

ILA LFBVU Model Solutions

Spring 2019

1. Learning Objectives:

3. The candidate will understand and apply emerging financial and valuation standards, principles and methodologies.

Learning Outcomes:

- (3a) Describe, evaluate and calculate the impact on reserves, income, capital, and processes of emerging developments in Statutory and U.S. GAAP reporting, International Financial Reporting Standards, and Solvency Modernization.

Sources:

IFRS 17 Insurance Contracts – IFRS Standards Effects Analysis, May 2017, IASB

Commentary on Question:

This question tested the candidates' knowledge of IFRS 17 and its application to insurance contracts. Credit was given based on the justification and not on a simple identification of true vs. false statements.

Solution:

Critique the following statements regarding IFRS 17:

- A. *IFRS 17 affects the same population of contracts as IFRS 4: insurance contracts issued, reinsurance contracts held, and investment contracts with discretionary participation features issued.*

Model solution to Part A:

Statement is false.

Under IFRS 17, the first two groups of policies are identical between IFRS 4 & 17. However, under IFRS 17 contracts with discretionary participation features must be issued by a company that also issues insurance contracts.

Commentary on Part A:

Many candidates indicated that IFRS 4 and IFRS 17 applied identically to the first two groups of policies and received partial credit. However, a complete answer noted the key fact that contracts with discretionary participation features must be issued by a company that issues insurance contracts.

1. Continued

- B. *All assumptions used to calculate fulfillment cash flows and the contractual service margin (CSM) are current assumptions. The cash flows and assumptions are updated at each reporting date, using current estimates.*

Model solution to Part B:

Statement is false.

Under IFRS 17, assumptions used to calculate the CSM and fulfilment cash flows (FCF) are current assumptions, except for the discount rate used for non-variable contracts. These are calculated as at initial recognition of the contracts (issue).

Commentary on Part B:

The key item to note is that the calculation of the CSM uses discount rates determined at issue. Stating this, in addition to the fact that assumptions used to calculate CSM and FCF are current assumptions, would receive full credit.

- C. *There is no special treatment for contracts with a variable fee (compared to all other IFRS 17 applicable contracts) in recognizing fulfillment cash flows, changes due to discount rates and other financial variable changes.*

Model solution to Part C:

Statement is false.

Variable fee contracts are treated differently under IFRS 17. For general contracts without variable fee, changes are reported in the statement of comprehensive income (profit or loss or other comprehensive income). For contracts with variable fee, the CSM is adjusted to reflect the changes in the variable fee, which included some changes in discount rates and other financial variables.

Commentary on Part C:

Successful candidates were able to not only identify that contracts with a variable fee are treated separately, but also have a comparison of the methods with and without a variable fee to show how they are different.

- D. *In the event of non-economic assumption updates, changes that relate to current or past insurance coverage are recognized in profit or loss; changes that relate to future coverage are recognized by adjusting the CSM.*

Model solution to Part D:

Statement is false.

For future changes, it can only be adjusted through CSM when there is an existing CSM and it's greater than 0. Also, the CSM cannot go negative. If CSM is zero or negative, the changes are recognized in profit or loss.

1. Continued

Commentary on Part D:

Future coverage changes can only be recognized through CSM if it is greater than zero. Candidates generally got credit for this statement. However, full credit would have been realized by noting that changes flow through profit or loss if CSM is negative or zero.

E. IFRS 17 helps to eliminate the economic mismatches between insurance contract liabilities and assets by using a discount rate based on the characteristics of the liability.

Model solution to Part E:

Statement is false.

The economic mismatch occurs regardless of whether the old or new accounting method is used. The use of a discount rate based on the liability makes the mismatch clearer, compared to an asset yield discount rate which can obscure the mismatch.

Commentary on Part E:

The key fact to note is that the economic mismatch occurs regardless of which accounting method is used.

F. Under IFRS 17, a company can group contracts within a portfolio into: 1) those contracts that are onerous at initial recognition and 2) those contracts that are not onerous at initial recognition. In addition, a group of contracts cannot include contracts issued more than one year apart.

Model solution to Part F:

Statement is false.

Under IFRS, company can group contracts into

- 1) Onerous at initial recognition (issue)
- 2) Not onerous at issue, and no significant possibility of becoming onerous in the future
- 3) Remaining contracts

Also, a group of contracts cannot include contracts issued more than 1 year apart, so this is true.

Commentary on Part F:

This section was generally answered well by candidates. To receive full credit candidates had to identify that contracts that are not onerous should be divided into two groups as above.

G. Under IFRS 17, a company can: 1) include an explicit, current risk adjustment in the measurement of insurance contracts; 2) use risk adjustment for some contract types but not for others; 3) use an implicit risk margin or allowance.

1. Continued

Model solution to Part G:

Statement is false.

These are all allowed approaches under existing insurance accounting practices, where companies can choose any method to set risk margins, whether explicit or implicit, all products or certain products only, etc.

However, under IFRS 17, a company is required to specify an explicit risk margin for all insurance contracts and to provide relevant exposures.

Commentary on Part G:

To receive full credit candidates had to identify that IFRS 17 requires an explicit risk margin for all type of insurance contracts.

2. Learning Objectives:

1. The candidate will understand U.S. life insurance company financial statements and reports.

Learning Outcomes:

- (1c) Describe, apply and evaluate regulatory documentation and disclosure requirements.
- (1e) Apply and recommend methods for performing reviews of financial statements including reserves.

Sources:

LFV-102-09: Actuarial Review of Reserves and Other Annual Statement Liabilities

Actuarial Aspects of SOX 404, Financial Reporter #59, December 2004

Responsibilities of the Actuary for Communicating Sarbanes-Oxley control: Effectiveness in Accordance with Actuarial Standards of Practice, Financial Reporter #59, December 2004

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Describe the four key risk areas impacting the processes for determining actuarial amounts in the financial statements.

Commentary on Question:

Candidates generally did well on this part of the question. To receive full credit candidates were expected not only to identify each of the four risks, but to elaborate with supporting details.

4 key risk areas impacting the processes for determining actuarial amounts in the financial statement are as below:

(1) Data

- It's the process of gathering and interpreting data (might include policy inventories, paid claims, experience studies, etc.)
- For example, failing to update an extract program to include new plans can result in policy reserves to be understated.

(2) Actuarial valuation systems

- It's the programs, spreadsheets and other processes used to calculate reserves, DAC, etc.
- For example, incorrectly coding system modifications may result in errors in calculations and a misstatement of output.

2. Continued

(3) Compilation process

- It's the process of compiling calculated reserves and other pieces of financial statement balances for input to the statement assembly.
- For example, the compilation process is too complex which includes manually inputting large numbers of separate calculations into a compilation spreadsheet, and therefore it's easy to lead to a misstatement of results.

(4) Management review process

- It's the ways in which management evaluates the processes involved in data gathering and interpreting actuarial valuations and the compiling the results.
- For example, there is excessive reliance on a key individual for a specific subprocess. Actuarial resources are thinly spread across the organization, with little cross-training.

(b) Critique the statements below from the Chief Financial Officer of ABC with regard to best practices for adherence to SOX 404:

- A. *Internal controls have no obvious benefit.*
- B. *Only processes that directly support the compilation of GAAP reserves and DAC should be included in the company's internal controls, and there is no reason to include other processes at all.*
- C. *Once the compilation task is peer reviewed, I will attest, and no further action will be necessary.*
- D. *Our actuary will respond to auditor queries only pertaining to the appropriateness of the method of compilation.*

Commentary on Question:

This part of the question tested required the candidate to defend the importance of SOX 404, to describe the shortcomings of ABC's policies, and to provide alternatives.

