ILA LFVU Model Solutions
Spring 2016

1.   **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.

(4f)   Explain and apply methods in earnings management and capital management.

Sources:
LFV-137-16: Kraus 2011 – EVARAROC vs. MCEV Earnings – A Unification Approach

Commentary on Question:
This question tested the candidate's understanding of performance metrics comparing EVA/RAROC to MCEV earnings.

Candidates were expected to understand the underlying concepts and demonstrate their comprehension through the quality and correctness of their error analysis

The candidate was expected to assess and justify the accuracy of a series of statements. True statements were not expected to provide a justification for full credit. False statements required identification of what is incorrect and some explanation of what would be correct.

To receive full credit, candidates were required to clearly identify whether a statement was true or false, which some failed to do. Some candidates who correctly identified a statement as false did not give sufficient justification as to why.

1. **Continued**

Solution:
Assess the accuracy of each of the following statements with regard to the use of performance metrics for value-based management of insurance business. Include any necessary recommendations to correct the statements.

A. *Economic value added (EVA) and risk-adjusted return on capital (RAROC) are good performance metrics for life insurance.*

B. *There is an important connection between the cost of capital and solid enterprise risk management (ERM).*

C. *The cost of capital can be interpreted as the minimum rate of return on equity capital that is required by the shareholders to make it worthwhile to invest in a company. The correct cost of capital rate is essential to measuring performance.*

D. *Traditional accounting-based performance measures such as return on equity (ROE) or return on investment (ROI) evaluate performance and provide good indications for relative performance measurement and value creation.*

E. *Businesses should distinguish forward-looking objectives, such as target setting and decision making, from backward-looking objectives, such as performance evaluation and compensation schemes.*

F. *Market-based measures of return are superior to accounting-based measures of return.*

G. *The market consistent embedded value (MCEV) corresponds to the value of the business at one specific point in time and is a good measure for managerial performance.*

H. *For operating variances there is no need to separate between experience variances and assumption changes. The MCEV methodology makes implicit allowances for change in all assumptions as it is based on market consistent values.*

I. *The total MCEV earnings should be used for managerial performance evaluation.*

J. *In order to measure the true value creation of MCEV earnings, the unwinding of the inforce business needs to be included since there is no additional value creation by the expected business contribution.*

1.   Continued

A. FALSE
   - EVA and RAROC focus on the performance of specific periods and do not take into account future profits that can be expected from existing business.
   - MCEV is more appropriate for considering cash-flows from long-term business such as life insurance

B. TRUE
   - With a unique and complex risk landscape compared to other industries there is a need for proper risk and capital management.
   - Shareholders require a particular rate of return which needs to be measured within the context of performance measurement and reporting
   - Identifying the correct cost of capital is one of the central tasks for measuring value in the insurance industry
   - Clear connection between risk management and value creation is the core of a solid ERM

C. TRUE
   - the cost of capital varies across industries and across lines of business in the insurance industry
   - Important in considering a multi-line pricing and capital allocation for insurance companies
   - There are different models for estimating the cost of equity capital for property-liability reserves with different business line composition

D. FALSE
   - ROE and ROI are without any consideration of risk and uncertainty components
   - This can lead to misleading indications of relative performance measurement and value creation

E. TRUE
   - there is a natural split in performance metrics between evaluation before the performance has actually occurred and evaluation after the performance has taken place.
   - EVA and RAROC are used for both

1. **Continued**

F. FALSE
- There are differences that need to be understood.
- Traditional accounting based measures fail to assess the market based measures or return because they are based on historical asset values which are distorted by inflation and other factors
- The EVA presents the difference between the accounting rate of return and the market rate of return required by shareholders.
- The MVA is the present value of all future accounting biases and can be referred to as the franchise value.
- The use of valuation models based on discounted cash flows to reduce the accounting bias and bring accounting based performance measures more into line with market based measures (similar to residual income valuation models).
- Embedded value reporting is intended to minimize accounting bias
- To fully eliminate the bias future new business has to be integrated into the valuation model

