements.

Sources:

Life and Health Reinsurance, Third Edition, 2005 by Tiller

- Chapter 5 Advanced Methods of Reinsurance
- Chapter 13 GAAP Accounting for Reinsurance
- Chapter 10 Reinsurance Regulations

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Reinsurance treaties must comply with FAS 113.
 - (i) Explain the difference between Statutory and U.S. GAAP reporting with regard to risk transfer.
 - (ii) Explain how each of the two reinsurance proposals, from the perspective of U.S. GAAP Reporting, complies with FAS 113 as it pertains to risk transfer.

Commentary on Question

Performance on sections (a)(i) and (a)(ii) was relatively poor, with students generally having trouble recalling FAS113 requirements. To obtain full marks on question (a)(ii), the students were expected to explain how reinsurance treaties comply with FAS113 in general and to evaluate how the two proposals presented in the question comply with FAS113. Students had difficulty presenting the treaty elements as they pertain to FAS113 qualification, with many simply explaining the differences between the two types of treaties outside of the FAS 113 application.

7. Continued

(i) Statutory:

- For statutory reporting, the focus is on solvency and on the responsibility of future benefit payments.
- If the ceding company is allowed to reduce its liabilities or establish an asset, the regulators need to be certain that risk associated with the liabilities or assets is truly transferred to the reinsurer and that the financial statements contain accurate statement of liabilities.

GAAP:

- Focus more on whether the transfer of risk is permanent or temporary.
- To qualify for reinsurance accounting, the agreement must provide indemnification, not just financial relief.
- Concern with long range economic results of the treaty.

(ii) General requirements to qualify as FAS 113:

- The contract must contain uncertainty as to both the underwriting (claims) and the timing of payments.
- It is required to have the reasonable possibility that the reinsurer may realize a significant loss from assuming the reinsurance.
- Reinsurer(s) to pay benefits to the ceding company in the same time frame as the ceding company pays benefits to its policyholders.

In terms of the two reinsurance contracts listed in the question, there are problems for FAS 113 qualification:

- Yearly Renewable Term Coinsurance: the reinsurer's investment and lapse risk are limited as there is no reserve buildup. This potentially limits the possibility of a significant amount of loss from assuming this block of business.
- Funds-Withheld Coinsurance: there could be an extended period of time when the reinsurer wouldn't have to pay any benefits.

(b) With respect to a funds withheld coinsurance arrangement with Oceanic Re:

(i) Assess the suitability of this proposal for Midwest Life.

(ii) Discuss the advantages and disadvantages of using:

- An Escrow account
- Letter of Credit

7. Continued

Commentary on Question

Performance on question (b)(i) was lower than expected; question (b)(ii) was completed relatively well. For (b)(i), students were expected to mention the reserve credit issue brought about by the differing states of domicile would lead to a reserve credit limitation and how the proposed funds withheld coinsurance solves the issue. Overall for (b)(ii), full credit was achieved.

(i)

- The ceding company may not be allowed to reflect a reserve credit if the reinsurer is not licensed or admitted in the ceding company's state of domicile.
- In this case, the ceding company may be required to hold 100% of policy reserves, reflecting the pre-reinsurance level.
- This problem is somewhat mitigated if the ceding company continues to hold all assets backing the reserves.

(ii) **Escrow Accounts**

Advantages

- If the reinsurer is not licensed or admitted in the ceding company's state of domicile, a properly structured escrow account permits the ceding company to recognize the appropriate reserve credit.
- Identify and ear-mark assets associate with the risk transfer, limiting dispute on the market value of assets upon recapture.

Disadvantages

- Can be expensive to administer.
- Includes restrictions on investment management.
- If the asset transfer is later reversed, depreciation in market values could create a surplus strain.

Letter of Credit (LOC)

Advantages

- Inexpensive and easy to obtain
- Requires very little administration.

Disadvantages

- LOC are of short duration, typically only one year, and neither renewal capacity nor pricing is certain.
- Ceding company has difficulty to withdraw the funds when actually needed.

7. Continued

- (c) Explain the implications of recapture under U.S. GAAP reporting from the ceding company's perspective.

Commentary on Question

Overall, performance was poor for this question with few question writers obtaining points for section (c).

If it is highly likely that recapture will occur in a short period of time, such reinsurance is recognized as temporary in nature. The only economic effect is the payment of a fee from the ceding company to the reinsurer; GAAP accounting would not reflect any transfer of assets and liabilities.