A. Internal controls have no obvious benefit.

Critique: The primary benefit of an effective internal control structure is to provide the company, its management, its board and audit committee, and its owners and other stakeholders with a reasonable basis on which to rely on the company's financial statements.

2. Continued

- B. Only processes that directly support the compilation of GAAP reserves and DAC should be included in the company's internal controls, and there is no reason to include other processes at all.

Critique: The scope of the above statement is too narrow. Reasons are:

- 1) Since financial statements also depend on other processes, the scope of internal controls need be expanded. Examples of other processes are the pricing process (setting up pricing assumptions), the modeling process, the construction of experience studies, the underwriting process, and the statutory reserving process.
- 2) Risk identification must be expanded not just to compilation processes but data, actuarial valuation systems, and management review processes as well.

- C. Once the compilation task is peer reviewed, I will attest, and no further action will be necessary.

Critique: Peer review is not a sufficient control.

- 1) An example of controls is to reconcile the total inputs versus total outputs that are produced by a computer process. (Other accepted examples of controls include but not limit to:
 - formal review processes to assess calculations, methodologies and assumptions are accurate and appropriate;
 - reconciliation the results to the general ledger;
 - review by the chief actuary; have a regular review by the management regarding the changes in actuarial assumptions and methodologies;
 - periodic sample testing of the calculations;
 - trending and other analytical analysis of the actuarially determined balances;
 - password protection of the key spreadsheets and other programs;
 - cross-training of personnel to eliminate over-reliance on a single person.
- 2) Testing of controls
After assessment of controls, testing of controls are needed. One need determine what actions are necessary to define the effectiveness of the control, add/change the test steps for each control, execute the test activities, document the test results, prepare a remediation plan for the control if it is determined as ineffective.

2. Continued

3) Documentation

A key component of SOX 404 is the documentation which is reviewed by both internal and external auditors. What to be included in the documentation are formal identification of processes and sub-processes in the actuarial area which impact the financial statement, identification of the risks involved with these processes and subprocesses, narrative descriptions of the process and subprocesses, process flow charts, a control matrix, and documentation of testing the controls.

- D. According to ASOP 21 the responding actuary should be prepared to discuss the data used and the sources of assumptions along with the methods used. The responding scope is too narrow for this statement. SOX44 requires an independent auditor to access the validation of the internal controls for financial reporting. The method of compilation is one the steps, but other steps, such as assumption, should be also reviewed.

- (c) Evaluate the reasonableness of ABC's reported change in statutory reserves for the two blocks. Justify your answer with an appropriate formula ratio test. Show all work.

Commentary on Question:

Candidates generally did better on the term life calculation and struggled with life annuities calculation. Some candidates did not use the proper formula for the ratio test.

Term Life:

$$M_0 + P + I - C - V_d - V_T = M_1$$

$$\text{Trend Ratio} : \frac{C - I}{M_0 + 0.5P} \text{ or } \frac{C}{\text{Average Amount at Risk}}$$

C - cost of mortality

I - Tabular Interest

P - Premium

V_d - Reserve release by death

V_t - Reserve release by other terminations

M₀ - Beginning Reserve

M₁ - Ending Reserve

For 2016:

$$C = M_0 + P + I - M_1 - V_d - V_T$$

$$C = 2407 + 1115 + 100 - 2478 - 93 - 62$$

$$C = 989$$

$$C - I = 989 - 100 = 889$$

$$\text{Trend Ratio} = \frac{889}{2407 + 0.5 * 1115} = 29.99\%$$

2. Continued

Term Life	2016	2017	2018
C	989	1,021	1,291
C-I	889	918	1,183
Trend Ratio	29.99%	30.08%	37.16%

The tabular mortality has increased significantly in 2018 from prior years. It seems something has changed in the mortality profile of the block, which should be questioned.

Life Annuities:

$$M_0 + P + I + \frac{(T - A) - \text{Payments}}{T} = \frac{M_1}{T}$$

$$\text{Trend Ratio} = \frac{\text{Beginning Reserve}}{\text{Ending Reserve}} \text{ or } \frac{\text{Beginning Reserve}}{\text{Ending Reserve}}$$

Payments – Payments to Annuitants

I - Tabular Interest

P – Premium

T – Tabular Reserve Release by death

A – Actual Reserve Release by death

M0 – Beginning Reserve

M1 – Ending Reserve

For 2016:

$$T = M_1 - P - I + A - M_0 + \text{Payments}$$

$$T = 479 - 0 - 24.75 + 13 - 512 + 58$$

$$T = 13.25$$

$$\text{Trend Ratio} = \frac{13.25}{512} = 2.59\%$$

Life annuities	2016	2017	2018
T	13.25	12.25	11.50
Trend Ratio (Beginning Reserve)	2.59%	2.56%	2.63%
Trend Ratio (Ending Reserve)	2.77%	2.80%	2.70%

This is a stable trend, indicating the change in reserves is reasonable.

3. Learning Objectives:

5. The candidate will understand the nature and uses of basic reinsurance arrangements used by life insurance companies.

Learning Outcomes:

- (5a) The candidate will understand the various forms of reinsurance, and be able to, with respect to both the ceding and assuming parties, analyze and evaluate:
 - (i) Risk transfer considerations
 - (ii) Cash flow mechanics
 - (iii) Accounting and financial statement impacts
 - (iv) Reserve credit considerations

Sources:

Life, Health & Annuity Reinsurance, Tiller, John E. and Tiller, Denise, 4th Edition, 2015, Ch 5,13,17

US GAAP for Life Insurers, Herget et. Al., Ch. 17.4 to 17.7 (pp. 527-561) US

ASOP 52–PBR for Life Products under the NAIC Valuation Manual on PBR for Life Products, Section 3

Commentary on Question:

This question tested the candidates' knowledge of reinsurance.

Solution:

- (a) Critique the following statements:
 - A. *The cash transfer at inception of a partially modified coinsurance treaty equals the sum of the initial allowance and the modified coinsurance adjustment.*
 - B. *It is not possible for a ceding company to take credit for reinsurance ceded to a reinsurer who does not meet the criteria defined in the Credit for Reinsurance Model Regulation.*
 - C. *Some states in the U.S. have a "mirror image" reserve requirement that does not allow the ceding company to reduce its reserves by an amount greater than the reserves the reinsurer holds.*
 - D. *Under ASOP 52, Principle-Based Reserves for Life Products under the NAIC Valuation Manual, the reserve credit for yearly renewable term reinsurance is equal to $(\frac{1}{2})c_x$ which is calculated using a prescribed valuation table and interest rate.*

3. Continued

Commentary on Question:

Candidates generally did well on this part of the question. Most candidates correctly identified whether the statements are correct or not. If a candidate correctly identified a false statement but failed to provide the correct reason for why the statement is false, no credit was awarded for that statement.

For Statement A, most candidates who correctly identified the statement to be false were also able to note that there is no cash transfer at inception of a partially modified coinsurance treaty. However, to obtain full credit, the candidate also needed to identify the specific cash flow items that cancel each other out.