G. FALSE
- Need to analyze the change in MCEV over time to use for managerial performance and decision making
- Detailed movement analysis of MVEV earnings provides helpful information for management and can be a good indicator for value creation
- Detailed movement analysis helps sort out the value creation (or destruction of the in-force)

H. FALSE
- This is true for economic variances and economic assumptions
- Operating variances are divided into non-economic variances affected by experience variances (changes from variance between actual experience and anticipated) and assumption changes (changes in the experience assumptions).
- It is important to identify, explain, and disclose the different kinds of variances in the MCEV reporting

I. FALSE
- Management does not have any impact on economic variances
- Companies can disclose information about the operating return which attempts to exclude the change in economic assumptions.

J. FALSE
- The unwinding should be EXCLUDED
- For calculation of the total unwinding effect separate the unwinding effect of the PVFP, the cost of residual non-hedgeable risks, frictional costs of required capital.

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

Learning Outcomes:

(5a) Describe the considerations and evaluate the appropriate reinsurance form from the ceding and assuming company perspectives.

(5b) Explain the consequences and calculate the effect on both ceding and assuming companies with respect to:
- (i) Risk transfer
- (ii) Cash flow
- (iii) Financial statements
- (iv) Reserve credit requirements
- (v) Tax

Sources:
Life, Health & Annuity Reinsurance, Tiller, 3rd Edition, Ch. 4-6

Commentary on Question:
This question tested the candidates' understanding of the various forms of reinsurance and the considerations to evaluate the appropriate form of reinsurance from the ceding company perspective. Candidates were expected to demonstrate their understanding of the consequences and the effect on both ceding and assuming companies with respect to risk transfer, cash flows and reserve credit treatment. In addition, candidates were required to demonstrate the impact to mortality risk of excluding non-forfeiture options and policy loan.

Solution:

(a) Explain how an insurance company can use reinsurance on an inforce block as part of its financial strategy.

Commentary on Question:
This question tested the candidates' knowledge of the use of reinsurance as part of companies' financial strategy. Most candidates understood the major reasons as capital and tax relief. Not all candidates identified using the ceding company's expertise or the using reinsurance to recapture a block of business.

2. Continued

An insurance company can use reinsurance on an inforce block as part of its financial strategy to:
- Cede business to reduce required capital
- Cede business to optimize the use of tax losses
- Ceding commission will have a positive effect on earnings and surplus
- Use of mod co (or other forms) leave the assets with the ceding company
  - This will not trigger a capital gain/loss
  - The ceding company retains the investment policy
  - The reinsurer can utilize the cedant's expertise
  - There is no concern for the reinsurer's credit quality
  - Recapture can be more easily accomplished
  - Aligns the cedant's and reinsurer's view of earned and credit rate

(b)

    (i)   Describe the characteristics of modified coinsurance (mod-co).

    (ii)   List two advantages and two disadvantages of mod-co.

Commentary on Question:
Most candidates were able to list some of the characteristics of mod-co reinsurance (asset remaining with ceding company and mod-co adjustment). Candidates needed to provide a more complete list to receive full grading points.

Characteristics of modified coinsurance include:
- The ceding company maintains the reserves and the assets backing the reserves
- There is a proportional sharing of premiums, benefits, and reserve increases
- The reinsurer pays the ceding company an allowance to provide gains and cover ceding company expenses
- A mod-co adjustment is used for the increase of statutory reserve increase of the ceded portion.

Advantages of mod-co include:
- Ceding company avoids transferring ownership of the assets
- Ceding company receives reserve credit even if the reinsurer is not licensed in the ceding company's state of domicile
- The reinsurer may not prefer to manage the assets

2. **Continued**

Disadvantages of mod-co include:
- Mod-co is complicated to administer
- Transfer of assets back to the reinsurer in the event of treaty termination could create exposure to capital loss for the ceding company
- Transfer of the initial mod-co adjustment could create the same problem for the reinsurer
- Special transactions are needed in the case of surrender or death
- The reinsurer is exposed to the ceding company's credit risk

(c) Calculate the following for each year:

(i) Gain or loss to JZ Life each year under the base scenario.

