

ILA LFMU Model Solutions

Spring 2020

1. Learning Objectives:

1. The candidate will understand and apply U.S. GAAP valuation principles and methods applicable to individual life insurance and annuity products issued by U.S. life insurance companies.
4. The candidate will understand the fundamental features of the U.S. and International regulatory framework.

Learning Outcomes:

- (1b) Describe and apply the requirements, calculations, and disclosures related to GAAP "Targeted Improvements"
- (4a) The features of the U.S. regulatory regime and the forces which are shaping the evolution of the regime.
- (4b) The features of the emerging International regulatory framework, and its development in Canada.
- (4c) The valuation methodology specified in IFRS 17.

Sources:

In Depth - Detailing the new accounting for long-duration contracts of insurers, PWC, Sep 2018

IFRS 17 Insurance Contracts – IFRS Standards Effects Analysis, May 2017, IASB (sections 1, 2, 4 & 6.1-2 only)

Tailoring Global Capital Standards, The Actuary, 2017

Commentary on Question:

This question tested the candidates' knowledge of new accounting standards, IFRS 17 and ASU 2018-12, and the Insurance Capital Standard (ICS).

Solution:

- (a) Compare the methodology and assumptions used to calculate ABC's liabilities under IFRS 17 and ASU 2018-12.

1. Continued

Commentary on Question:

Candidates did well on this part of the question. Most candidates were able to identify the similarities and differences between IFRS 17 and ASU 2018-12. However, there were candidates who seem to have confused FAS 60 for ASU 2018-12 and did not understand how provisions for adverse deviations were treated under ASU 2018-12.

Calculation of Liability:

IFRS 17: Fulfillment Cash Flows + Contractual Service Margins, where Fulfillment of Cash Flows = Present Value of Future Cash Flows + Risk Adjustment.

ASU 2018-12: Present Value of Future Benefits and Expenses less (Net Premium Ratio x Present Value of Future Gross Premiums), where Net Premium Ratio = minimum (100%, Present Value of Benefits and Expenses / Present Value of Gross Premiums).

Discount Rates:

IFRS 17: Reflects the characteristic of the cash flows arising from the insurance contracts using either the Top-Down or Bottom-Up Approach, where:

Top-Down Approach: the insurer reflects the characteristics of the cash flows by starting with the expected current market return on assets and deducting from that expected current market return the premium that market participants require for bearing the risks, including credit risk, that are associated with those asset returns but are not present in the liability (or are excluded from the measurement of the liability);

Bottom-Up Approach: the insurer captures the characteristics of the cash flows by starting from a risk-free discount rate and adding to that rate an adjustment to reflect the extent of illiquidity present in the group of insurance contracts.

ASU 2018-12: Based on high-quality fixed-income instrument.

Disclosure Requirements: For both IFRS 17 and ASU 2018-12, similar enhanced disclosures are required.

Assumptions: Both IFRS 17 and ASU 2018-12 require current up-to-date assumptions that are reviewed and revised often.

Margins:

IFRS 17: Margins are provided in the risk adjustment and the contractual service margins. The risk adjustment are the adjustments to fulfillment cash flows for the uncertainty of such cash flows. The contractual service margins represent the profit that the company expects to earn as it provides insurance coverage and is recognized in profit or loss over the coverage period as the company provides insurance coverage.

ASU 2018-12: Implicit in the setting of assumptions due to their uncertainty.

1. Continued

Display of Premiums in Income Statements:

IFRS 17: Premiums are not considered to be income and are not reflected in income statements for all lines of business.

ASU 2018-12: Premiums are not considered to be income for some lines of business, like universal life insurance, and are not reflected in income statements, and are considered to be income for other lines of business, like non-participating whole life and accident insurance, and are reflected in income statements.

Treatment of Acquisition Expenses:

IFRS 17: Acquisition expenses are included in the measurement of fulfillment cash flows and implicitly amortized in the contractual service margin.

ASU 2018-12: Acquisition expenses are capitalized and amortized in the DAC (Deferred Acquisition Cost) asset.

- (b) Calculate ABC's equity under both ASU 2018-12 and IFRS 17. Assume that the basis of Other Assets is the same under both regimes. Show all work.

Commentary on Question:

Candidates did well on this part of the question. Some candidates failed to show all of their work. Some candidates had difficulty with determining the liability under IFRS 17. A common error was including the present value of cash flows in assets rather than liabilities. Another common error was including both IBNR and the Liability for Incurred Claims in the calculation of liabilities for both IFRS 17 and ASU 2018-12.

Assets:

IFRS 17: Assets = Other Assets = 2000

ASU 2018-12: Assets = Other Assets + GAAP-DAC = 2000 + 100 = 2100

Liabilities:

IFRS 17: Liabilities = Present Value of Cash Flows + Risk Adjustment + Contractual Service Margin + Liability for Incurred Claims
= 1000 + 250 + 100 + 475 = 1825

ASU 2018-12: Liabilities = Liabilities for Future Policyholder Benefits + IBNR
= 1280 + 500 = 1780

Equity: Equity for both IFRS 17 and ASU 2018-12 = Assets – Liabilities

IFRS 17: Equity = 2000 – 1825 = 175

ASU 2018-12: Equity = 2100 – 1780 = 320

1. Continued

- (c) Critique the following statements regarding the Insurance Capital Standard (ICS) guided by International Association of Insurance Supervisors (IAIS).
- A. *The main objectives of the ICS are protection of shareholders and to contribute to financial growth.*
 - B. *The ICS reflects only insurance and investment risks to which an International Active Insurance Group (IAIG) is exposed.*
 - C. *The capital requirement in the ICS is intended to represent a three-year 95 percentile Conditional Tail Expectation (CTE) level of risk.*
 - D. *Currently, the only approach being considered to estimate margin over current estimates (MOCE) is the Cost of Capital MOCE approach, which is based on an assumed cost of holding ICS required capital.*

Commentary on Question:

Candidates generally did not do well on this part of the question.

- A. The correct statement should be: “The main objectives of the ICS are protection of policyholders, not shareholders, and to contribute to financial stability, not financial growth.”
- B. The correct statement should be: “The ICS reflects all material risks, such as insurance, investment/credit, marketing, and operational risks, to which an International Active Insurance Group (IAIG) is exposed.”
- C. The correct statement should be: “The capital requirement in the ICS is intended to represent a one-year 99.5% VaR, not a three-year 95% CTE level of risk.”
- D. The correct statement should be: “Currently, the two approaches being considered to estimate margin over current estimates (MOCE) is the Cost of Capital MOCE (CoC-MOCE) approach; which is based on an assumed cost of holding ICS required capital, and a Prudence MOCE (P-MOCE) approach, which determines a conservative buffer at the 75th percentile of an assumed loss distribution, assuming a normal distribution of losses between current estimate of liabilities (50th percentile) and capital requirements (99.5th percentile).”

2. Learning Objectives:

2. The candidate will understand and apply U.S. Statutory valuation principles and methods applicable to individual life insurance and annuity products issued by U.S. life insurance companies.
3. The candidate will:
 - Understand the significant impact on individual life insurance and annuity product design and management of U.S. insurance product taxation rules.
 - Understand and apply the significant rules of U.S. insurance company taxation as they apply to U.S. life insurers.

Learning Outcomes:

- (2b) Describe, apply and evaluate the Principle-Based Reserves valuation methods and techniques for specific insurance products under U.S. Statutory rules.
- (3a) Describe and apply the significant US tax regulations relating to the taxation of individual life and annuity insurance products.