Most candidates struggled with Statement D. A common mistake was to note that the $(\frac{1}{2})c_x$ reserve credit is correct but needs to be calculated using a company's prudent assumptions rather than prescribed assumptions.

- A. False. There is no cash transfer at inception of a partially modified coinsurance treaty. The initial coinsurance reserve is set equal to the initial allowance, and the remaining reserve liabilities are handled on a modified coinsurance basis. The sum of the initial allowance and initial modified coinsurance adjustment equals the initial ceded premium, thereby resulting in no cash transfer between the companies.
 - B. False. Reserve credit can be taken if the reinsurer provides some type of security in the form a trust or letter of credit.
 - C. True. New York is an example of a state with a “mirror image” reserve requirement.
 - D. False. Under ASOP 52, the reserve credit is calculated as the difference between a company's pre-reinsurance reserves and post-reinsurance reserves. Each of these reserves is calculated separately following VM-20 requirements for assumptions and methodology.
- (b) Calculate the amount the reinsurer would pay under each of the following scenarios:
- (i) Covered claims = 6,000,000
 - (ii) Covered claims = 7,000,000
 - (iii) Covered claims = 8,000,000

Show all work.

3. Continued

Commentary on Question:

Candidates generally did well on this part of the question. A common mistake was for candidates to apply the 95% adjustment only to covered claims.

$$\text{attachment point} = 105\% \times 6,500,000 = 6,825,000$$

reinsurer payment = $0.95 \times (\text{covered claims} - \text{attachment point})$, subject to a minimum of 0 and a maximum of 1,000,000

(i) $0.95 \times (6,000,000 - 6,825,000) = -783,750$
reinsurer payment = 0

(ii) $0.95 \times (7,000,000 - 6,825,000) = 166,250$
reinsurer payment = 166,250

(iii) $0.95 \times (8,000,000 - 6,825,000) = 1,116,250$
reinsurer payment = 1,000,000

- (c) Assess if the treaty meets the requirements for reinsurance accounting per SFAS 113. Show all work.

Commentary on Question:

This part of the question required candidates to analyze a reinsurance arrangement and determine whether or not the reinsurer has a reasonable probability of a significant loss. Full calculations for all five loss ratio ranges were not necessary. Full credit was awarded to candidates who demonstrated knowledge of the material by performing full calculations for one range followed by a clear rationalization resulting in the correct conclusion. Partial credit was given for any parts of the calculation that were completed correctly.

Ceded Claims Reimbursed =

$$\begin{aligned} &0.9 \times \text{Assumed Loss Ratio} \times \text{Ceded Premium in year 1} \\ &0.1 \times \text{Assumed Loss Ratio} \times \text{Ceded Premium in year 2} \\ &0 \text{ in year 3} \end{aligned}$$

$$\text{Expense Allowance} = 30\% \times 5,000,000 = 1,500,000$$

$$\begin{aligned} \text{Present Value of Net Cash Flow} = &\text{Ceded Premium} - \text{Expense Allowance} - \\ &(\text{Ceded Claims Reimbursed in year 1})/(1.045) - \\ &(\text{Ceded Claims Reimbursed in year 2})/(1.045)^2 \end{aligned}$$

3. Continued

Year	Loss Ratio Range	Assumed Loss Ratio	Ceded Premium	Ceded Claims Reimbursed	Expense Allowance	Present Value of Net Cash Flow	Present Value as a % of Premium
1	40-50%	45%	5,000,000	2,025,000	1,500,000	1,356,162	27.1%
2				225,000			
3				-			
1	50-60%	55%	5,000,000	2,475,000	1,500,000	879,753	17.6%
2				275,000			
3				-			
1	60-70%	65%	5,000,000	2,925,000	1,500,000	403,345	8.1%
2				325,000			
3				-			
1	70-80%	75%	5,000,000	3,375,000	1,500,000	(73,064)	-1.5%
2				375,000			
3				-			
1	80-90%	85%	5,000,000	3,825,000	1,500,000	(549,472)	-11.0%
2				425,000			
3				-			

The 80-90% loss ratio range is the only range that results in a significant loss for the reinsurer (a loss in excess of 10% of ceded premium). However, the probability of a loss occurring in this range is only 5%, which is less than the defined reasonable probability of 10%. The treaty therefore does not meet the requirements for reinsurance accounting under SFAS 113.

4. Learning Objectives:

4. The candidate will understand basic financial management, capital management and value creation principles and methods in a life insurance company context.

Learning Outcomes:

- (4a) Assess financial performance, including analyzing and interpreting the financial performance of a product line or company.
- (4b) Apply methods and principles of embedded value.

Sources:

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

LFV-815-13: Understanding profitability in Life Insurance

Commentary on Question:

This question tested the candidates' understanding of profitability analysis and embedded value.

Solution:

- (a) Describe the drivers of profitability for each of the following product types according to Source of Earnings Analysis:
- (i) Term insurance with level premium products
 - (ii) Unit-linked savings products
 - (iii) Payout annuity products

Commentary on Question:

Candidates generally did not do well on this part of the question. Candidates described drivers of variances between the actual and expected values but did not describe the drivers of profitability.

Term:

- Main driver is underwriting. Investment income to smaller extent
- Large negative cash outflow in first year driven by commission
- Positive net cash flows are invested to generate investment income
- Premium declines while policies die/lapse. Claims increase from higher mortality rates

Unit-linked Savings:

4. Continued

- Main driver = fee income
- Mostly savings vehicle
- No minimum investment return guarantee
- Small mortality insurance component

Payout annuity:

- Main driver = underwriting and investment income
- Single payment at inception after which policyholders receive regular payment
- Reserves and investment income must be sufficient to match cash flows of future liabilities
- Claims declines as policyholders die.

(b) Compare the following profitability metrics. Consider areas of use, advantages and assumptions.

- (i) Actuarial Appraisal Value (AAV)
- (ii) Embedded Value (EV)
- (iii) Operating (or profit) margin

Commentary on Question:

Candidates generally performed well on this part of the question. Candidates generally demonstrated knowledge of AAV and EV but struggled demonstrating knowledge of operating margin.

Actuarial appraisals:

- mergers and acquisitions (buy or sell means acquisitions)
- assigns value to the contribution of future new business
- assumptions more reflective of prevailing sentiments in the market (mentioned market, no point, has to be assumptions)
- typically higher discount rates than EV

Operating (for profit) margin:

- pricing
- profit of a company generates per unit of premium
- operating profit/loss divided by net premium
- easy comparison across products
- does not reflect timing of profits or losses
- cost of capital and relative riskiness of business not taken into account

4. Continued

EV:

- Better reflects value creation and profitability
- no new business
- assumptions are best estimate
- typically lower discount rates than actuarial appraisals

- (c) Calculate the EV that should be produced by the model. Show all work.

Commentary on Question:

Candidates generally performed well on this part of the question. A common error was assuming the provided “Market Risk Premium over 10 Year Treasury” was the Market Risk Premium.