8. Learning Objectives:

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

Learning Outcomes:

- (5a) Explain and distinguish the roles of capital from the perspectives of regulators, investors, policyholders and insurance company management.
- (5b) Describe the US Risk Based Capital (RBC) regulatory framework and the principles underlying the determination of Regulatory RBC, and be able to compute RBC for a US life insurance company including:
- Identification of significant risk components
 - Identification of specialized product RBC requirements
 - Interpreting results from a regulatory perspective
 - Implementation under emerging US principle-based approach

Sources:

Valuation of Liabilities, Lombardi

- Chapter 16, Risk-Based Capital, exclude 16.6

Commentary on Question:

Question tests basic knowledge of how RBC works and why RBC is important. Numerical example is relatively straightforward for a well versed student. The key in the very last part of the question is to make a recommendation of what to do (notice the use of the word recommend in the question).

Solution:

- (a) List reasons for regulators' interest in a company's RBC position.
- RBC measure increased the capital requirements for insurers and increased the authority of regulators over life insurance companies with deteriorating financial conditions.
 - The primary concern of regulators is the policyholders and the insurer's abilities to satisfy their contractual obligations to policyholders.
 - The act is meant to minimize the risk of insolvency and to allow insurers to measure the soundness of insurance companies.
- (b) The actuary in charge of statutory reporting prepared the RBC reports and made the following comment:
- “I calculated the RBC Ratio at 105%. Since the ratio is greater than 100% I am sure the regulators will be satisfied.”

Critique the above comment.

8. Continued

The actuary is obviously not trained in the ways of RBC. Most companies target their RBC level at 200-300% of target RBC.

There are five action levels triggered based on the RBC level. An RBC ratio of 105% would fall into the “regulatory action level” trigger (100-150%). The company would be required to submit an action plan to improve RBC and the commissioner would specify the required next steps.

The company would need to be above 150% to avoid corrective actions ordered by the Commissioner.

(c)

- (i) Calculate the RBC ratio. Show all work.
- (ii) Evaluate the two investment strategies and recommend changes to each strategy as necessary to meet management targets.

A size factor is computed based on the number of issuers of bonds (Size Factor = Total Weighted Issuers / Total Number of Issuers). Total Weighted Issuers = First 50 x 2.500 + Next 50 x 1.300 + Next 300 x 1.000 + Over 400 x 0.900.

So the size factor is $(50 \times 2.5 + 50 \times 1.3 + 300 \times 1.0 + 100 \times 0.9) / 500 = 1.16$.

RBC is the size factor X statement value X RBC factor. Government bonds have no RBC factor so their contribution to required RBC is zero.

$$= 1.16 \times 1100 \times 0.013 = 16.588.$$

Using the provided formula, the Authorized Control Level (ACL) Risk-Based Capital was calculated as follows:

$$\text{ACL RBC} = 0.5 \times \{0 + 5 + [(16.588 + 30)^2 + 0 + 50^2]^{0.5}\} = 36.67.$$

RBC Ratio = Total Adjusted Capital / Authorized Control Level Risk-Based Capital = $95 \div 36.67 = 259\%$.

Current Investment Strategy:

Yield is low because of conservative investments and RBC ratio is more than adequate given that management only requires 200%.

8. Continued

- Can increase yield by buying bonds with higher risk class and trading in less risky bonds
- Could trade in bonds and invest in other asset classes having higher yields such as stock.
- Watch RBC though and make sure it meets management's tolerance.
- Not many assets earn more than 12%; would be difficult to earn 12% ROC, may want to reduce minimum to reflect investment environment

Alternate Investment Strategy:

Yield is higher because of riskier investments and RBC ratio is more than adequate given that management only requires 200%. Sort of the opposite problem that the current strategy has (maybe we really need to take the very best of both strategies).

Focus should be on increasing RBC

- Improve quality of bonds by buying better NAIC class. Better classes have lower capital requirements
- Increase the number of issuers. The higher number of issuers has smaller adjustment factors.
- Have more unaffiliated stock. Unaffiliated has a smaller capital factor than affiliated
- Reduce the beta on affiliated stock, beta adjustments are included in capital requirements
- Invest more in asset classes with lower factors, this can be cash or other type of investments

9. 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:

- (7c) Describe and evaluate the other risks an insurance company faces including operational, marketplace and expense risks.
- (7d) Describe how risks (e.g. product, investments and operational) and opportunities interact and how they influence firm strategy.
- (7e) Describe and apply methods of risk mitigation and hedging and to understand the limitations of such methods.