Sources:

Lombardi, Chapter 19 – Variable Deferred Annuities

Lombardi, Chapter 24 – PBR for Variable Annuities

LFM-846-20 Company Tax – Introductory Study Note

Commentary on Question:

This question tested the candidates' knowledge of product features and reserving practices appropriate to variable deferred annuities, including benefit calculations, practical application of VM-21 at both the group and policy level, as well as the tax reserve calculation according to the 2017 Tax Cuts and Jobs Act.

Solution:

- (a)
 - (i) Calculate the death benefit at the end of each year. Show all work.
 - (ii) Calculate the guaranteed minimum withdrawal benefit available each year. Show all work.
 - (iii) Assess whether the Alternative Methodology can be used for the valuation of this product.

2. Continued

Commentary on Question:

Credit for the question was received for properly calculating the death benefit and guaranteed minimum withdrawal benefit for each year. Partial credit was received for the correct formula and/or sub-steps, e.g. minimum DB or GMWB Base. For full credit for part (iii), candidates were required to correctly state that the alternative method was not appropriate for the specified reason. Common errors included incorrectly accounting for withdrawals in the calculation of the minimum DB and incorrectly applying the ratcheting for GMWB Base.

(i) Minimum Death Benefit(t) = (Minimum Death Benefit(t-1) - Partial Withdrawal(t))*1.05

Death benefit = Max (Account Balance , Minimum Death Benefit)

year 1; Minimum DB = $100,000 * 1.05 = 105,000$

DB = Max (90,000 , 105,000) = 105,000

year 2; Minimum DB = $105,000 * 1.05 = 110,250$

DB = Max (110,000 , 110,250) = 110,250

year 3; Minimum DB = $(110,250 - 2,000) * 1.05 = 113,663$

DB = Max (150,000 , 113,663) = 150,000

year 4; Minimum DB = $(113,663 - 2,000) * 1.05 = 117,246$

DB = Max (140,000 , 117,246) = 140,000

year 5; Minimum DB = $(117,246 - 2,000) * 1.05 = 121,008$

DB = Max (170,000 , 121,008) = 170,000

(ii) Since it is a 1 year ratchet, GMWB Base(t) = Max (GMWB Base(t-1) , Account Balance(t-1))

GMWB(t) = GMWB Base(t) * GMWB Rate(t)

In years 1 & 2, there is no GMWB available, as there is a two-year waiting period

GMWB Base(3) = 110,000 as that is the maximum annual account balance to date

GMWB Base(4) = Max (110,000 , 150,000) = 150,000

GMWB Base(5) = Max (150,000 , 140,000) = 150,000

GMWB(3) = $110,000 * 5\% = 5,500$

GMWB(4) = $150,000 * 5\% = 7,500$

GMWB(5) = $150,000 * 5\% = 7,500$

The answer provided above does not reduce the GMWB Base for withdrawals, however full marks would be provided if the candidate applied reduction for withdrawals in the calculation of the GMWB Base, as this is consistent with the example provided in the source material (Lombardi).

2. Continued

(iii) The alternative methodology may not be used. The only guaranteed benefits allowed in the Alternative Method are GMDBs but this product also contains a GMWB.

(b) Calculate the VM-21 reserve. Show all work.

Commentary on Question:

Key concepts are the calculation of the CTE amount and the comparison to the standard scenario. Most candidates were able to correctly calculate the VM-21 reserve and received full credit for this question. A common error was the omission of the starting assets in the stochastic scenario amount.

VM-21 reserve = Max (standard scenario amount , CTE70)

CTE70 = average of the worst 30% of the stochastic scenario amounts

stochastic scenario amount = starting assets + largest discounted accumulated deficiency

$CTE70 = (2,300,000 + 1,300,000 + 1,050,000 + 800,000 + 550,000 + (25 \times 300,000)) / 30 = 450,000$

VM-21 reserve = Max (400,000 , 450,000) = 450,000

(c) Assume:

- Both policies have a GMDB and a GMWB
- No reinsurance or hedging

Calculate the VM-21 reserve for Policy 1 and Policy 2. Show all work.

Commentary on Question:

This part of the question tested the candidates' ability to calculate the VM-21 reserve at the policy level. Key concepts are the allocation of the excess CTE to the sub-groups, and then within the subgroup to the policy. Generally, candidates were able to correctly calculate the PSSR for each policy but were challenged in proportioning the aggregate excess CTE amount.

PSSR = policy standard scenario reserve = Max (A , B)

A = policy cash surrender value

B = policy basic adjusted reserve + policy greatest present value of negative accumulated net revenue

Policy 1 PSSR = Max (200,000 , (198,000 + 2,400)) = 200,400

Policy 2 PSSR = Max (160,000 , (159,100 + 800)) = 160,000

2. Continued

PECTER = policy excess CTE reserve = portion of aggregate excess CTE amount allocated to the policy

> aggregate excess CTE amount is first allocated to subgroups in proportion to their excess CTE amounts

> each subgroup's allocation is then allocated to policies within the subgroup in proportion to "PSSR - A"

aggregate excess CTE amount = $(120,000,000 + 79,000,000 + 160,000,000) - (110,000,000 + 85,000,000 + 155,000,000) = 9,000,000$

sum of the subgroup excess CTE amounts = $10,000,000 + 0 + 5,000,000 = 15,000,000$

aggregate excess CTE amount allocated to Subgroup A = $9,000,000 \times (10,000,000 / 15,000,000) = 6,000,000$

sum of "PSSR - A" for all policies in Subgroup A = $110,000,000 - 90,000,000 = 20,000,000$

Policy 1 PECTER = $6,000,000 \times (200,400 - 200,000) / 20,000,000 = 120$

Policy 2 PECTER = $6,000,000 \times (160,000 - 160,000) / 20,000,000 = 0$

policy VM-21 reserve = PSSR + PECTER

Policy 1 VM-21 reserve = $200,400 + 120 = 200,520$

Policy 2 VM-21 reserve = $160,000 + 0 = 160,000$

- (d) Calculate the tax reserves for Policy 3 according to the 2017 Tax Cuts and Jobs Act (TCJA).

Commentary on Question:

Key concept is that the reduction using the 92.81% factor only applies to the excess over the Max(CSV, Separate Account Reserve). Most candidates received full credit for this part of the question.

Max (CSV , SA Reserve) = Max (184,000 , 189,050) = 189,050

Excess Reserve = $193,000 - 189,050 = 3,950$

Excess * 92.81% = $3,950 * 92.81\% = 3,666$

Tax Reserve = Max (CSV, SA Reserve) + Excess * 92.81%
= 189,050 + 3,666,19 = 192,716

3. **Learning Objectives:**

2. The candidate will understand and apply U.S. Statutory valuation principles and methods applicable to individual life insurance and annuity products issued by U.S. life insurance companies.
3. The candidate will:
 - Understand the significant impact on individual life insurance and annuity product design and management of U.S. insurance product taxation rules.
 - Understand and apply the significant rules of U.S. insurance company taxation as they apply to U.S. life insurers.

Learning Outcomes:

- (2b) Describe, apply and evaluate the Principle-Based Reserves valuation methods and techniques for specific insurance products under U.S. Statutory rules.
- (3a) Describe and apply the significant US tax regulations relating to the taxation of individual life and annuity insurance products.

Sources:

LFMU - ASOP 52 - Principle-Based Reserves for Life Products under the NAIC Valuation Manual

Principle-Based Approach to Statutory Reserves, Rudolph, April 2019

VM-20 Mortality Credibility, Rudolph and Wang, Financial Reporter, June 2016

LFM-845-20 Chapters 1 and 2 of Life Insurance and Modified Endowments Under IRC §7702 and §7702A, Desrochers, 2nd Edition

Commentary on Question:

Commentary listed underneath question component.