EV = Adjusted Net Worth + Inforce Business Value

ANW = Required Capital + Free Surplus = 50 + 10 = 60

IBV = Present Value Book Profit - PV Cost of Capital discounted with risk discount rate (RDR)

RDR under CAPM = Risk Free + Beta * (Market Risk Premium)

RDR = 2.9% + 1.3 * 5% = 9.4%

PVBP = $100/(1+9.4\%) + 90/(1+9.4\%)^2 + 95/(1+9.4\%)^3 + 103/(1+9.4\%)^4 = 311.07$

Cost of capital (t) = RC(t-1) * (RDR - after tax investment rate of return)

Time	Book Profit	RC	COC	Discount Factor
0		50		1
1	100	48	2.95	0.914076782
2	90	46	2.832	0.835536364
3	95	44	2.714	0.763744391
4	103	42	2.596	0.698121016
5			2.478	0.638136212

PVBP = 311.06813

PVCOC = 10.529191

IBV = 300.53894

EV = 360.54

- (d) Critique each of the following statements related to EV methodology:

- A. *Since assets backing reserves include debt securities, the company should consider factoring in the cost of debt into the risk discount rate.*
- B. *Assumptions that are considered sensitive should have a Provision for Adverse Deviation (PAD) in EV calculations.*

4. Continued

- C. *Market Consistent Embedded Value (MCEV) would be a significant improvement over EV since it is easier to track changes over time, and it is easier to compare across companies.*
- D. *Policyholder behavior should not be modeled when calculating the Time Value of Financial Options and Guarantees (TVFOG) because it cannot be accurately forecasted.*

Commentary on Question:

Candidates who received full credit were able to state an effective critique of the false statements. Candidates generally correctly critiqued Statement B and D. Most candidates generally struggled with Statement A. If a candidate correctly identified a false statement but failed to provide the correct reason for why the statement was false, no credit was awarded for that statement.

- A. The reasoning is wrong. The cost of debt may be included in calculating the risk discount rate; however, it would be included because the company has some debt financing contributing to surplus (can happen in Canada, not US as it just creates offsetting liability) and not because debt is backing reserves. In this situation, using cost of equity is most appropriate.
- B. False. Embedded value is designed to be a measure of the value of the business. Assumptions should reflect best estimate.
- C. The first part is false. It is harder to analyze movement in MCEV since it involves tracking movement of both fair value of assets and fair value of liabilities over time. However, the second part is true. MCEV is easier to compare across companies since the model must be calibrated to observed market prices for similar options and guarantees, and the risk discount rate and pre-tax & investment expense returns on assets are assumed to be risk free rate. This eliminates some hard to estimate and subjective economic assumptions, thus providing more consistency across companies.
- D. This is false. Policyholder behavior is hard to estimate; however, it is an important assumption in calculating TVFOG. For example, reduced lapse rates in scenarios where options are in the money should be included.

5. Learning Objectives:

3. The candidate will understand and apply emerging financial and valuation standards, principles and methodologies.

Learning Outcomes:

- (3a) Describe, evaluate and calculate the impact on reserves, income, capital, and processes of emerging developments in Statutory and U.S. GAAP reporting, International Financial Reporting Standards, and Solvency Modernization.
- (3b) Compare and contrast rules-based and principles-based approaches.

Sources:

LFV-833-18: Fundamentals of the Principle – Based Approach to Statutory Reserves for Life Insurance, 2017

Commentary on Question:

This question tested candidates' knowledge of VM-20, specifically the reinsurance reserve credit. Candidates had to demonstrate their knowledge of how the VM-20 approach differs from the rules-based approach and perform a VM-20 calculation.

Solution:

- (a) Describe the differences in determining the reinsurance reserve credits under rules-based methods and VM-20 methods.

Commentary on Question:

Candidates generally did well on this part of the question. Candidates received full credit if they explained why mirror image reserving is likely under rules-based methods and not likely under VM-20 methods. The explanation needed to address formula differences and assumption differences.

Under rules-based methods, the credit taken by the ceding company is usually equal to the reserve held by the reinsurer (i.e. mirror image reserving usually occurs), since the calculations typically use the same formula and prescribed assumptions. Under VM-20 methods, mirror image reserving is less likely to occur, since the DR and SR components are not formulaic and require each company to use assumptions based upon their own experience. The ceding company's reserve credit under VM-20 equals the difference between its pre-reinsurance VM-20 reserve (excludes the effects of reinsurance) and post-reinsurance VM-20 reserve (includes the effects of reinsurance).

- (b) Calculate the reinsurance reserve credit as of the end of year 2. Show all work.

5. Continued

Commentary on Question:

Candidates generally did well on this part of the question and only missed a few minor details. Candidates struggled to appropriately reflect the IMR balance, and most candidates ignored it completely. Also, many candidates incorrectly included net investment income and federal income taxes in the calculations.

$$\begin{aligned} \text{reinsurance reserve credit} &= \\ &\text{pre-reinsurance VM-20 reserve} - \text{post-reinsurance VM-20 reserve} \end{aligned}$$

$$\begin{aligned} \text{VM-20 reserve} &= \\ &\max(\text{net premium reserve, deterministic reserve, stochastic reserve}) = \\ &\max(\text{NPR, DR, SR}) \end{aligned}$$

Since the product passes the stochastic exclusion test:

$$\text{VM-20 reserve} = \max(\text{NPR, DR})$$

$$\begin{aligned} \text{pre-reinsurance DR} &= \\ &\text{PV of death benefits, expenses and commissions} - \\ &\text{PV of gross premiums} - \\ &\text{PIMR} \end{aligned}$$

$$v = 1/1.04$$

$$\begin{aligned} \text{PV of death benefits, expenses and commissions at EOY 2} &= \\ 480 + 8 + (700 + 7)v + (1,000 + 6)v^2 &= 2,098 \end{aligned}$$

$$\begin{aligned} \text{PV of gross premiums at EOY 2} &= \\ 600 + 500v + 400v^2 &= 1,451 \end{aligned}$$

$$\text{PIMR at EOY 2} = 112$$

$$\text{pre-reinsurance DR at EOY 2} = 2,098 - 1,451 - 112 = 535$$

$$\text{pre-reinsurance NPR at EOY 2} = 800$$

$$\text{pre-reinsurance VM-20 reserve at EOY 2} = \max(800, 535) = 800$$

$$\begin{aligned} \text{post-reinsurance DR} &= \\ &\text{pre-reinsurance DR} + \\ &\text{PV of reinsurance premiums} - \\ &\text{PV of reinsurance death benefit recoveries} \end{aligned}$$

5. Continued

pre-reinsurance DR at EOY 2 = 535

PV of reinsurance premiums at EOY 2 =
 $300 + 250v + 200v^2 = 725$

PV of reinsurance death benefit recoveries at EOY 2 =
 $120 + 175v + 250v^2 = 519$

post-reinsurance DR at EOY 2 = $535 + 725 - 519 = 741$

post-reinsurance NPR at EOY 2 = 700

post-reinsurance VM-20 reserve at EOY 2 = $\max(700, 741) = 741$

reinsurance reserve credit at EOY 2 = $800 - 741 = 59$

6. Learning Objectives:

2. The candidate will understand valuation principles and methods of individual life insurance and annuity products issued by U.S. life insurance companies.
3. The candidate will understand and apply emerging financial and valuation standards, principles and methodologies.

Learning Outcomes:

- (2b) Evaluate, calculate, and interpret liabilities and DAC assets.
- (3a) Describe, evaluate and calculate the impact on reserves, income, capital, and processes of emerging developments in Statutory and U.S. GAAP reporting, International Financial Reporting Standards, and Solvency Modernization.