(ii) Gain or loss to CM Re each year under the catastrophe scenario.

Show all work.

Commentary on Question:
Most candidates were able to calculate the net premium, expense allowance and net claims. However, most candidates were not able to calculate the risk charge correctly (generally not applying the 90% reinsurance factor). Candidates that demonstrated full understanding of the key components of the calculation received most of the grading points. Full grading points were awarded only if there were correct calculation for all years.

Base

Cedant	2017	2018	2019	
Gross Premium	200	210	200	
Ceded Premium	180	189	180	*=90% * Gross Prem*
Net Premium	20	21	20	*=Gross Prem less Ceded Prem*
Expense Allowance	18	18.9	18	*=10% * Ceded Prem*
Total Revenue	38	39.9	38	*=Net Prem + Exp Allowance*
Gross Claims	140	147	140	
Ceded Claims	126	132.3	126	*=90% * Gross Claim*
Net Claims	14	14.7	14	*=Gross Claim less Ceded Claim*

2. Continued

Required Capital	50	52	50	
Risk Charge	4.5	4.68	4.5	*=Req Cap * 200% * 90% * 5%*
Total Benefits	18.5	19.38	18.5	*=Net Claims + Risk Charge*
Net Income	19.5	20.52	19.5	*=Total Revenue less Total Ben*

Catastrophic

Reinsurer	2017	2018	2019	
Premium	180	162	144	*=90% * Gross Prem*
Risk Charge	4.68	5.04	5.4	*=ReqCap * 200% * 90% * 5%*
Total Revenue	184.68	167.04	149.4	*=Prem + Risk Charge*
Expense				
Allowance	18	16.2	14.4	*=10% * Ceded Prem*
Claims	180	207	252	*=90% * Gross Claims*
Total Benefits	198	223.2	266.4	*=Exp Allowance + Gross Claims*
Net Income	-13.32	-56.16	-117	*=Total Revenue less Total Ben*

(d)   The catastrophe scenario in part (c) excludes the following:

- 40% of the policies of this block are eligible for non-forfeiture options.
- Policyholders are eligible to take policy loans, and the utilization has been volatile over the years.

(i)   Assess how these exclusions affect the mortality risk to CM Re.

(ii)   Describe how these exclusions would be handled in a reinsurance transaction.

Commentary on Question:
Most candidates correctly demonstrated that mortality risk could increase due to the exclusion of the non-forfeiture option. However, most candidates stated that policy loan exclusions should not impact mortality risk. In addition, most candidates could only identify 'the provisions in the reinsurance treaty' as a way to handle the exclusions.

2. **Continued**

(i)   The mortality risk could increase due to the exclusion of the non-forfeiture option.
The mortality risk could decrease due to the exclusion of policy loan.

(ii)   Ways to handle the exclusions include:
- The reinsurance treaty should describe how the amount of reinsurance is treated
- The reinsurer could fulfill its obligation by paying an amount equal to the statutory reserve for the benefit – this eliminates the difficult task of administering these benefits
- Stress test should be revised to include the consideration of non-forfeiture option and policy loans.

3. **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:

LFV-134-16: Ready or Not, Here it Comes, include Appendix 2, PWC

Commentary on Question:

This question tests the candidate's knowledge of International Financial Reporting Standards. To receive full credit for Part (a), the candidate needed to clearly indicate if the statement is correct, and if not correct, recommend how to correct it. To receive full credit for Part (b), the candidate needed to describe the key areas and concerns.

Candidates generally performed poorly on this question, particularly on Part (b) where most candidates demonstrated a lack of understanding of the topic.

Solution:

(a) Assess the accuracy of each of the following statements with regard to tentative decisions made by the IASB during its re-deliberations on the IFRS for insurance contracts. Include any necessary recommendations to correct the statements.