Solution:

- (a) Calculate the following:
 - (i) Guideline Level Premium
 - (ii) Guideline Single Premium
 - (iii) 7-pay Premium
 - (iv) CVAT maximum cash surrender value at issue

Show all work.

3. Continued

Commentary on Question:

Candidates generally did well on this part of the question. Common errors included not selecting the appropriate interest rate factors for the calculation and incorrectly applying a premium load when calculating the 7-pay premium or the CVAT maximum cash surrender value at issue.

(i)

GSP =

Face amount $\times A(60) / (1 - \text{premium load})$ using 6% interest =

$$100,000 \times 0.3419 / (1 - 0.07) = 36,763$$

(ii)

GLP =

Face amount $\times A(60) / \text{adue}(60) / (1 - \text{premium load})$ using 4% interest =

$$100,000 \times 0.4458 / 13.7940 / (1 - 0.07) = 3,475$$

(iii)

7-pay Premium =

Face amount $\times A(60) / \text{adue}(60,7)$ using 4% interest =

$$100,000 \times 0.4458 / 5.2310 = 8,522$$

(iv)

CVAT maximum CSV at issue =

Face amount $\times A(60)$ using 4% interest =

$$100,000 \times 0.4458 = 44,580$$

(b) Describe how interest rates should be determined for this new product for each of the following:

(i) Net premium reserve

(ii) Deterministic reserve

(iii) Stochastic reserve

3. Continued

Commentary on Question:

For part (i), candidates were required to describe how the rate should be determined, such as how it was similar to the prior CRVM reference rate approach.

For part (ii), candidates generally understood what reference rate should be used. Many noted that the rates were based on the assets or the NAER, which were acceptable.

For part (iii), candidates had to describe how the rates were generated, such as through an ESG. Few candidates described the number of scenarios or mentioned scenario reduction techniques

- (i) The interest rate for the net premium reserve will be a prescribed rate similar to the approach under the prior CRVM.
 - (ii) The interest rate for the deterministic reserve will be developed from a prescribed single path of US Treasury curve rates.
 - (iii) The interest rate for the Stochastic reserve will be developed from the Academy ESG using 10,000 paths of US treasury curve rates. A subset of the 10,000 paths may be considered by meeting specified calibration requirements.
- (c) Critique the following statements regarding the cash flow model that will be used to determine the stochastic and deterministic reserves for this new product:
- A. *When setting anticipated experience assumptions, DBM should consider ASOP 2 (Nonguaranteed Charges or Benefits for Life Insurance Policies and Annuity Contracts) and use professional judgment in setting reasonable assumptions.*
 - B. *The new product should be combined with all of DBM's other VM-20 products in a single segment to help offset risk.*
 - C. *If the new product includes a bonus for higher premiums, then DBM can assume a higher level of future premiums for this product.*
 - D. *DBM has done well at keeping expenses level over the past five years, so it should be able to set the expense inflation assumption at or near zero.*
 - E. *DBM should not project any mortality trends beyond the date of valuation.*

3. Continued

Commentary on Question:

- A. *Candidates generally critiqued the ASOP mentioned with some providing more relevant ASOPs to consider. Few candidates noted that professional judgement should be used.*
- B. *Candidates generally did well critiquing this statement.*
- C. *Few candidates critiqued this statement correctly. A traditional ULSG product does not emphasize accumulation, but rather protection. A bonus may only result in higher premiums depending upon other policy features and how the product is marketed. Some candidates did not know if the bonus was referring to a sales incentive for an agent or for a benefit to the policyholder.*
- D. *Most candidates stated that inflation should be used, but did not state how to set the assumption*
- E. *Most candidates mentioned that no mortality improvement would be allowed past the valuation date. However, few candidates specified that negative trends that would increase reserves are allowed after the valuation date. "Other trends" did not receive credit.*

A. The statement is partially true.

- ASOP 2 is not applicable and you should instead consider ASOP 23 (Data Quality) and ASOP 25 (Credibility Procedures).
- You should use professional adjustment within the range of acceptable practices described in VM-20

B. The statement is false since products that are backed by different investment strategies and portfolios should not be combined

C. This statement is partially true as the bonus might result in higher premiums but needs to be considered in the context of other policy features and how the product will be marketed. ULSG products emphasize protection not accumulation and as a result the bonus may not incent clients to pay higher premiums.

D. This statement is false. An assumption for the inflation of expenses based on the consumer price index should be used.

E. This statement is false. Mortality trends that will increase reserves should be projected while trends that would decrease reserves should not be projected.

3. Continued

- (d) When establishing the anticipated experience mortality assumption for the deterministic and stochastic reserves, DBM currently uses the Buhlmann Empirical Bayesian method to assess credibility. DBM is thinking about switching to the Limited Fluctuation method.
- (i) Describe the process that DBM would need to follow to change credibility methods.
- (ii) You are given the following:
- Using company experience mortality data, DBM has estimated its A/E ratio to be 80%
 - The relative error in the estimate is no more than 5% with a probability of at least 95%
 - The standard deviation of the estimate is σ

Determine the values of σ where it is not possible for the Buhlmann Empirical Bayesian credibility factor to equal or exceed the Limited Fluctuation credibility factor. Show all work.

Commentary on Question:

For part (i), few candidates discussed that both commissioner approval and documentation is needed. Candidates generally struggled with part (ii).

- (i) There are two key steps to change the credibility method. You need to develop the documentation to justify the change and obtain regulatory approval for the change.
- (ii) Assume that Limited Fluctuation credibility factor $Z = LZ$

$$LZ = \min [1, (0.05 \times m) / (1.96 \times sd)]$$

Where $m = A/E = 0.8$

$$\text{If } LZ = 1, \text{ then } sd = 0.5 \times 0.8 / 1.96 = 0.0204$$

$$\text{If } sd > 0.0204, \text{ then } LZ < 1$$

$$\text{If } sd < 0.0204, \text{ then } LZ = 1 \text{ (capped)}$$

Assume that the Buhlmann Empirical Bayesian credibility factor $Z = BZ$

Since BZ is always less than 1, BZ will always be less than LZ if $sd \leq 0.0204$

4. Learning Objectives:

1. The candidate will understand and apply U.S. GAAP valuation principles and methods applicable to individual life insurance and annuity products issued by U.S. life insurance companies.

Learning Outcomes:

- (1a) Describe, apply and evaluate the appropriate valuation methods and techniques and related accounting treatments for reserves and related items (e.g., DAC), and other assets and liabilities for specific insurance products under U.S. GAAP. Further, describe and recommend assumptions and margins appropriate to these GAAP reserves.
- (1b) Describe and apply the requirements, calculations, and disclosures related to GAAP "Targeted Improvements".
- (1d) Describe, apply and evaluate the appropriate valuation methods and techniques and related accounting treatments for Investments held by insurance companies.

Sources:

US GAAP for Life Insurers, Herget et al., 2nd Edition, 2006 – Chapter 3

US GAAP for Life Insurers, Herget et al., 2nd Edition, 2006 – Chapter 13

In Depth - Detailing the new accounting for long-duration contracts of insurers, PWC, Sep 2018

Targeted Improvements Interactive Model

Commentary on Question:

This question tested candidates' knowledge of new GAAP developments.

Solution:

- (a) With respect to the impact of ASU 2018-12 on long duration nonparticipating traditional insurance contracts:
 - (i) Explain the impact on the DAC asset and benefit reserve liability of each of the following product costs:
 - Commissions in excess of the ultimate level
 - Claims expenses
 - Salary and benefit costs of the Chief Actuary
 - (ii) List three ways that the DAC asset calculation has changed.