Sources:

LFV-812-10: "A Discussion of AG 43 for Variable Annuities", Milliman Research Report, April 2009

US GAAP For Life Insurers, Second Edition, Ch 8

Proposed Changes to US GAAP - An Impact Analysis of Proposed Targeted Improvements, Milliman Research Paper 2017

LFV-831-17: AG43 – CARVM for Variable Annuities (excl. appendices 2,4,5,8,9,10,11)

Commentary on Question:

This question tested the candidates' knowledge of GAAP and STAT concepts related to a simplified variable annuity with a GMDB.

Solution:

- (a) Calculate the SOP 03-1 liability at the end of year 1. Show all work.

Commentary on Question:

This part of the question requires the candidates to demonstrate a SOP 03-1 calculation in the current reporting environment for a simplified GMDB. Many candidates correctly calculated the total assessments and excess death benefits (as shown in the table). Some candidates did not take into account the appropriate surrender rate for the surrender charge portion of total assessments or the mortality rate for excess death benefits. Some candidates attempted to adjust the account values, when it was given the account values were projected and already include the past history of surrenders and deaths and earnings; therefore, those account values can be used without any adjustment.

Rows a through d in the table below were not required for full credit.

6. Continued

Timing of cash flows was not provided; however, a good assumption is end of year cash flows (assessments collected and surrender and death benefits paid at end of year). As exact timing of cash flows was not given, credit was given based on the calculation performed.

Most candidates calculated PV (total assessments) and PV (excess death benefits) to find a benefit ratio and then an SOP 03-1 liability. Depending on any miscalculation earlier in the PVs, the benefit ratio and final SOP 03-1 liability reflects that earlier miscalculation. Partial credit was given for correct future calculations using incorrect earlier values. A number of candidates used a benefit ratio near 100% due to not including the mortality rate for excess death benefits.

Given the number of intermediate calculations that could differ slightly, the following comparisons were helpful to understand whether an answer is close to correct.

- *GMDB is only slightly higher than AV therefore excess benefit is small*
 - *Separate GMDB rider charge is not included in the product*
 - *If GMDB = AV then benefit ratio would have been 0%*
- *Therefore, benefit ratio should be a small percentage*
- *Therefore, SOP Liability should be a small reserve*

It is observable this is a small GMDB, therefore a benefit ratio near or exceeding 100% as some candidates calculated means intermediate values were incorrect. It is good to know initially whether the benefit is small, medium, or large to help confirm whether a calculated benefit ratio is reasonable. An intuitive guess is the benefit ratio should be 0-5% just from comparing GMDB to the Account Value. A few candidates corrected intermediate values when they saw their calculated benefit ratio was too high.

Calculate Total Assessments and Excess Death Benefits

	Year		1	2	3	4
a	SC% of AV	Given	2%	2%	2%	0%
b	M&E% of AV	Given	1.2%	1.2%	1.2%	0%
c	Projected AV	Given	315,000	310,000	305,000	N/A
d	GMDB	Given	320,000	320,000	320,000	0
e	Assessment: M&E	= b*c	3,780	3,720	3,660	-----
f	Assessment: SC	= a*c*.01	63	62	61	-----
g	Total Assessments	= e + f	3,843	3,780	3,721	-----
h	Excess Death Benefits	= (d-c)*.01	50	100	150	-----

Note: Given surrender rate = 0.01; given mortality rate = 0.01

6. Continued

At end of year 1 (assuming all cash flows are end of year):

$$\text{PV (Total Assessments)} = 10,919.81 = 3,842 + 3,782/1.04 + 3,721/1.04^2$$

$$\text{PV (Excess Death Benefits)} = 284.84 = 50 + 100/1.04 + 150/1.04^2$$

$$\text{Benefit Ratio (1)} = 2.608\% = 284.84 / 10,919.81$$

SOP Liability (1) = Total Assessments (1) * Benefit Ratio (1) – Excess Death Benefits (1) + SOP Liability (0) + Interest

$$\text{SOP Liability} = 3,843 * 2.608\% - 50 + 0 + 0 = 50.23$$

- (b) Describe concerns a company might have related to FASB's targeted improvements for GMDB GAAP calculations.

Commentary on Question:

Most candidates demonstrated understanding that FASB Targeted Improvements require GMDB to become a fair value calculation as a Market Risk Benefit. For full credit, candidates needed to address concerns that a company might have about this change. Some candidates described increased volatility of earnings that will occur when the current SOP 03-1 reserve is replaced with a fair value reserve calculation based on point in time values. Fewer candidates mentioned concerns about hedging more benefits and that such hedging will cost more due to the same increased volatility.

- FASB's proposed changes would require the GMDB to be valued under fair value as a Market Risk Benefit (MRB) rather than SOP 03-1.
 - Reserve levels would be much more volatile since reserve calculations using fair value method would be much more sensitive to market movements when compared to reserves calculated using SOP 03-1.
 - The company may consider hedging benefits that were previously not hedged, due to the increased volatility. This would come with increased costs to the company from additional trading.
- (c) Calculate the statutory reserve for policy 1 and policy 2. Show all work.

Commentary on Question:

This part of the question tested candidates' knowledge about how a CTE excess is allocated across subgroups to find a final STAT reserve. Most candidates found the total and subgroup excess amounts to allocate. Some candidates incorrectly allocated the entire 5 mm total excess to Subgroup A, which would leave none for Subgroup C (Subgroup B receives no allocation).

6. Continued

Some candidates found the correct Standard Scenario reserve for each policy, but there were a few common mistakes: ignoring the Cash Surrender Value floor for the Standard Scenario reserve; only comparing the Cash Surrender Value (CSV) and the Basic Adjusted Reserve (BAR) in the Max function; using some other variation on the formula for Standard Scenario reserve.

Given the number of intermediate calculations that could differ slightly, the following comparisons were helpful to understand whether an answer is close to correct.

- *CTE is only slightly higher than SS therefore total CTE excess is small*
 - *Max for subgroup A < 5/145, leaving nothing for other subgroups*
- *Therefore, CTE Excess allocated to subgroup A should be small*
- *Therefore, STAT reserve increase above the SS reserve should be small*
- *Total allocated = 3.125 mm + 1.875 mm = 5 mm allocated total CTE excess*

It is observable that not much CTE excess in total or by subgroup in percentage terms needs to be allocated. An intuitive guess is the percentage increase to allocate the CTE excess to a subgroup might be in the range of 0-5% and therefore the percentage increase to each policy's Standard Scenario reserve is in the 0-5% range. Some candidates allocated the entire total excess to one subgroup, ignoring other subgroups requiring part of the CTE excess allocation. A few candidates allocated the entire subgroup's excess to just two policies when many other policies were in that subgroup resulting in policy 1 or 2 STAT reserves in the millions of dollars.

Standard Scenario (SS) reserve = Max (CSV, BAR + Greatest present value of the negative of the Accumulated Net Reserve – Allocated value of approved hedges)

Policy 1 SS reserve = Max (250000, 248000 + 3000 – 600) = 250,400

Policy 2 SS reserve = Max (200000, 199100 + 1000 – 200) = 200,000

Total CTE Excess amount = Max (0, 450 mm – 445 mm) = 5 mm

Must allocate 5 mm across subgroups A, B, and C

Subgroup A Excess = Max (0, 150 mm – 145 mm) = 5 mm

Subgroup B Excess = Max (0, 100 mm – 103 mm) = 0 mm

Subgroup C Excess = Max (0, 200 mm – 197 mm) = 3 mm

Subgroups Total Excess = 5 mm + 0 mm + 3 mm = 8 mm

CTE Excess allocated to subgroup A = 5 mm * (5 mm / 8 mm) = 3.125 mm

CTE Excess allocated to subgroup B = 5 mm * (0 mm / 8 mm) = 0.000 mm

CTE Excess allocated to subgroup C = 5 mm * (3 mm / 8 mm) = 1.875 mm

6. Continued

CTE excess would normally be allocated to policies based on difference between SS reserve and CSV (unless CSV is not available, in which case SS reserve is the basis). CSV is not available at the subgroup level therefore use SS reserve.