> *A. Changes in the discount rate are presented in other comprehensive income (OCI).*
>
> *B. Investment components are excluded from revenue.*
>
> *C. Premiums written are presented in the income statement.*
>
> *D. The day one locked-in discount rates are used to accrete interest on the contractual service margin (CSM) and calculate the subsequent adjustments that unlock the CSM.*
>
> *A.*
> - This statement is partially correct
> - changes in discount rate can be presented in either profit or loss or OCI
>
> *B.*
> - This statement is correct

3. **Continued**

    C.
- This statement is not correct
- presentation of premiums due or written in the income statement is prohibited

    D.
- This statement is correct

(b)   The IASB continues to discuss a number of matters surrounding the treatment of participating insurance contracts under IFRS.

    (i)   Describe the five key areas under discussion.

    (ii)   Describe any concerns an insurance company may have with the IASB's proposals regarding these five key areas.

    (i)

1. Scope
   - need to clarify which contracts the separate model would apply to
   - may divide contracts which result in payments to policyholders that vary with returns on underlying items into separate categories

2. Splitting of cash flows
   - rethinking proposed requirement to split cash flows into three types
   - approaches that do not involve the splitting of cash flows are also being explored, including a mirroring exception

3. Determining interest expense in profit or loss
   - need to determine discount rate
   - looking at both book yield and effective yield approaches

4. Unlocking and amortization of the CSM
   - need to clarify the circumstances under which the CSM is unlocked and amortized
   - unlocking could be permitted for certain contracts when the change is viewed as an implicit management fee
   - need to determine what constitutes an appropriate pattern for the transfer of services used to release the CSM in profit or loss over the life of the contract

3.   Continued

        5. Presentation of changes in the value of options and guarantees
- contracts within the scope of the mirroring exception: considering presenting   all changes in profit or loss
- contracts outside the scope of the mirroring exception: considering splitting changes between profit or loss, OCI and CSM unlocking depending on the driver

(ii)

        1. Scope
- complications and additional costs associated with dividing contracts
- potential for clouding of financial results due to different presentations for contracts in scope vs. out of scope
- until the final model is determined, it is unclear whether being within or outside the scope will significantly affect the measurement of the liability and income statement presentation

        2. Splitting of cash flows
- approaches requiring splitting: complex, potentially arbitrary and potentially result in accounting mismatches
- approaches not involving splitting: companies are generally supportive

        3. Determining interest expense in profit or loss
- potential for accounting mismatches

        4. Unlocking and amortization of the CSM
- potential for unrealistic representation of performance

        5. Presentation of changes in the value of options and guarantees
- companies are generally supportive of the direction in which IASB is heading

4. **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:
US GAAP For Life Insurers, Second Edition, Ch 8 Variable and Equity-Based Products

Commentary on Question:
This question tested the candidate's knowledge of GAAP accounting on variable annuity benefits. Candidates were expected to name and describe the reserve methodologies as well as demonstrate an understanding of when they are used and how different inputs affect each reserve calculation.

Solution:
(a) Describe the reserve calculation methodologies used to produce the GAAP reserve for each benefit listed above.

Commentary on Question:
Candidates generally did well in identifying which benefits use which methodologies. However, many candidates struggled to describe each of the methodologies with any detail.

GMDB: The benefit is triggered by a "life contingent" or "contingent upon death" event, and the benefit has a pattern of profits followed by losses, so it is reserved for under SOP 03-1. This methodology is designed to set aside up front revenues to pay for future liabilities.

Benefit Ratio = PV Expected Excess Benefits / PV Expected Assessments

SOP 03-1 Liability = Current Benefit Ratio * Cumulative Assessments – Cumulative Excess Benefits + Accrued Interest

GMAB: This benefit has no life contingent component and meets the qualifications for an embedded derivative and is reserved for under FAS 133.

The GMAB benefit is bifurcated from the host contract and is recorded at fair value. The FAS 133 reserve uses a stochastic calculation and can either be a liability or an asset.