Sources:

ERM Specialty Guide, Chapters 1-6.

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

Commentary on Question:

The goal of this question is to test candidates' understanding of ERM, including how risks (such as product risks, investments risks and operational risks) and opportunities interact with each other and how they influence an insurance company's ERM process

Candidate needs to

- a) Demonstrate an understanding of overall ERM Process
- b) Clarify the uses of risk mitigation strategies associated with specific insurance products
- c) Clearly communicate the advantages and disadvantages of each recommendation to mitigate risks

Solution:

- (a) Explain how the following factors affect the quality of the ERM process according to the ERM Specialty Guide:
 - Judgment
 - Breakdowns
 - Collusion
 - Management override

Commentary on Question:

Overall, most candidates received credit for describing how the four factors affecting ERM.

9. Continued

Solution:

- Judgment - human judgment can falter under the pressures of time and information constraints
- Breakdowns - mistakes and errors can result from fatigue, distractions or lack of training and experience
- Collusion - two or more individuals may collude to circumvent controls, conceal activity or alter data
- Management override - may suspend prescribed controls for illegitimate purposes

(b) FL's management is especially concerned about risks associated with:

- Potential excess volatility on its variable annuities block
- Redundant XXX reserves held for its term insurance products
- Amount of capital locked in its closed blocks

(i) Describe the pros and cons of using each of the following strategies to mitigate the above risks:

- Hedging
- Securitization
- Strategic Risk Management

(ii) Recommend the most suitable strategy to mitigate the above risks for each of FL's blocks of business.

Commentary on Question:

Overall, most candidates received partial credit for describing the pros and cons of using each of the risk mitigation strategies. However, to receive full credit, candidate must go beyond retrieval and show comprehensive knowledge by providing detailed explanation and appropriate conclusion concerning the situation described in the question.

Hedging

- Earnings are based on fixed % of the underlying assets and hence they are sensitive to market movement. Company may want to incorporate a static portfolio hedge for their VA business, designed to offset losses from lower revenues because of a potential decline in assets.
- Dynamic hedging can also be used.
- Protect statutory and GAAP earnings
- Protect tail risks
- Protect the company from policyholder behaviors / basis risks.

9. Continued

Securitization

- Reserve relief for Term. The viability of these securitizations is predicated on the redundancy of a large proportion of the excess reserves. Can be used as an alternative to reinsurance
- Closed block securitization. Relief for assets assigned to support the closed block.
- EV securitization. Capital relief and New Business Strain relief.
- Reduce VA volatility
- Mortality catastrophe bonds to help mitigate mortality risks

Strategic Risk Management

- Focus on products with better risk-return profile
- Realize natural hedge in the product mix: longevity risks from annuities and mortality risks from life insurance products
- Achieve scale by managing assets supporting the products together

10. 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 including actual vs. projected differences
 - (v) Recommend appropriate strategies
- (6b) Apply a model office process and make appropriate recommendations.

Sources:

Life Insurance products and Finance, by Atkinson and Dallas

- Chapter 14, Financial Modeling

Valuation of Life Insurance Liabilities, Lombardi, 4th Edition

- Chapter 13, Cash Flow Testing

ASOP 7 Analysis of Life, health or Property and Casualty Insurer Cash Flows (excluding Transmittal Memo and Appendices)

http://www.actuarialstandardsboard.org/pdf/asops/asop007_128.pdf

ASOP 22 Statement of Opinion Based on Asset Adequacy Analysis (excluding Transmittal Memo and Appendices)

http://www.actuarialstandardsboard.org/pdf/asops/asop022_140.pdf

Asset Adequacy Analysis Practice Note, Dec. 2004, Exclude Sections B, I and K

http://www.actuary.org/pdf/practnotes/life_asset.pdf

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) With respect to asset adequacy testing:
 - (i) Identify situations that indicate a need for CFT.
 - (ii) Identify situations where other types of analysis might be sufficient.
 - (iii) List acceptable methods of asset adequacy analysis other than CFT.