4. Continued

- (iii) Describe the considerations for setting the liability discount rate and how changes in the rate are reflected in the financial statements.

Commentary on Question:

Candidates generally did well on this part of the question.

- (i)/ -Commissions in excess of the ultimate level are added to DAC – but not included in the net premium reserve (NPR).
-Claims expenses are included in the NPR but not to DAC
-Salary costs of the Chief Actuary are considered overhead and not added to either DAC or the NPR
- (ii)/ DAC is to be amortized on a straight-line basis over the expect term of the underlying contracts
Balance no longer accrues interest
No shadow adjustments anymore
- (iii)/ Reflects yield on an upper medium grade fixed (single A) with a duration similar to the liabilities
Original rate is locked-in – liability adjustments due to current yield changes are reflected in Other Comprehensive Income

- (b) Calculate the following under ASU 2018-12:

- (i) Liability remeasurement gain/loss at the end of year 3
- (ii) Expected amount of DAC amortization during year 4

Show all work.

Commentary on Question:

Candidates generally did well on part (ii). Common errors were calculating part (i) at the beginning of year 3 and not identifying the result as a loss.

- (i)/Original premium ratio = $523023/726874 = .71955$
Original end of year 3 liability = $253339 - .71955 \times 245152 = 76,940$
Revised premium ratio = $536886/707787 = .75854$
Revised liability = $269388 - .75854 \times 223057 = 100190$
Liability remeasurement gain/loss = $76940 - 100190 = -23250$ (loss)
- (ii)/ Original DAC amortization ratio =
 $(200000 \times .9) / (1000000 + 900000 + 7920000 + 6810000 + 5720000) = .0045627$
End of Year 3 DAC Asset = $.0045627 \times (6810000 + 5720000) = 57171$
Year 4 expected DAC amortization after revision
 $= 57171 \times 6810000 / (6810000 + 4560000) = 34242$

4. Continued

- (c)
- (i) Calculate the amount of accumulated other comprehensive income (AOCI) at the end of year 1. Show all work.
 - (ii) Provide an argument for why this bond should not be written down at the end of year 1.

Commentary on Question:

A common error was treating the coupons as annual rather than semi-annual. Some candidates were not clear about the direction of the gain or loss.

(i)/Amortized Book Value at t-.5 = $ABV(0.5)$
 $= 1,046.11 - [(1,000 \times .04 / 2) - (1,046.11 \times .03 / 2)] = 1,041.80$
 $ABV(1.0) = 1,041.80 - [(1,000 \times .04 / 2) - (1,041.80 \times .03 / 2)] = 1,037.43$
 $AOCI(t) = \text{accumulated other comprehensive income at time } t = FV(t) - ABV(t)$
 $AOCI(1) = 950 - 1037.43 = -87.43$
[Note – using exponential interest calculation $(1.03^{(1/2)} - 1)$ also acceptable]

- (ii)/ As maturing in 4 years reasonable to assume bond can be held to collect full amount.
Impairment might be temporary – possibly due to increased interest rates.

5. Learning Objectives:

6. The candidate will understand important insurance company issues, concerns and financial management tools.

Learning Outcomes:

- (6a) The candidate will be able to describe, apply and evaluate considerations and matters related to:
- Insurance company mergers and acquisitions
 - Management of variable deferred annuities
 - Embedded Value determinations
 - VM-20 financial impacts
 - Rating agency considerations
 - Special Purpose Vehicle

Sources:

Understanding VM-20 Results, SoA and Milliman, 2017, Sections 1, 2, 3, 5 & 6

Commentary on Question:

This question tested the candidates' understanding of VM-20 attribution structure.

Solution:

- (a) Your company currently performs attribution analysis under both Market Consistent Embedded Value (MCEV) and AG 43. You are tasked with performing a reserve attribution analysis based on VM-20.
- (i) Propose which current attribution analysis structure to use as an initial template for the VM-20 attribution analysis. Justify your answer.
- (ii) Identify changes necessary, if any, to the proposed attribution analysis structure for VM-20.

Commentary on Question:

- (i) *Full credit was received for recommending either AG43 or MCEV attribution structure as long as it was reasonably justified. Candidates generally did well with making a recommendation and providing supporting justifications.*
- (ii) *Full credit was received for listing changes needed for the proposed structure in part (i).*

5. Continued

Model solution for part (i):

(Example 1 - AG43)

I propose using the AG-43 attribution structure as each is based on similar reserve components such as:

- VM-20 deterministic reserve is similar to AG 43's standard scenario amount.
- Both have consideration for a stochastic reserve.

Other acceptable justification for AG43:

- Since the AG43 and VM20 reserves have similar components, many attribution elements would be relevant to both:
 - Impact from Equity Markets
 - Impact from Interest Rates
 - Change in In-Force
 - New business
 - Change in assumptions
 - Reinsurance
- Why not using MCEV:
 - MCEV is a measure of shareholder value of a block of business while VM-20 focuses on statutory reserves, or the value of obligations to policyholder
 - Many attribution elements are only relevant to MCEV:
 - Risk allowances for certain types of non-hedge able risk
 - The impact of income taxes
 - Capital contributions or dividends to shareholders
 - Business acquired or divested

(Example 2 - MCEV)

I Propose using the MCEV given that it has a broader scope, can start with that, and only use those attribution elements that are most relevant to both MCEV and VM-20 such as:

- New Business Value
- Expected Existing Business Contribution

Other acceptable justification for MCEV:

- Attribution elements relevant to both:
 - - Operating Variances (i.e. experience changes for mortality, lapse)
 - - Change in Assumptions
 - - Economic Variances
- Why not using AG43:
 - AG43 relates to regulatory reserves for variable annuities while VM-20 relates to regulatory reserves for life products

5. Continued

Model solution for part (ii)

(Example 1 - AG43)

Most components will be the same, however

- AG43 relates to regulatory reserves for variable annuities while VM-20 relates to regulatory reserves for life products
- The stochastic reserve is mandatory for AG 43, VM-20 allows for exclusion tests
- additional emphasis should be placed on assumptions that are more relevant for Life Insurance vs. Annuities, such as
 - o mortality assumption updates
 - o policyholder behavior
 - o non-guaranteed elements

Other acceptable measures:

- VM-20 NPR is formulaic, there is no formulaic reserve comparison in AG43
- VM20- is max (NPR, DR, SR) – requires 3 reserve requirements.

Other acceptable attribution elements:

- Additional steps in VM20:
- economic changes to VM20 assets
- VM20 preliminary reserve changes

(Example 2 - MCEV)

- MCEV and VM-20 reserves are fundamentally different measures. MCEV is a measure of shareholder value of a block of business while VM-20 focuses on statutory reserves, or the value of obligations to policyholders.
- VM-20 NPR is formulaic
- Since MCEV has a broader scope, remove irrelevant items such as
 - o Risk allowances for certain types of non-hedge able risk
 - o Impact of income taxes
 - o Capital contributions or dividends to shareholders

Other acceptable measures:

- VM20- is max (NPR, DR, SR) – requires 3 reserve requirements.

Other acceptable attribution elements:

- Business acquired or divested
- Also consider effects of changes in the prevailing reserve.