FAS 133 Liability = Average PV benefits + Required Profit – Specified Charges

4. Continued

GMIB: This benefit leads to profits followed by losses and has a longevity component, so is reserved for under SOP 03-1. See above for a detailed explanation.

GMWB: This benefit does not have mortality or longevity risk and qualifies as an embedded derivative and is reserved for under FAS 133. See above for a detailed explanation.

(b)   For each of the following independent future events:

    (i)   Decrease in the risk-free rate

    (ii)   Constant 6% equity returns over the next 10 years

    (iii)   A decrease in overall mortality improvement

    (iv)   No equity growth combined with low prevailing interest rates

Identify which of the benefits, GMDB, GMAB, GMIB, or GMWB, you would expect to produce the largest GAAP reserve increase. Justify your answer.

Commentary on Question:

Candidates generally did well connecting an increase in mortality with an increase in the GMDB benefit reserve. Most candidates struggled to identify the connection between the risk-free rate and the FAS 133 fair value calculation. Candidates tended to focus more on secondary or indirect effects rather than the more direct impacts. Many candidates did well in explaining why a particular benefit reserve would increase, but did little to justify why the other benefits were not the correct choice.

(i)   GMDB – The risk free rate has no direct impact in the SOP 03-1 calculation.

       GMAB – The reserve would be likely to increase as the risk-free rate would lead to a lower discount rate in the fair value calculations, increasing the PV of benefits.

       GMIB - The risk free rate has no direct impact in the SOP 03-1 calculation.

4. **Continued**

GMWB - The reserve would be likely to increase as the risk-free rate would lead to a lower discount rate in the fair value calculations, increasing the PV of benefits.

Given the GMWB benefit has a longer duration than the GMAB, the GMWB reserve would be expected to increase the most.

(ii)   GMDB – Equities up 6% for 10 years would increase the AV and put this ROP benefit more and more out of the money. Reserves would likely decrease.

GMAB - Equities up 6% for 10 years would increase the AV and put this ROP benefit more and more out of the money. Reserves would likely decrease.

GMIB – The 5% roll-up occurs regardless of market performance and doesn't keep pace with the 6% market returns preventing the reserves from increasing very much, and most likely would decrease.

GMWB – The annual ratchet prevents this benefit from getting too out of the money. With the benefit base increasing the present value of benefits would increase. This would lead to a likelihood of an increase in reserve.

Therefore, the GMWB benefit reserve is expected to increase the most as the other benefits are likely to decrease or be relatively unaffected. In addition, as the other benefits get further out of the money, dynamic lapses should increase, which would reduce the reserve on the other benefits even more.

(iii)   GMDB – A decrease in mortality improvement would increase mortality leading to more deaths sooner in the projection. The GMDB provides a return of premium upon death so this would increase benefits and increase the reserve.

GMAB – Even though the benefit is unrelated to mortality, higher mortality may reduce the amount of benefits paid as beneficiaries may elect to receive the death benefit instead of the GMAB. Therefore reserves are likely to decrease.

GMIB - Higher mortality would reduce the amount of benefits paid as more policy holders will die before the benefit is elected. Therefore reserves would likely decrease.

4.   Continued

GMWB - Even though the benefit is unrelated to mortality, higher mortality may reduce the amount of benefits paid as beneficiaries may elect to receive the death benefit instead of the GMWB. Therefore reserves are likely to decrease.

The GMDB reserve is the only reserve that would increase at all since the other benefits are living benefits and are not subject to mortality risk. Therefore the GMDB reserve would increase the most.

(iv)   GMDB – Positive equity returns were expected so when this does not occur the reserve may increase slightly.

GMAB - Positive equity returns were expected so when this does not occur the reserve may increase slightly.

GMIB – This will result in a large increase in reserves as the 5% roll-up occurs each year putting this benefit further in the money. The low interest rates will make the guaranteed income rates more attractive, causing the rate at which policyholders annuitize to increase, which will increase the reserve even more.