10. Continued

Commentary on Question

Most candidates were able to list other acceptable methods of asset adequacy analysis, and most recognized that cash flow testing is not needed if business is insensitive to interest rates. In order to earn full credit, the candidate should have identified several situations in which cash flow testing was necessary or unnecessary.

- (i)
 - 1. There are material asset risks
 - 2. There are liabilities that have cash flows far out into the future
 - 3. The company has a new or rapidly growing line of business
 - 4. Options have been granted to policyholders and the risk of antiselection in the exercising of these options is significant
- (ii)
 - 1. The risks are short term liabilities supported by short term assets
 - 2. The risk is an unanticipated source of significant claims
 - 3. If, in the actuary's judgment, the block of business is relatively insensitive to changes in economic conditions or interest rate scenarios
- (iii)
 - 1. Gross premium reserve test
 - 2. Risk theory techniques
 - 3. Loss ratio methods
 - 4. Demonstrate the degree of conservatism is so great that moderately adverse deviations are covered
- (b) In previous CFT models, the only strategy for handling negative cash flows was to borrow cash internally from another product line within the company. Identify other strategies for handling negative cash flows and explain the modeling considerations for each.

Commentary on Question

In general, most candidates did well on this part and were able to identify the appropriate strategies.

- 1. Borrow money externally
 - You must make an assumption about the interest rate that will be charged
 - The interest rate assumption should reflect the company's credit quality (company's ratings, capital position, borrowing capacity, etc.)
- 2. Sell assets
 - The model must calculate the market value of assets to be sold
 - The model will need rules for determining which assets to sell first, such as: sell assets with largest capital gains, sell assets with shortest time to maturity, sell assets that have been held at least one year

10. Continued

- (c) Recommend changes to the assumptions. Justify your answer.

Commentary on Question

Most candidates were able to recommend a few valid assumption changes; to earn full credit, a candidate should have recommended several assumption changes for lapse rate, expenses, and taxes. Some candidates did not understand credited rate and market rate; the credited rate is a given and it is not appropriate to just change the credited rate in the model to match the market rate.

Base Lapse Rate

Should not use same lapse rate for all plans; lapse rate will be influenced by the level of surrender charges, the duration from issue, and the difference between the credited rate and the market rate

Consider using a dynamic lapse assumption, where lapse rates vary from scenario to scenario and from year to year

Consider setting lapse assumption by plan code according to company experience

Excess Lapse Rate

An excess lapse formula should be developed based on differentials between credited rates and market rates, and adjusted for impact of surrender charges

SPDA1 should have the lowest excess lapse assumption because the credited rate is higher than the market rate

SPDA2 should have the highest excess lapse assumption since the credited rate is lower than the market rate and it is out of the surrender charge period

Taxes

Taxes should be modeled

According to ASOP 22, asset adequacy analysis should take into account anticipated material cash flows, which includes taxes

Expenses

Should consider maintenance expenses, overhead expenses, and investment expenses

The current expense assumption should be checked for reasonableness against company experience; a multiplier could be used in the model to make expenses equal actual

10. Continued

Could split expenses into fixed and variable; fixed could increase to account for inflation and variable could decrease over time as economies of scale are reached

- (d)
- (i) Additional reserves must be established for the SPDA, UL, and VA lines.
 - (ii) Bighorn could retest the SPDA and VA blocks together. The combined assets will potentially result in more scenarios with positive ending surplus for SPDA.
 - (iii) In the 11 scenarios for which the UL block had negative PV of ending surplus, the WL block had very large positive results. Bighorn could combine the UL and WL results and report them as "Total Life Results" to make the results look more favorable.
 - (iv) To ensure the UL block passes all scenarios (i.e. having positive PV of ending surplus), Bighorn could increase its UL reserves.

Critique each of the above statements.

Commentary on Question

To earn full credit, the candidate should have stated whether the statement was appropriate or not and provided justification for that assessment. Many candidates did well on parts (i) and (iv), however many candidates struggled with parts (ii) and (iii) as they did not understand the difference between testing blocks of business together and reporting blocks of business together.

- (i) This is not necessarily correct. When a large number of scenarios are run, the failure of a small percentage may not indicate a need for more reserves. The actuary should use professional judgment in determining if the number of failed scenarios indicates a need for additional reserves.
- (ii) This is not necessarily appropriate. According to ASOP 22, the liabilities of two blocks should not be tested together if the assets used to support one block cannot be used to support the other block. In this case, the VA block likely contains separate account assets that could not be used to support the SPDA block.
- (iii) This is acceptable. According to ASOP 22, after testing is done the deficiencies in one segment may be offset by sufficiencies in another segment for the purpose of reporting and documenting results.