Policy Stat reserve = SS reserve * (1 + Subgroup allocated CTE excess / Subgroup SS reserve)

Both policies are from Subgroup A:

Policy 1 Stat reserve = $250,400 * (1 + 3,125,000/145,000,000) = 255,797$

Policy 2 Stat reserve = $200,000 * (1 + 3,125,000/145,000,000) = 204,310$

7. Learning Objectives:

1. The candidate will understand U.S. life insurance company financial statements and reports.
4. The candidate will understand basic financial management, capital management and value creation principles and methods in a life insurance company context.

Learning Outcomes:

- (1a) Construct, analyze and evaluate basic U.S. GAAP, Statutory, and Tax financial statements for a life insurance company.
- (1e) Apply and recommend methods for performing reviews of financial statements including reserves.
- (4f) Explain and apply methods in earnings management and capital management.

Sources:

Chapter 3 of Valuation of Life Insurance Liabilities, Lombardi

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

Commentary on Question:

This question tested the candidates’ knowledge of the statutory annual statement and the financial planning process.

Solution:

- (a) Assume the amount of capital and surplus at the end of the prior year is 100.
 - (i) Calculate net income for the current year.
 - (ii) Calculate the amount of capital and surplus at the end of the current year.

Show all work.

Commentary on Question:

This part of the question tested the candidates’ ability to differentiate between components that are part of net income and components that are part of capital and surplus. The following were common errors in part (i): (1) including both policyholder and stockholder dividends or excluding both; (2) including both realized and unrealized gains or excluding both; and (3) including annuity considerations as a cost or excluding it entirely from the computation.

7. Continued

Errors made in part (ii) were consequential based on errors made in part (i). However, if the wrong net income was used in part (ii) but the formula and computations were otherwise correct, the candidate still received full credit for part (ii).

- (i) Net income =
Revenue – Costs – Dividends to policyholders –
Federal income taxes excluding taxes on capital gains +
Net realized capital gains less capital gains taxes

Revenue	
Premium	100
Annuity considerations	50
Net investment income	<u>35</u>
TOTAL	185

Costs	
Death benefits	15
Surrender benefits	5
Increase in reserves	10
Commissions	50
Expenses	<u>25</u>
TOTAL	105

$$\text{Net income} = 185 - 105 - 15 - 16 + 3 = 52$$

- (ii) Capital and surplus at end of current year =
Capital and surplus at end of prior year +
Current year net income –
Current year dividends to stockholders +
Current year change in net unrealized capital gains

$$\text{Capital and surplus at end of current year} = 100 + 52 - 10 + 12 = 154$$

7. Continued

(b) Assume:

- The company's cost of capital is 10%.
- The company wants to maintain a policy of dividend payouts to shareholders equal to 2% of equity.
- The company wants to maintain a policy of supporting all growth through earnings.

(i) Assess the appropriateness of the financial plan at the total company level.

(ii) Make recommendations for improving the plan.

Commentary on Question:

This part of the question required candidates to analyze a company's financial plan and provide recommendations for improvements. Candidates who based their assessments and recommendations on an analysis of economic value and free cash flow generally did well. Candidates who provided an assessment of the individual profit centers but not of the company in total did not receive credit for part (i); however, their assessments were taken into consideration when awarding credit for part (ii).

Most candidates who provided a total company assessment did not recognize that growth needs to be capped at the ROE less 2% (or, alternatively, that the ROE cannot be less than the growth rate plus 2%) to support both the 2% dividend policy and the policy to fund all growth through earnings.

For part (ii), partial credit was received for suggesting a reallocation of capital among the profit centers. To receive full credit, candidates needed to recommend options to increase ROE or reduce growth.

- (i) In order for a company to create economic value, the return on equity (ROE) must be greater than the cost of capital (CoC). At the total company level, the plan creates economic value since $ROE (15\%) > CoC (10\%)$.

However, the company has stated that it wants to maintain a policy of dividend payouts to shareholders equal to 2% of equity, and that it wants to support all growth through earnings. In order to achieve both objectives, the company cannot grow faster than 13% ($ROE - 2\%$). The plan requires the company to grow at a rate of 16%. Despite the fact that it creates economic value, the plan is therefore not appropriate at the total company level since it requires the company to grow too fast.

7. Continued

(ii) Given the financial plan of the company is not appropriate at the total company level, the company should make the following changes to improve it:

- Increase the ROE in Profit Center C.

Unlike the other profit centers, Profit Center C is destroying economic value since its ROE (6%) is less than the CoC (10%).

- If the ROE of Profit Center C cannot be increased, reduce the investment in Profit Center C.

Profit Center C is also consuming free cash flow, since its ROE (6%) is less than its growth rate (15%).

- Constrain the growth of Profit Center B.

Profit Center B is the largest and fastest growing of the profit centers. While it is creating economic value (17% ROE > 10% CoC), it is also consuming free cash flow (17% ROE < 18% growth rate). Due to its relative size, it may therefore be necessary to constrain the growth of Profit Center B to keep the company from growing too fast.

8. Learning Objectives:

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

Learning Outcomes:

- (2a) Compare and apply methods for life and annuity product reserves.
- (2b) Evaluate, calculate, and interpret liabilities and DAC assets.

Sources:

Valuation of Life Insurance Liabilities, Chapter 13

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Calculate the reserve for this policy at the end of policy year 2. Show all work.

Commentary on Question:

There was an error in this part of the question. The valuation annuity factors were listed as

$$1000 \times a_{\text{due}}(66:4) = 3.61 \text{ and } 1000 \times a_{\text{due}}(67:3) = 2.77$$

when they should have been stated as

$$a_{\text{due}}(66:4) = 3.61 \text{ and } a_{\text{due}}(67:3) = 2.77.$$

The majority of the candidates correctly identified the typo and assumed the correct values. For the candidates who did not recognize the error, full credit was given so long that the process and methodology were stated correctly.

Candidates generally did not identify the correct modified first-year net premium. The most common error was to double the net level premium of 40.35.

It should be noted that the question did not mention if the CRVM expense allowance was limited, nor did it provide enough information to calculate a 20-pay whole life expense allowance. Since the later was not provided, it was assumed that the 20-pay expense allowance limitation was not reached. Most students assumed that the normal expense allowance would not be limited.