5. Continued

- (b)
- (i) Analyze the reasonableness of each attribution step's result.
 - (ii) List one additional potential cause of unexpected change in reserve for the following attribution categories:
 - 1. Demographic changes
 - 2. Economic assumptions
 - 3. Non-economic assumptions
 - 4. Risk management

Commentary on Question:

- (i) *Candidates generally did well on this part of the question. Full credit was received for describing why each step was or was not reasonable. Candidates generally missed steps 7 and 8.*
- (ii) *Full credit was received for listing one cause of unexpected change for each attribute. Partial credit was received for identifying a cause for a category. No credit was received if the attribute was already covered in part(i). For example:*
 - *Economic assumptions: No credit was received for "Change in U.S. Treasury Yield Curve" as this was covered in step 6*
 - *Non-economic assumptions: No credit was received for "lapses" since that is change in experience assumptions. Similarly, mortality was already provided in step 4.*

Model solution for part (i)

Step 1: Time passage – A moderate 10% increase is in line with the fact that this is a block of recent issues which are aging, so we would expect reserves to increase.

Step 2: Inforce Terminations – terminations of existing policies are not recognized in step 1, so the anticipated change is negative as expected. Since actual terminations were higher than expected, the negative reserve volatility makes sense.

Step 3: New Business – The negative anticipated change does not make sense as we would expect new issues of the same product to increase reserves. Positive reserve volatility is in line with sales being higher than expected.

Step 4: Mortality Experience – There should be no anticipated change for experience assumptions. Since the experience study shows a moderate increase in mortality, the slight positive reserve volatility makes sense.

5. Continued

Step 5: Mortality Credibility – Higher credibility would result in a lower mortality margin, so we might expect a lower reserve. This is inconsistent with the positive reserve volatility.

Step 6: Yield Curve – a decrease in treasury rate would increase reserve volatility. This is inconsistent with the negative reserve volatility.

Step 7: Investment Strategy – For some changes, as is the case here, it is difficult to discern what the impact on reserves will be without running the model. However, given that the reserve volatility is larger than every other step, this indicates that something might be wrong, and this step should be investigated.

Step 8: PBR Time 1 – Given that all applicable attribution steps are provided, there should not be any reserve changes here. This might indicate that an attribution step was missed, or something is incorrect.

Model solution for part (ii)

Demographics changes:

- Account value changes

Economic assumptions:

- Change in Mean Reversion Target

Non-economic assumptions:

- Change in valuation software

Risk management:

- Reinsurance

Other acceptable responses:

Demographics changes:

- Miscellaneous changes (i.e. Benefit elections, rider additions)

Economic assumptions:

- Change in Asset Spreads
- Change in Asset Default Charge

Non-economic assumptions:

- Other Methodology changes (i.e. correction of error)
- Material changes to non-guaranteed elements (i.e. changes made by management)

Risk management:

- Other Risk Mitigation Programs (i.e. Hedging)
- Management Actions (i.e. provision for Pandemic)
- Other (acceptable examples: change in VM-20 requirements)

5. Continued

- (c) Construct an attribution analysis using the similar structure as the ULSG product for the 2019 reporting period.

Commentary on Question:

Candidates were asked to construct an attribution results grid like the one provided in part (b). Full credit was received for a reasonably complete grid. Partial credit was received for Anticipated Reserve Change and Volatility reserve change for each step. Partial credit was received for showing supporting work even if the grid was not complete.

Candidates did well on the first 3 steps (PBR at 12/31/2018, Time Passage, and Inforce Terminations).

Candidates were more challenged identifying reserve changes associated with the Prevailing Reserve step. This resulted in difficulty with the Starting Yield Curve step.

Credit was received if the Prevailing Reserve and Yield Curve steps were reversed.

Model solution for (c)

Movement	Final VM-20 Reserves	Anticipated Reserve Change	Reserve Volatility
PBR at 12/31/2018	200	-	-
Time Passage	210	10	0
Inforce Terminations	205	-2	-3
Experience Assumptions	200	0	-5
Prevailing Reserve	203	0	3
Starting Yield Curve	203	0	0
PBR at 12/31/2019	203	0	0

5. Continued

Supporting calculations:

1. PBR at 12/31/2018:
 - Prevailing Reserve = DR
 - Final Reserve = $\max(\text{DR}, \text{NPR}) = 200$
2. Time passage:
 - Prevailing Reserve = DR
 - Step: Roll-forward to 12/31/2019,
 - Final Reserve = $\max(\text{DR}, \text{NPR}) = 210$
 - Anticipated change = 10 = Expected: $210 - 200$
 - Reserve volatility = 0 = Change in Actual DR less change in Anticipated
3. Inforce Terminations:
 - Prevailing Reserve = DR
 - Step: Policy inventory update,
 - Final Reserve = $\max(\text{DR}, \text{NPR}) = 205$
 - Anticipated change = -2 = Expected: $208 - 210$
 - Reserve volatility = -3 = Change in Actual DR less change in Anticipated
4. Experience Assumptions:
 - Prevailing Reserve = DR
 - Step: Update experience assumptions,
 - Final Reserve = DR = 200
 - Anticipated change = 0 = Expected: $208 - 208$
 - Reserve volatility = -5 = Change in Actual DR less change in Anticipated
5. Prevailing Reserve:
 - Prevailing Reserve = NPR
 - Step: Update experience assumptions,
 - Final Reserve = NPR = 203
 - Anticipated change = 0
 - Reserve volatility = 3 = NPR - DR
6. Starting Yield Curve:
 - Prevailing Reserve = NPR
 - Step: Updated yield curve,
 - Final Reserve = $\max(\text{DR}, \text{NPR}) = 203$
 - Anticipated change = 0 = change in Expected NPR
 - Reserve volatility = 0 = change in Actual NPR
7. PBR at 12/31/2019:
 - Prevailing Reserve = NPR
 - Step: Final reserve at 12/31/2019,
 - Final Reserve = $\max(\text{DR}, \text{NPR}) = 203$
 - Anticipated change = 0 = Anticipated Reserve Change previous step (starting yield curve)
 - Reserve volatility = 0 = Reserve Volatility previous step (starting yield curve)

5. Continued

Alternate Solution:

Movement	Final VM-20 Reserves	Anticipated Reserve Change	Reserve Volatility
PBR at 12/31/2018	200	-	-
Time Passage	210	10	0
Inforce Terminations	205	-2	-3
Experience Assumptions	200	0	-5
Starting Yield Curve	195	-3	-2
Prevailing Reserve	203	0	8
PBR at 12/31/2019	203	0	0

6. Learning Objectives:

2. The candidate will understand and apply U.S. Statutory valuation principles and methods applicable to individual life insurance and annuity products issued by U.S. life insurance companies.
3. The candidate will:
 - Understand the significant impact on individual life insurance and annuity product design and management of U.S. insurance product taxation rules.
 - Understand and apply the significant rules of U.S. insurance company taxation as they apply to U.S. life insurers.

Learning Outcomes:

- (2a) Describe, apply and evaluate the appropriate valuation methods and techniques and related accounting treatments for reserves and related items, and other assets and liabilities for specific insurance products under the U.S. Statutory rules. Further, describe and recommend assumptions and margins appropriate to these statutory reserves.
- (2b) Describe, apply and evaluate the Principle-Based Reserves valuation methods and techniques for specific insurance products under U.S. Statutory rules.
- (3b) Describe, apply and evaluate the valuation methods and techniques for specific insurance products under U.S. taxation rules. Further, evaluate and calculate deferred tax items.

Sources:

NAIC Life Insurance Illustrations Model Regulation

Principle-Based Reserves Spreadsheet Model

Lombardi, Chapter 23 – PBR for Life Products (exclude 23.1)

LFM-846-20: Company Tax – Introductory Study Note

Commentary on Question:

This question tested the candidates' knowledge of VM-20.