10. Continued

- (iv) This is inappropriate. When forming an opinion on the adequacy of reserves, the actuary should consider whether reserves are adequate under moderately adverse conditions. Holding reserves so great as to withstand any conceivable adverse situation would imply an excessive amount of reserves.

11. 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.

Learning Outcomes:

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

Sources:

ILA-C800-07: IASA, 2001, Chapter 12 Federal Income Taxation, up to page 15 and pages 32–33 only

Valuation of Life Insurance Liabilities, Chapter 1 Overview of Valuation Requirements

Commentary on Question:

This question tested the candidate's understanding of basic concepts underlying the determination of U.S. life insurance company taxable income.

Solution:

- (a) U.S. life insurance companies are required to use Federally Prescribed Tax Reserves (FPTRs) in the calculation of taxable income. Briefly describe the method, interest rate and mortality table requirements for calculating FPTRs on life insurance policies.

Commentary on Question:

Candidates tended to be too general in their answers and to not provide enough detail to support full credit for this part. However, most candidates received partial credit.

FPTR's should be calculated using the following methodology and assumptions:

- Methodology should be CRVM
 - Interest rate should be the maximum of :
 - PSAR (Prevailing State Assumed Rate)
 - AFIR (Applicable Federal Interest Rate)
 - Mortality table should be the prevailing Commissioners standard table
- (b) U.S. life insurance company taxable income (LICTI) is defined as gross income less deductions.
 - (i) Describe the general deductions that life insurance companies use to determine their LICIT.

11. Continued

Commentary on Question:

Numerous deductions are listed in the source. Most candidates were familiar with at least three of the deductions.

General deductions used to determine LICTI include the following:

- Death and Other Policy Benefits
- Increase in Tax Reserves
- Policyholder Dividends
- Dividends Received Deduction
- Operations Loss Deduction
- Consideration Paid to Reinsurer
- Amortization of DAC
- Other Deductions Similar to General Corporate Taxpayers

- (ii) Calculate the LICTI for the tax years 2008, 2009, and 2010. Show all work.

Commentary on Question:

Many candidates understood the 3 year operation loss carry back. Fewer candidates applied the small company deduction.

		2008	2009	2010
A	Tentative LICTI	\$300,000	\$300,000	\$200,000
B	Loss Carryback*	\$300,000	\$150,000	\$0
C	Tentative LICTI After Loss Carryback (A – B)	\$0	\$150,000	\$200,000
D	Small Life Insurance Company Deduction (C x 60%, max of \$3 million)	\$0	\$90,000	\$120,000
E	LICTI (C – D)	\$0	\$60,000	\$80,000

*Operation Losses can be carried back three years:

- Apply the loss in 2011 to the 2008 tentative LICTI
- Apply the loss in 2012 to the 2009 tentative LICTI
- No losses remain to apply to the 2010 tentative LICTI

- (c) When determining LICTI, your company plans to calculate the DAC amortization deduction using the following assumptions:
- DAC capitalization rate is 7.7%
 - DAC amortization period is 10 years
 - Reinsurance is ignored

Recommend changes, if any, to the assumptions above. Justify your answer.

11. Continued

Commentary on Question:

The points earned on this part were fairly uniformly distributed across the possible outcomes.

For the DAC capitalization rate, I recommend using the correct rate for each product type:

- 1.75% for annuities
- 2.05% for group life
- 7.70% for individual life and A&H products

For the DAC amortization period, the company is a small company and is therefore allowed to amortize over 5 years. I recommend using 5 years.

I recommend the company not ignore reinsurance. The company should reflect the net consideration paid for reinsurance arrangements.

12. 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) Recommend and justify 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

Sources:

US GAAP for Life Insurers, Second Edition, Chapter 4 Traditional Life Insurance (SFAS 60 & SFAS 97)

Commentary on Question:

For a SFAS 97 limited-pay product, this question tested the candidate's understanding of 1) considerations impacting the selection of GAAP valuation assumptions and 2) how the deferred profit liability helps match revenue with costs.