Step 1: Determine the first-year net premium as double the amount produced by the CRVM methodology

$$\text{CRVM first-year net premium} = c(65) = v \times q(65) = 16.85/1.035 = 16.28$$

$$\text{Modified first-year net premium} = 2 \times c(65) = 2 \times 16.28 = 32.56$$

Method 1

$$\text{Modified Reserve}(2) = \text{PVFB}(2) - \text{PVFP}(2)$$

Step 2: The renewal net premium (RNP) is set so that the present value of future benefits equals the present value of future net premiums at issue

8. Continued

$$\begin{aligned}PVFB(0) &= PVFP(0) \\1000 \times A(65:5) &= \text{Modified first-year net premium} + RNP \times a(65:5) \\ \text{Where } a(65:5) &= a_{\text{due}}(64:4) \times v \times p(65) \\ &= 1 + 3.61 \times (1/1.035) \times (1 - 0.01685) \\ &= 3.43 \\ \text{So, } 178.73 &= 32.56 + RNP \times 3.43 \\ RNP &= 42.62\end{aligned}$$

Step 3: Calculate modified reserve for this policy at the end of policy year 2

$$\begin{aligned}\text{Modified Reserve}(2) &= PVFB(2) - PVFP(2) \\ &= 1000 \times A(67:3) - RNP \times a(67:3) \\ &= 154.24 - 42.62 \times 2.77 \\ &= 36.18\end{aligned}$$

(or) Method 2

$$\begin{aligned}\text{Modified Reserve}(2) &= VB(2) - VE(2) \\ &= \text{Net Level Premium Reserve}(2) - \text{Unamortized Expense Allowance}(2)\end{aligned}$$

Step 2a: Calculate the Net Level Premium (PB)

$$\begin{aligned}NLP = PB &= 1000 \times A(65:5) / a_{\text{due}}(65:5) \\ \text{Where } a_{\text{due}}(65:5) &= 1 + a_{\text{due}}(64:4) \times v \times p(65) \\ &= 1 + 3.61 \times (1/1.035) \times (1 - 0.01685) \\ &= 4.43 \\ NLP = PB &= 178.73 / 4.43 = 40.34\end{aligned}$$

Step 2b: Calculate the EA amortization amount (PE)

$$\begin{aligned}PE &= \text{Modified EA} / a_{\text{due}}(65:5) \\ \text{Where Modified EA} &= RNP - \text{Modified first-year net premium} \\ &= 42.62 - 32.56 = 10.06 \\ &\text{** here the RNP is calculated using method 1, step 2} \\ PE &= 10.02 / 4.43 = 2.27\end{aligned}$$

Step 3: Calculate modified reserve for this policy at the end of policy year 2

$$\begin{aligned}\text{Modified Reserve}(2) &= VB(2) - VE(2) \\ VB(2) &= 1000 \times A(67:3) - NLP \times a(67:3) = 154.24 - 40.34 \times 2.77 = 42.50 \\ VE(2) &= PE \times a(67:3) = 2.27 \times 2.77 = 6.29 \\ \text{Modified Reserve}(2) &= 42.50 - 6.29 = 36.21\end{aligned}$$

Algebraically equivalent and acceptable answer:

$$\begin{aligned}\text{Modified Reserve}(2) &= 1000 \times A(67:3) - (PB + PE) \times a(67:3) \\ &= 154.24 - (40.34 + 2.27) \times 2.77 = 36.21\end{aligned}$$

8. Continued

- (b) Assess whether this modified methodology will meet statutory valuation requirements. Justify your answer.

Commentary on Question:

Candidates generally identified that the modified reserve must be greater than the CRVM reserve in order to meet statutory valuation requirements. Some candidates identified the need for deficiency reserves. However, few candidates identified that deficiency reserves are the result of a comparison of the gross premium with the CRVM valuation net premium, not the modified net premium from part (a). Few candidates calculated the minimum requirements as the gross premium reserve.

The CRVM reserve is the minimum allowed reserve. This modified reserve method must be at least as great as the CRVM reserve.

$$\text{CRVM first-year net premium} = c(65) = v \times q(65) = 16.85/1.035 = 16.28$$

$$1000 \times A(65:5) = c(65) + \text{CRVM RNP} \times a(65:5)$$

$$178.73 = 32.56 + \text{CRVM RNP} \times 3.43$$

$$\text{CRVM RNP} = 47.36$$

Since the CRVM RNP > Gross Premium, a deficiency reserve must be included such that the minimum reserve is calculated substituting the gross premium for the CRVM RNP.

$$\begin{aligned} \text{CRVM Reserve}(2) &= \text{PVFB}(2) - \text{PV Gross Prem}(2) \\ &= 1000 \times A(67:3) - 45 \times a(67:3) \\ &= 154.24 - 45 \times 2.77 \\ &= 29.59 \end{aligned}$$

Since the modified reserve at time 2 has a value (36.18) which is greater than the minimum required reserve (29.59), then this method does meet statutory valuation requirements.

9. Learning Objectives:

2. The candidate will understand valuation principles and methods of individual life insurance and annuity products issued by U.S. life insurance companies.
3. The candidate will understand and apply emerging financial and valuation standards, principles and methodologies.

Learning Outcomes:

- (2b) Evaluate, calculate, and interpret liabilities and DAC assets.
- (3a) Describe, evaluate and calculate the impact on reserves, income, capital, and processes of emerging developments in Statutory and U.S. GAAP reporting, International Financial Reporting Standards, and Solvency Modernization.

Sources:

US GAAP for Life Insurers, Herget et al., 2nd Edition, 2006 – Chapter 6

Proposed Changes to US GAAP - An Impact Analysis of Proposed Targeted Improvements, Milliman Research Paper 2017

LFV-835-17: Overview of the FASB's Proposal for Long-Duration Contracts of Insurers, PwC, October 17, 2016

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Calculate the DAC balance at the end of year 2. Show all work.

Commentary on Question:

Candidates generally did well on this part of the question. Alternative approaches were considered for full credit, such as flooring the revised first year EGP at 0 and using a prospective calculation to get the second year DAC.

Year	Chg in SOP	Revised EGP	discount factor	EGP x Factor
1	1637	1595-1627 = -42	.9709	-40.78
2	1287	1497-1287 = 210	.9426	197.95
3	56	1400-56 = 1344	.9151	1228.89
4	-2980	1323-(-2980)=4203	.8885	3823.22
				Total: 5210.28

Revised amortization factor = $k = 3750/5210.28 = 71.97\%$

Revised DAC = (prior revised DAC + deferrals)*(1+i)- revised k*revised EGP

DAC(1) = $3750*1.03 - .7197*(-42) = 3892.73$

DAC(2) = $(3892.73)*1.03 - .7197*210 = 3858.72$

9. Continued

- (b) Describe how the values in each column of the tables given above would change if the credited rate is increased without a change in investment strategy.

Commentary on Question:

Candidates generally did well on this part of the question. A common mistake was reversing the effect of the discount rates.

- increasing the credited rate would decrease the discount factors
- the decreased discount rate will lower the PV EGP
- also would be less interest spread if credited rate increased without investment change
- deferrals would not change
- amortization factor would be higher (deferrals the same but PV EGPs lower)
- Increased Account values would result in lower excess death benefits
- also slight decrease due to lower discount factor
- assessments would be slightly lower and PV affected by lower discount factors
- DAC balances should be higher due to higher accrual rate
- different effects may affect the DAC amortization to be higher or lower
- Benefit ratio probably lower due to PV death benefits affected more than PV of assessments
- hence SOP balance probably lower

- (c) Describe how the GAAP valuation of this product would be different under FASB's Targeted Improvements with respect to the following:

- (i) DAC balance and amortization
- (ii) SOP 03-1 balance and benefit ratio

Commentary on Question:

Candidates generally demonstrated a basic level of understanding of the DAC and SOP03-1. A common mistake was missing the change related to capping the SOP03-1 benefit ratio.