Solution:

- (a) Critique the following statements:

A. All policies issued will pass LIIMR testing and no testing is required for the next certification since the assumptions are the same.

6. Continued

- B. *The level term product will no longer require testing under the LIIMR and there no longer is a benefit of lower reserves by having non-guaranteed premiums under PBR.*
- C. *For modeling efficiency, the company will use the same models for PBR deterministic testing and for LIIMR testing.*

Commentary on Question:

Candidates generally described LIIMR, level term product premium restrictions, or differences in testing without critiquing the statement.

For statement A candidates generally did not mention the annual certification requirement.

For statement B candidates generally recognized that the statement was false but failed to recognize the first part of the statement as true. Candidates generally did not describe the benefit for non-guaranteed premiums.

For statement C candidates generally did not critique the model efficiency and focused on the how the two testing are different.

- A. This statement is false.
 - a. Annually the illustration actuary must file a certification with the board and with the commission, so the form must be tested to comply with the regulation.
 - b. Reserves affect policy cash flow so the accumulated values will change as the company changes reserve basis. Therefore, the illustration actuary will need to test to ensure the policy passes both the lapse and self-support test.
- B. This statement is partially true.
 - a. The level term product does not fall under the LIIMR because there are no non-guaranteed elements. Therefore, a test is no longer required for the level term product.
 - b. However, under PBR, there still could be a benefit to having non-guaranteed premiums.
 - (i) Net premium reserves do make use of the premiums and therefore can be both higher and lower.
 - (ii) Deterministic reserves use present value of liability cash flows.
 - (iii) If NPR is the higher reserve in any year, it would be to the EHP Life's benefit to have non-guaranteed premiums.
 - (iv) Unlike CRVM, PBR reserves are not fixed at issue. If experience assumptions deteriorate, reserves will need to be increased and relief will be available only if non-guaranteed premiums were included.

6. Continued

- C. This statement is partially true.
- a. EHP Life can achieve model efficiency by using the same models for PBR deterministic testing and for LIIMR testing, but some assumptions will need to be changed.
 - b. For example, LIIMR testing does not require margins in the assumptions but deterministic testing require margins. Also, LIIMR testing allows the use for marginal or generally recognized expense whereas deterministic testing uses best estimate with a margin.

- (b)
- (i) Assess life insurance Company X and Y's ability to satisfy the conditions required to qualify for the small company exemption under VM-20 PBR requirements.
 - (ii) Determine additional information necessary to make the full assessment.

Commentary on Question:

Candidates generally addressed the life premium and the RBC requirements but did not address the \$50 million exception. Candidates generally did not recognize that company X has no UL products and therefore no material secondary guarantee.

A life insurance company qualifies for the small company exemption under VM-20 PBR requirement, if it satisfies all the following four conditions:

- (1) The company has less than \$300 million of ordinary life premiums, and if the company is a member of an NAIC group of life insurers, the group has combined ordinary life insurance premiums of less than \$600 million.
- (2) The life insurance company Total Adjusted Capital is at least 450% of the authorized control level RBC of the most recent RBC report.
- (3) The appointed actuary has provided an unqualified opinion for the prior year.
- (4) Any ULSG policies issued or assumed after January 1, 2020 that have the definition of non-material secondary guarantee ULSG product.

(i)

Company X

- (1) \$45 million life premiums is less than \$300 million.
- (2) Total Adjusted Capital (TAC) / RBC = $105/30 = 350\% < 450\%$
The RBC level is below the 450%, but this condition does not need to be satisfied if the life premiums are less than \$50 million.
- (4) Whole Life is the only product issued by company X. Therefore, there are no material secondary guarantee.

If the 3rd condition is met, company X could qualify for the small company exemption.

6. Continued

Company Y

(1) \$290 million life premiums is less than \$300 million.

(2) $TAC/RBC = 2500/500 = 500\% > 450\%$

If the other conditions are met, company Y could qualify for the small company exemption.

(ii)

(3) Company X and Y need to ensure that the appointed actuary has provided an unqualified opinion in the prior year.

(4) Company Y needs to confirm the UL product has non-material secondary guarantee.

(c) Determine the following values under VM-20:

(i) Net premium reserve

(ii) Deterministic reserve

(iii) Stochastic reserve

(iv) Minimum reserve

(v) Tax reserve according to Tax Cuts and Jobs Act of 2017

Show all work.

Commentary on Question:

Candidates generally did well in this section. A few candidates did not use the PVFB under mortality assumption with margins in part (ii). In part (iv), candidates received credit for using the alternate formula.

(i) Net Premium Reserve (NPR) is the Calculated Reserve (CR) floored at the Cash Surrender Value (CSV).

$$NPR = \max(CR, CSV) = \max(5000, 2600) = 5000$$

(ii) Deterministic Reserve (DR) is the sum of the PV of future benefits under anticipated mortality assumption with margins (PVFB) and the PV of future expense (PVFE) minus the PV of gross premiums (PVFP).

$$DR = PVFB + PVFE - PVFP = 25000 + 950 - 19000 = 6950$$

(iii) Stochastic Reserve (SR) is the reserve calculated at CTE level of 70

$$SR = 6000$$

6. Continued

- (iv) Minimum Reserve (MR) is the maximum of NPR, DR, and SR.
 $MR = \max (NPR, DR, SR) = \max (5000, 6950, 6000) = 6950$

Alternate formula: $MR = NPR + \max (0, \max (DR, SR) - (NPR - DPA))$
assuming $DPA = 0$

- (v) Tax Reserve (TR) is 92.81% times the MR floored at the CSV.
 $TR = \max (CSV, 92.81\% * MR) = \max (2600, 92.81\% * 6950)$
 $= \max (2600, 6450.30) = 6450.30$

7. Learning Objectives:

1. The candidate will understand and apply U.S. GAAP valuation principles and methods applicable to individual life insurance and annuity products issued by U.S. life insurance companies.

Learning Outcomes:

- (1a) Describe, apply and evaluate the appropriate valuation methods and techniques and related accounting treatments for reserves and related items (e.g., DAC), and other assets and liabilities for specific insurance products under U.S. GAAP. Further, describe and recommend assumptions and margins appropriate to these GAAP reserves.
- (1b) Describe and apply the requirements, calculations, and disclosures related to GAAP "Targeted Improvements".

Sources:

A Closer Look at How Insurers Will Have to Change their Accounting and Disclosures for Long-Duration Contracts, E&Y, Nov 2018

Commentary on Question:

This question tested the candidates' knowledge of US GAAP.

Solution:

- (a) Calculate the impact to each of the following as of the transition date:
 - (i) Retained earnings
 - (ii) Accumulated other comprehensive income

Show all work.

Commentary on Question:

Common errors included:

- *Calculating the impact to retained earnings and to AOCI in aggregate instead of calculating each issue year separately.*
- *Applying the incorrect discount rate for each part of the question.*
- *Including the PV maintenance expenses in the PV expenses.*
- *Not including the maintenance reserves in the carryover basis.*
- *Not capping the net premium ratio to 100%.*

Model Solution for part (i)

An adjustment to retained earnings occurs if the revised net premium ratio is > 100%.

7. Continued

Revised Net Premium Ratio (Revised NPR)
= (PV Benefits + PV Claim Expenses – Carryover Basis) / (PV Gross Premium)

Cash flows are discounted at the rate used just before the transition date, which is 6%.