Solution:

- (a) Describe considerations taken into account when determining the interest, mortality and lapse assumptions for the U.S. GAAP valuation model.

Commentary on Question:

Most candidates correctly stated that the assumptions should be best estimate plus a provision for adverse deviation, but many candidates provided little relevant information beyond this.

12. Continued

The valuation interest assumption should be best estimate plus a provision for adverse deviation (PAD). The best estimate should be consistent with current yields available in the marketplace and the company's historical investment experience. The PAD should serve to decrease the valuation assumption.

The valuation mortality assumption should be best estimate plus PAD. The best estimate should be based on historical mortality experience and will typically not reflect anticipated mortality improvement. The PAD should serve to increase the valuation assumption.

The valuation lapse assumption should be best estimate plus PAD. The best estimate may vary by a variety of factors such as issue year and premium frequency, and if composite rates are used, they should be representative of the anticipated business mix. Testing is typically needed to determine whether the PAD should serve to increase or decrease the valuation assumption.

- (b) Explain the role of the Deferred Profit Liability, in a U.S. GAAP context, for this product.

Commentary on Question:

Most candidates correctly indicated that profits would not emerge properly without a Deferred Profit Liability, but many candidates struggled to describe why the profits would not emerge properly and how the Deferred Profit Liability fixes the problem.

For this type of product, U.S. GAAP requires profits to be recognized over the benefit period. Without a Deferred Profit Liability, profits would emerge as a level percentage of premiums. Since the premium-paying period is limited, profits would therefore emerge over a period of time that is shorter than the benefit period. The Deferred Profit Liability spreads profits over the entire benefit period, causing them to emerge as a level percentage of insurance in force.

- (c) Calculate the Deferred Profit Liability for this policy at the end of policy year 1. Show all work.

Commentary on Question:

Candidates who used the approach illustrated in the model solution typically did well on this part. Candidates who used the alternative annual book profits approach (involves determining and discounting the book profit for each policy year) typically did not do as well because they did not correctly reflect investment income and reserve changes in the annual book profits.

12. Continued

First, determine the present value of book profits at issue:

- $PVBEN_0 =$ present value of benefits at issue
 $= 1,000,000 \times (0.01) / (1.06) +$
 $1,000,000 \times (1 - 0.01) \times (0.015) / (1.06)^2 +$
 $1,000,000 \times (1 - 0.01) \times (1 - 0.015) \times (0.02) / (1.06)^3$
 $= 39,026$
- $PVME_0 =$ present value of maintenance expenses at issue
 $= 40 +$
 $40 \times (1 - 0.01) / (1.06) +$
 $40 \times (1 - 0.01) \times (1 - 0.015) / (1.06)^2$
 $= 112$
- $PVPROF_0 =$ present value of book profits at issue
 $= \text{Single Premium} - \text{Acquisition Expense} - PVBEN_0 - PVME_0$
 $= 50,000 - 7,500 - 39,026 - 112$
 $= 3362$

Next, express the present value of book profits at issue as a percentage (PROF%) of the present value of insurance in force at issue:

- $PVINS_0 =$ present value of insurance in force at issue
 $= 1,000,000 +$
 $1,000,000 \times (1 - 0.01) / (1.06) +$
 $1,000,000 \times (1 - 0.01) \times (1 - 0.015) / (1.06)^2$
 $= 2,801,842$
- $PROF\% = PVPROF_0 / PVINS_0$
 $= 3362 / 2,801,842$
 $= 0.12\%$

Finally, calculate the Deferred Profit Liability at the end of policy year 1 (DPL_1) by applying PROF% to the present value of insurance in force at the end of policy year 1:

- $PVINS_1 =$ present value of insurance in force at end of policy year 1
 $= 1,000,000 +$
 $1,000,000 \times (1 - 0.015) / (1.06)$
 $= 1,929,245$
- $DPL_1 = PROF\% \times PVINS_1$
 $= 0.12\% \times 1,929,245$
 $= 2,315$

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:
 - (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

- (2e) Describe and assess the impact of emerging U.S. principle-based reserve regulation on the valuation of reserves.

Sources:

Valuation of Life Insurance Liabilities, Chapter 8 Universal Life Insurance

Commentary on Question:

The purpose of this question is to see if the candidate understands the process of CRVM and the rationale for some steps (GMP calculation, different processes used for over-funding vs. under-funding cases). It also tests an important element of UL products -- secondary guarantee, and if the candidate understands the need for additional reserving other than CRVM.