- (i) DAC amortization would be in proportion to the undiscounted amount of Insurance
 - or using a straight line adjustment if that can't be done
 - there will no longer be accrued interest on the DAC
- (ii) mechanics of SOP 03-1 calculation largely unchanged
 - but benefit ratio would be capped at 100%
 - if greater – immediate loss recognition
 - will accelerate GAAP losses for UL-SG

10. Learning Objectives:

2. The candidate will understand valuation principles and methods of individual life insurance and annuity products issued by U.S. life insurance companies.
3. The candidate will understand and apply emerging financial and valuation standards, principles and methodologies.

Learning Outcomes:

- (2b) Evaluate, calculate, and interpret liabilities and DAC assets.
- (3a) Describe, evaluate and calculate the impact on reserves, income, capital, and processes of emerging developments in Statutory and U.S. GAAP reporting, International Financial Reporting Standards, and Solvency Modernization.

Sources:

ILA- LfV-833-18: Fundamentals of the Principle – Based Approach to Statutory Reserves for Life Insurance, 2017

ILA-LfV-822-16: Study Note on Actuarial Guidelines 38 and 48 (exclude pp. 6-8)

Commentary on Question:

This question tested the candidates' knowledge of statutory valuation practices.

Solution:

- (a) Describe the conditions specified in Actuarial Guideline 48 that PHI must satisfy to receive a reinsurance reserve credit.

Commentary on Question:

Candidates generally described a few of the conditions.

To receive a reinsurance reserve credit under Actuarial Guideline 48, PHI must satisfy the following conditions:

- PHI must receive Primary Security collateral from the captive reinsurer in an amount greater than or equal to the Actuarial Method amount. Primary Security collateral consists of cash and SVO-listed securities meeting certain characteristics. The Actuarial Method is a modified form of the VM-20 reserve methodology.
- If the reinsurance reserve credit exceeds the amount of Primary Security collateral, PHI must also receive Other Security collateral from the captive reinsurer in an amount equal to the excess. Other Security collateral consists of any security acceptable to the Commissioner of PHI's state of domicile.
- Either PHI or the captive reinsurer must hold a RBC cushion.

10. Continued

- The Commissioner of PHI's state of domicile must approve the transaction.
- PHI and its independent auditor must include a note within the audited Annual Statement indicating that PHI is complying with Actuarial Guideline 48.
- PHI's Appointed Actuary must address compliance with Actuarial Guideline 48 in the asset adequacy opinion and supporting memorandum.

(b) Assume:

- The policy has a cumulative premium design that satisfies the safe harbor requirements of AG38 Section 8E
- No surrender charges

Calculate the AG38 Section 8E reserve for the policy. Show all work.

Commentary on Question:

Candidates generally did well on this part of the question, demonstrating their understanding of the nine required steps and how to calculate them.

The AG38 Section 8E reserve is calculated using a nine-step process as follow:

1. Determine the minimum gross premiums at issue that satisfy the secondary guarantee requirement

These premiums are unknown but are not needed to complete the calculation since they have already been reflected in Step 2

2. Calculate the basic and deficiency reserves, with "specified premiums" equal to the premiums determined in Step 1 =

- basic reserve = 5,000 (given)
- deficiency reserve = 1,500 (given)

3. Determine the premiums paid in excess of the minimum gross premiums =
1,000 (given)

4. Take 93% of Step 3 and divide it by the amount necessary at the valuation date to fully fund the remaining secondary guarantee =

$$(0.93 \times 1,000) / 3,720 = 0.25$$

10. Continued

The amount necessary at the valuation date to fully fund the remaining secondary guarantee equals the amount of cumulative premiums to fully fund the secondary guarantee less the cumulative premiums requirement, and this amount is given (3,720)

5. Calculate the net single premium on the valuation date for the coverage for the remainder of the secondary guarantee period =

$$7,000 \text{ (given)}$$

6. Determine the net amount of additional premiums =

$$\text{Step 4} \times (\text{Step 5} - \text{Step 2}) = 0.25 \times (7,000 - 5,000 - 1,500) = 125$$

7. Determine the reduced deficiency reserve =

$$\text{Step 2 deficiency reserve} \times (1 - \text{Step 4}) = 1,500 \times (1 - 0.25) = 1,125$$

8. Calculate the actual reserve =

$$\min(\text{Step 5}, \text{Step 6} + \text{Step 2}) = \min(7,000, 125 + 5,000 + 1,500) = 6,625$$

9. Determine the increased basic reserve =

$$\text{Step 8} - \text{Step 7} = 6,625 - 1,125 = 5,500$$

The final total reserve is Step 9 (basic) + Step 7 (deficiency) =

$$5,500 + 1,125 = 6,625$$

- (c) Compare and contrast the VM-20 net premium reserve, deterministic reserve and stochastic reserve in the following areas:
- (i) Methodology
 - (ii) Non-prescribed assumptions
 - (iii) Economic scenarios
 - (iv) Discount rate

10. Continued

Commentary on Question:

Candidates generally were able to describe the similarities and differences between the three reserves. Some candidates confused the details of one reserve with another.

(i) Methodology

Net Premium Reserve: seriatim formulaic net premium approach comparable to CRVM

Deterministic Reserve: aggregate cash flow approach where the reserve equals the present value of future benefits, expenses and related amounts less the present value of future premiums and related amounts less the pretax interest maintenance reserve; alternatively, the reserve can be determined by the direct iteration approach which solves for the amount of assets needed to liquidate liabilities over the projection horizon

Stochastic Reserve: aggregate cash flow approach where the reserve equals the 70 CTE of the economic scenario reserves, where the reserve for an economic scenario equals the greatest present value of the negative of the projected statement value of assets

(ii) Non-Prescribed Assumptions

Net Premium Reserve: none (all assumptions are prescribed)

Deterministic Reserve: best estimate plus a margin for risk of adverse deviation and estimation error; a margin is not required for stochastically-modeled assumptions

Stochastic Reserve: same as Deterministic Reserve

(iii) Economic Scenarios

Net Premium Reserve: not applicable

Deterministic Reserve: single prescribed scenario which reflects a single path of interest rates, bond returns and equity returns

Stochastic Reserve: set of scenarios determined by using a prescribed economic scenario generator with prescribed parameters

10. Continued

(iv) Discount Rate

Net Premium Reserve: prescribed

Deterministic Reserve: the discount rate varies by model segment and equals the projected asset portfolio rates

Stochastic Reserve: for each economic scenario, the discount rate equals 105% of the projected one-year U.S. Treasury rates

(d) Assume:

- Corporate tax rate = 21%
- No policy loans
- No derivative liability programs

Calculate the VM-20 reserve. Show all work.

Commentary on Question:

Candidates generally did well on this part of the question, demonstrating an understanding of how to determine a VM-20 reserve. Some candidates incorporated the tax rate into their calculations, which was incorrect since reserves are determined on a pre-tax basis.

NPR = Net premium reserve = 600

SR = Stochastic reserve = 800

DR = Deterministic reserve =

PV future benefits +

PV future commissions and expenses –

PV future gross premiums and/or other applicable revenue –

PV net reinsurance cash flows –

Interest maintenance reserve

DR = 1200 + 50 – 250 – 50 – 20 = 930

VM-20 reserve = max (NPR, DR, SR) = max (600, 930, 800) = 930