Carryover Basis = Benefit Reserves + Maintenance Reserves

2016 Carryover Basis = 40,000 + 10,000 = 50,000

2017 Carryover Basis = 20,000 + 5,000 = 25,000

Revised NPR for 2016 issues = $(500,000 + 75,000 - 50,000) / (500,000) = 105\%$

Revised NPR for 2017 issues = $(600,000 + 100,000 - 25,000) / (900,000) = 75\%$

2016 issue year requires a transition adjustment because the net premium ratio is > 100%

Remeasured liability = (PV Benefits + PV Claim Expenses) – PV Net Premiums

Where PV Net Premiums are capped at PV Gross Premiums (or NPR = 100%)

Remeasured 2016 liability = $(500,000 + 75,000) - 100\% * 500,000 = 75,000$

Transition Adjustment = Remeasured liability – Carryover Basis

2016 Transition Adjustment = $75,000 - 50,000 = 25,000$

There would be a negative impact to income of \$25,000.

Model Solution for part (ii)

Impact to AOCI is difference between carrying amount and remeasured liability. Carrying amount is equal to the transition adjustment for 2016 issue year but equal to the carryover basis for 2017 issue year as there was no transition adjustment.

Cash flows are discounted at the upper-medium grade fixed-income instrument yield, which is 4%.

Remeasured liability = (PV Benefits + PV Claim Expenses) – PV Net Premiums

Where PV Net Premiums = Revised NPR * PV Gross Premiums

For 2016 issues

Revised NPR for 2016 issues = 100% from part (i)

Remeasured liability = $(625,000 + 95,000) - (100\% * 575,000) = 145,000$

AOCI impact = $75,000$ (from part (i)) – $145,000 = -70,000$

There is a negative impact of \$70,000 to AOCI for 2016 issues.

7. Continued

For 2017 issues

Revised NPR for 2017 issues = 75% from part (i)

Remeasured liability = $(800,000 + 130,000) - (75\% * 1,080,000) = 120,000$

AOCI impact = $25,000$ (from part (i)) $- 120,000 = -95,000$

There is a negative impact of \$95,000 to AOCI for 2017 issues.

- (b) Describe three required disclosures relevant to TTB's calculation of transition adjustments.

Commentary on Question:

Candidates generally listed required disclosures. Few candidates described the disclosures as required in the question.

Model Solution for part (b)

Disaggregated Rollforwards for:

- Liability for future policyholder benefits
- DAC
- Balances amortized consistent with DAC
- Market risk benefits

The rollforwards should begin with the ending balance of the reporting period before the transition date and end with the opening balance at the beginning of the earliest period presented. The insurer should further disaggregate the rollforwards for any liability for balances for which it elects to apply the guidance retrospectively.

Disclose quantitative and qualitative information regarding transition adjustments

- related to the opening balance of retained earnings
- related to the opening balance of accumulated other comprehensive income
- where the net premium ratio has been capped at 100%.

Provide qualitative and quantitative information about the significant inputs, judgments and assumptions used in measuring the liability, including how they changed and the effects of the changes on the measurement of the liability.

8. Learning Objectives:

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

Learning Outcomes:

- (2a) Describe, apply and evaluate the appropriate valuation methods and techniques and related accounting treatments for reserves and related items, and other assets and liabilities for specific insurance products under the U.S. Statutory rules. Further, describe and recommend assumptions and margins appropriate to these statutory reserves.

Sources:

Lombardi 5th Edition Chapter 18

Commentary on Question:

The question tested the candidates' knowledge of Actuarial Guideline XXXIII. Candidates generally did well on the question, especially on the elective/non-elective portion of part (a) and part (b). Candidates generally did not fare as well on specifying whether the benefits in part (a) fell under plan types a, b or c in part (a) and part (c) of the question.

Solution:

- (a) Identify each of the above benefits under Actuarial Guideline XXXIII (AG 33) as one of the two categories and one of the three plan types. Justify your answer.

Commentary on Question:

The insured has a say in whether they want to enter a nursing home, but it is not their decision as to whether they qualify for entry into a nursing home. Thus, the nursing home benefits are non-elective. Candidates generally identified this as an elective benefit.

Both partial withdrawals and annuitization are elective type of benefits because it's up to the policyholder to choose them. However, people do not willingly decide to die or to fit the criteria for entering a nursing home so those benefits are non-elective.

Plan type C applies to the least restrictive election benefit option and plan A applies to the most restrictive. Rates for plan type C are lowest and give the highest reserve which makes sense since there are less restrictions. The opposite is true for plan type A and plan type B is in the middle.

The 10% partial withdrawal option is totally unrestrictive and up to the policyholder so that gets the lowest discount rate and the highest reserve. The other three benefits have restrictions or are non-elective so they all fall under plan type A.

8. Continued

- (b) Calculate the present value at time zero of an integrated benefit stream that ends in a full withdrawal at the end of year 4 including the given withdrawals and expected death benefit payments.

Commentary on Question:

Candidates were generally able to identify and calculate the correct discounting of the benefit streams, receiving full or most of the credit for this part of the question.

The benefit streams for this plan are classified into full withdrawal, annuitization, and other benefits. The two elective benefit streams (partial withdrawal and annuitization) are to use 4.5% for discounting. Death benefits use 5.0% for discounting.

The integrated benefit stream value is $1000 / 1.045 + 1000 / 1.045^3 + 50,000 / 1.045^4 + 50 / 1.05 + 100 / 1.05^2 + 150 / 1.05^3 + 200 / 1.05^4 = 44,193.74$.

- (c) Identify which of the two categories and which of the three plan types under AG 33 the Customer Loyalty Benefit would fall. Justify your answer.

Commentary on Question:

Candidates generally were not able to assign a plan type.

The benefit would be considered elective as the ultimate action that triggers the benefit involves a transfer into a new annuity and that's fully at the discretion of the policyholder. Other qualification benefits are under the control of the policyholder.

The transfer involves a cash withdrawal into a new annuity and does not appear to involve any adjustment. The relative "free reign" given to the policyholder in regards to the election of this benefit makes it more risky and lower plan type C rates are used to value it.

9. Learning Objectives:

5. The candidate will understand the fundamental purpose of capital, and its determination and stakeholders.

Learning Outcomes:

- (5a) The Candidate will be able to describe and evaluate the theory of capital (including economic capital), and evaluate its applicability for various purposes and its value to different stakeholders.

Sources:

Economic Capital A Case Study to Analyze Longevity Risk, Silverman, JRM, 2010

Economic Capital for life Insurance Companies, SOA Research paper, Oct 2016 (exclude sections 5 and 7)

Commentary on Question:

This question tested the candidates' knowledge of statutory capital and economic capital. Candidates were expected to answer from a SPIA perspective.

SPIA is assumed to be a product where single premium exchanged for life contingent payments with a variety of single and joint payment options and varying amounts to survivors, certain periods or refund features. Portions of a SPIA business may also have some non-life contingent payments in the form of payouts for a set number of years.

An actual company of this type might consider offsetting the longevity risk of SPIA business with the mortality risk of life business. NAIC is currently working to add an RBC longevity charge which will further encourage risk offsetting. In economic capital, offsetting is already occurring through the stochastic modeling of mortality.

Solution:

- (a) Assess the treatment of the key risks for SPIA under each of the following:
 - (i) Economic capital
 - (ii) Statutory risk-based capital

Commentary on Question:

In this part of the question, candidates were to elaborate on capital with the information that the company sells primarily SPIA and has been using statutory capital.

9. Continued

Only key risks were requested. Some candidates described the RBC framework of C0-to-C4 factors and applicable categories which received partial credit. A few candidates discussed disintermediation risk that would be applicable to deferred annuities but not immediate annuities. A few candidates confused longevity (risk of death later than expected) for mortality (risk of death earlier than expected). A few candidates incorrectly mentioned COVID-19 as an event that would reduce profitability in existing SPIA business. A few candidates identified cures for major diseases (or other mortality improvements) as events that might reduce profitability in existing SPIA business.