Most candidates are able to explain that GMP is the premium to endow the policy calculated on a guaranteed basis. But only less than half did well on (a)(i).

For (b)(i), less than 1/3 of candidates realized "Smith" is the over-funded case and fund roll-forward is needed. The "Lee" case was answered well. Unfortunately the question didn't provide any information on expense allowances. Any valid assumption (including $EA = 0$) received full marks.

For (b)(ii) it was important to keep the analysis within context. This question discusses statutory reserve, but many candidates wrote down GAAP SOP 03-1.

13. Continued

Solution:

- (a) With regard to U.S. statutory reserves for Universal Life (UL) products:
- (i) Explain the purpose of the guaranteed maturity premium (GMP) in the CRVM reserve calculation.
 - (ii) Describe the process used to calculate GMP for flexible premium products.
 - (i) Since UL products have flexible premium, future premium pattern is unknown. So it's hard to apply net level premium reserve as for traditional products. GMP is a reasonable assumption for future premium that can be used as gross premium in the net premium reserve calculation.
 - (ii) The Guaranteed Maturity Premium is the annual level gross premium paid on the issue date and periodically thereafter during the premium payment period. It provides for an endowment for the face amount at the latest permissible maturity date under the contract. It's calculated using policy guarantees as to expense charges, cost of insurance charges and interest credits.
- (b)
- (i) Calculate the basic CRVM reserve at the end of year 2 for each of the two policyholders.
 - (ii) Determine the appropriateness of holding only the basic CRVM reserve for these policies, and list the additional reserves (if any) which are required to be held. (Calculations are not required.)
 - (i)

SMITH:
Current fund > GMF, so re-projection of the fund is needed. Need to roll forward from the actual fund = 66500
Use GMP = 32275.6 as the deposit to the fund
 $66500 + 32275.6 = 98775.6$

Use guaranteed (not current) expense charge, risk charge, and interest rate, to roll forward the fund.
Expense charge = 120
Risk charge = Guar risk charge rate * NAAR
NAAR = Face - (Fund YS + Premium) = $100000 - 98775.6 = 1224.4$
Risk charge value = $3.96/1000 * 1224.4 = 4.85$
Fund after charges and before interest = $98775.6 - 120 - 4.85 = 98650.8$

13. Continued

$$\text{Interest} = 98650.8 * 2\% = 1973.0$$

$$\text{Fund at end of year 3} = 98650.8 + 1973.0 = 100623.8$$

The fund at maturity is greater than face amount now, so maturity benefit = 100623.81

Death benefit = 100000 (assumed death benefit paid at year end)

$$\begin{aligned} \text{CRVM at end of year 2} &= (\text{death benefit} * \text{valuation mortality} + \text{maturity} * \\ & (1 - \text{valuation mortality})) / (1 + \text{valuation interest rate}) - \text{valuation premium} \\ &= [100000 * 3.96/1000 + 100623.8 * (1 - 3.96/1000)] / (1 + 4\%) - 30969 \\ &= 65782.28 \end{aligned}$$

Not enough information to calculate Expense Allowance, can assume EA = 0

$$\text{Reserve for Smith} = 65782.28$$

LEE:

$$\text{Current fund} < \text{GMF}, \text{R-ratio} = \text{Current fund} / \text{GMF} = 0$$

$$\text{CRVM reserve} = \text{R-ratio} * \text{original CRVM} = 0$$

- (ii) Company ABC still hold liability for future death benefit and maturity benefit, so holding zero reserve is not fully reflecting ABC's liability and can cause serious problem.
Suggestion is to hold additional reserve to cover the liabilities provided by NLG.
Relevant regulation requirement is XXX and AG 38 for non-variable UL; AG 37 for variable UL.

14. 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:
- (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

Sources:

US GAAP for Life Insurers, Second Edition

- Chapter 9 Annuities in Payment Status

Valuation of Life Insurance Liabilities, Lombardi, Fourth Edition, 2006

- Chapter 10 Deferred Annuities
- Chapter 11 Immediate Annuities

Commentary on Question:

Most candidates demonstrated a basic understanding of the GAAP treatment of this annuity product. The performance on the statutory reserve part was not as strong as it required a higher level of knowledge utilization.