Of the following six points any four receive full credit:

- Key SPIA risks are investment and longevity
 - Risk-Based Capital (RBC) includes for investment risk, specifically duration mismatch, in C3-factors & C3-analysis
 - RBC has no capital charge currently for longevity in C2-factors
 - Factor-based capital models (RBC), by ignoring inherent mortality volatility, could potentially understate future economic capital. This shortcoming can be overcome with a principles-based approach that uses stochastic techniques and dynamic assumptions for mortality and other variables.
 - When static assumptions are used to calculate economic liabilities the reserve results tend to converge around a mean. If dynamic assumptions are used instead the tail percentile values show a much wider dispersion, leading to a better understanding of the risk profile.
 - Assessment: RBC may underestimate the amount of capital needed for longevity risk compared to the amount of economic capital needed.
- (b) Critique the following statements related to the capital needed for PCLC's SPIA product:
- A. *VaR is preferable over CTE because it recognize and allocates diversification benefits.*
 - B. *The liability runoff approach uses the preferred time horizon because of the importance of finding the amount of capital today that will provide sufficient protection for the lifetime of the portfolio.*
 - C. *The use of an economic valuation method provides the best assessment of risks across different companies and countries regardless of any regulatory or accounting framework.*
 - D. *If PCLC holds 400% of total RBC for its SPIA block the surplus will be sufficient to cover all the future benefits.*

9. Continued

Commentary on Question:

In this part of the question candidates were to critique the statements while connecting the answer to the company and the specific characteristics of the SPIA product. Candidates that did well critiqued the statements from the perspective of the company and the SPIA product.

For full credit, a rationale for true or false and some tie to characteristics of SPIA is necessary. The following sentences for each statement are somewhat more than what would be needed for full credit on that statement:

- A. False. SPIA is long-tailed business and CTE better captures tail events, recognizes diversification with other benefits and is also coherent. However, VaR is easier to implement and explain to a non-technical audience since an economic view would be new for PCLC.
- B. False. Given SPIA is long-duration, providing sufficient capital over the long-term is important. The time horizon needed may be longer than a finite risk horizon. Liability runoff approach attempts to find the amount of capital today that will provide sufficient protection for the lifetime of the portfolio, thus ignoring the reality that capital levels will be annually reevaluated. Interim solvency checks would need to be implemented. Liability runoff approach can give insufficient recognition of the ability to control risk through asset/liability trading. Liability runoff approach may have management actions though they are difficult to anticipate over the lifetime of the business.
- C. False. These bases may not be appropriate for all insurance products, especially SPIA. Risk-free rates and the short-term market volatility may be inappropriate for long duration annuities, and they do not appropriately recognize insurer's ability to hold assets and liabilities for the long term. Company-specific assumptions make comparisons across companies and countries extremely difficult.
- D. False. Statutory (RBC) does not necessarily capture all the risk. The risk charge for longevity applicable to SPIA is 0 in the current framework. RBC is only for purposes of checking whether regulatory activity might be needed and is only valid for a point in time.

9. Continued

- (c)
- (i) Calculate the economic capital for PCLC's asset and longevity risk. Show all work.
 - (ii) Explain the relationship between the statutory capital and economic capital for asset risk.
 - (iii) Explain the relationship between the statutory capital and economic capital for longevity risk.
 - (iv) Recommend an appropriate risk capital approach using the total asset requirement for the SPIA product. Justify your response.

Commentary on Question:

In this part of the question candidates were to interpret the data and perform calculations for economic capital (all statutory capital numbers are provided). Common errors included picking the highest of the 10 stochastic simulations when the 90th percentile is the second highest out of the 10; and calculating the economic reserves as the average discounted at 4.5% instead of the other set of values discounted at 5.0%. Few candidates correctly calculated the economic capital total asset required.

Note that a positive value was listed for statutory capital for longevity risk even though in part a) and part b) it was indicated there is no RBC factor for longevity currently. The correct interpretation is to use the given value.

- (i) Average economic liability @5.0% = 104.5
90th percentile of economic liability @5.0% = 108
90th percentile of economic liability @4.5% = 110

From the values already know economic TAR = 110 and reserve = 104.5, now have to uncover how much of 5.5 is longevity (walk up percentiles) and how much is asset (walk across discount rates).

Economic:

Capital for asset risk = 90th @4.5% - 90th @5.0% = 2 (=110 - 108)

Capital for longevity risk = 90th @5.0% - Ave @5.0% = 3.5 (=108 - 104.5)

	Economic	Statutory
Reserve =	104.5	99.0
Capital for asset risk =	2.0	2.0
Capital for longevity risk =	<u>3.5</u>	<u>1.0</u>
Total Asset Required =	110.0	102.0

9. Continued

- (ii) For asset risk, economic and statutory are the same because the supporting assets earn the statutory interest rate and the company enters into a total return swap. Statutory discount rate of 5.0% minus 0.5% total return swap rate results in economic discount rate of 4.5%. Economic and statutory frequently differ as economic relies on stochastic model results and statutory relies mostly on factors multiplied by exposures.
- (iii) For longevity risk, economic is higher than statutory because statutory does not reflect mortality volatility and uses a static/prescribed mortality assumption. Economic with the tail percentile value show a much wider dispersion of results. Economic better captures the risk profile.
- (iv) Statutory Total Asset Required = 102 (= 99 + 2 + 1)
Economic Total Asset Required = 110 (=104.5 + 2.0 + 3.5)

Recommend Economic Risk Capital approach to better capture the SPIA risk profile. Statutory doesn't fully capture longevity.

- (d)
 - (i) Construct a multi-tiered capital objective for PCLC assuming it takes a statutory view.
 - (ii) Explain how the multi-tiered capital objective would be different if PCLC took an economic view.

Commentary on Question:

In this part of the question candidates were to create and explain multi-tier structures for statutory and economic capital. Full credit was received by identifying multiple stakeholders and some kind of reasonable capital objective to satisfy the stakeholder. For statutory capital, some candidates merely listed the various RBC regulatory action levels as the multi-tier structure. For economic capital, some candidates merely listed different levels of VaR or CTE as the multi-tier structure.

There are different stakeholders to satisfy who have differing objectives that might not be consistent across tiers. For example, policyholders want claims and obligations paid and do not care about debtholders or shareholders, while debtholders want debt repaid and does not care about the policyholder or the shareholder. Tiers reflect that the policyholder is always first.

9. Continued

(i) Statutory multi-tier capital objective

Tier	Stakeholder	Objective
1	Policyholders	Meet Policyholder cash flows at they fall due with a 95% certainty over the life of the business
2	Debtholders	Meet debt payments as they fall due with 90% certainty
3	Operational Company	Ensure regulatory capital ratio above 200% Authorized Control Level over the next five years

(ii) Economic multi-tier capital objective

Tier	Stakeholder	Objective
1	Policyholders	Meet Policyholder cash flows at they fall due with a 95% certainty over the life of the business
2	Rating Agencies	Maintain capital to support or exceed current rating level with a 90% certainty
3	Operational Company	Ensure Objective 2 is met with an 80% certainty over the next five years

For PCLC, economic capital will generally exceed statutory capital due to a more complete risk view, especially longevity risk applicable to SPIA. In addition, rating agencies, as a part of economic capital, behave as a business governor when the company is still well above regulatory action levels that are part of statutory capital.