Solution:

- (a) Identify and justify the proper U.S. GAAP reserve methodology for this annuity. Justify your answer.

Commentary on Question:

Most candidates were able to identify the appropriate GAAP methodology applicable to this type of annuity product.

As a term certain payout annuity, there is no mortality risk. This annuity should be classified as an investment contract. Therefore, FAS 91 should be the U.S. GAAP reserve methodology used.

14. Continued

(b) Calculate the following values at the end of year 2 under U.S. GAAP:

- (i) Net GAAP Reserve
- (ii) Benefit Reserve
- (iii) Maintenance Expense Reserve
- (iv) Implied DAC Balance

Commentary on Question

Commentary on Question:

The question was looking to test the proper use of the Constant Yield Method calculations. The most common mistake was failure to solve for the 2 discount rates needed for the reserve calculations.

(i) First, solve for the interest rate that results in the present value of future cash flows equal the net proceeds at issue

- Net Proceeds at issue = Premium (\$100,000) - Acq. Exp. (\$5,000) = \$95,000
- Annual cash flows = 22,500.
- Therefore, the interest rate should correspond to the annuity-immediate calculation equal to $\$95,000/22,500 = 4.222$ or 5.91% (provided in table)

Net GAAP reserve at end of year 2 = present value of last 3 years of cash flows at 5.91% = $\frac{\$22,500}{1+5.91\%} + \frac{\$22,500}{(1+5.91\%)^2} + \frac{\$22,500}{(1+5.91\%)^3} = \mathbf{\$60,243}$

(ii) To split the net GAAP reserve into reserve & DAC components, need to solve for interest rate that equates the present value of the policy benefits & maintenance expense to the gross premium.

The interest rate should correspond to the annuity-immediate calculation equal to $\$100,000/22,500 = 4.444$ or 4.06%

Benefit Reserve at end of year 2 = present value of last 3 year of benefit payments at 4.06% = $\frac{\$22,000}{1+4.06\%} + \frac{\$22,000}{(1+4.06\%)^2} + \frac{\$22,000}{(1+4.06\%)^3} = \mathbf{\$60,983}$

(iii) Maintenance Expense Reserve at end of year 2 = present value of last 3 year of expenses at 4.06% = $\frac{\$500}{1+4.06\%} + \frac{\$500}{(1+4.06\%)^2} + \frac{\$500}{(1+4.06\%)^3} = \mathbf{\$1,386}$

14. Continued

- (iv) Implied DAC asset equals Benefit Reserve plus Expense Reserve minus Net GAAP Reserve
DAC Asset Balance at year 2 = \$60,983 + 1,386 - 60,243 = \$2,126
- (c) Calculate the U.S. Statutory CARVM reserve at the end of year 2 using a statutory valuation rate of 5.00%. Show all work.

Commentary on Question:

This was the most difficult part of the question. We were looking for demonstration of ability to apply the CARVM calculation to a specific set of product features.

There was some confusion around the timing of the payments and whether cash values at t=2 were included. Since the cash surrender value option could only be exercised prior to the benefit and the benefit would be paid by the end of year, the t=2 cash surrender value was not included in the calculation.

Some candidates made the mistake of looking at the annuity benefit payments and cash surrender values independent of each other.

First, calculate each possible integrated benefit stream. Then, compare the present value of the integrated benefit streams at the statutory valuation rate and the CARVM reserve will be the maximum of the present values.

Benefit Stream 1: Policy holder receives cash surrender value at t=3

$$\text{Present Value of Stream 1} = \frac{\$40,800}{1+5\%} = \mathbf{\$38,857.14}$$

Benefit Stream 2: Policy holder receives policy benefit at t=3 and cash surrender value at t=4

$$\text{Present Value of Stream 2} = \frac{\$21,000}{1+5\%} + \frac{\$21,000}{(1+5\%)^2} = \mathbf{\$39,047.62}$$

Benefit Stream 3: Policy holder receives policy benefit at t=3, t=4 and t=5

$$\text{Present Value of Stream 3} = \frac{\$21,000}{1+5\%} + \frac{\$21,000}{(1+5\%)^2} + \frac{\$21,000}{(1+5\%)^3} = \mathbf{\$57,188.21}$$

CARVM Reserve at end of year 2 = Max(\$38,857.14, \$39,047.62, \$57,188.21) = \$57,188.21