GMWB - Positive equity returns were expected so when this does not occur the reserve may increase slightly.

GMIB can be expected to have the largest reserve increase due to the rollup feature combined with the low interest rates.

5. **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:

LFV-812-10 A Discussion of AG 43 for Variable Annuities

Commentary on Question:

This question tests the candidate's knowledge of reserve and capital requirements for variable annuities. The product presented is similar to the example case study where AG 43 and C-3 Phase II values are calculated in detail.

As the question asks for lists of potential changes, no explanation as to why the change might improve reserve or capital is necessary. Qualitative or quantitative answers about various aspects of AG 43 and C-3 Phase II are asked in parts b), c), and d).

Most candidates answered most parts of the question well, with candidates performing better parts a) and b) than parts c) and d).

Solution:

(a) List four possible modifications to the guarantees that could minimize the impact on statutory reserves and capital requirements.

Commentary on Question:

Possible answers are listed by category. Product features and options items are more frequently mentioned than other items. Note that only four items were requested, more items are shown here to reflect a variety of possible answers and not to indicate the expected answer from a candidate.

Product features and options:

- Increase rider benefit charges; base on guarantee rather than account value
- For roll-up benefit establish lifetime cap
- For ratchet benefit use deductibles/participation rates
- Lengthen GMIB waiting period
- Avoid overly generous guarantee types and product designs
  - Combination GMIB/GMDB, "live or die" rider is a rich benefit
  - Consider reducing roll-up%
  - Consider lengthening the time between ratchet step-ups
  - Consider specifying whether the guarantee and benefit is 1) roll-up chosen at issue or 2) ratchet chosen at issue or 3) the greater of roll-up or ratchet at the point of utilization

5. Continued

       o Consider GMDB maximum issue age or contract duration or limit to Return of Premium (ROP) or to waiver of surrender charge

Investments available:
- Restrict sub-accounts available to less volatile/volatility-controlled funds
- Automatically rebalance to/from higher volatility and lower volatility or fixed accounts depending on fund performance

Management options:
- Implement some form of hedging or dynamic hedging

(b)   Describe the conditions in which the statutory reserves for the ratchet design would be higher than the statutory reserves for the roll-up design. Justify your answer.

Commentary on Question:
As roll-up reserves tend to exceed ratchet reserves when a reasonably high roll-up rate is used, this part of the question asks for an analysis of when ratchet reserves may actually exceed roll-up reserves. A qualitative answer is desired as few specifics are provided other than a roll-up percentage.

Ratchet design increases guarantee to account value on each step-up
Roll-up design increases guarantee by the annual roll-up percentage

Ratchet reserve requirement depends on projected market performance
- Projected market performance after fees and charges are deducted (after MER) <u>greater than</u> the roll-up rate increases ratchet reserve relative to roll-up reserve
- Projected market performance after fees and charges are deducted (after MER) <u>less than</u> the roll-up rate decreases ratchet reserve relative to roll-up reserve
- Market volatility conditions where high returns are followed by low/negative returns may also result in ratchet reserve exceeding roll-up reserve

(c)   You currently have a C-3 Phase II model.

    (i)   Describe the key changes that would be required to update the model to calculate the AG43 stochastic component.

    (ii)   Describe the key changes that would be required to update the model to calculate the AG43 standard scenario reserve.

5. **Continued**

Part (c) asks about major differences between a C-3 Phase II model and an AG 43 model for both stochastic and standard scenario purposes. Although many items could be written, the following solution covers the main points for (i) stochastic and (ii) standard scenario. Some candidates answered by saying "update assumption X" while the specific differences that exist between AG 43 and C-3 Phase II is the desired response.

(i)

Stochastic	C-3 Phase II	AG 43
Metric	CTE (90)	CTE (70)
Discount Rate	Forwards or 1-year Treasury Rate	Reinvestment rate net of default
Net Revenue-Sharing	Allowed	Guaranteed + limited non-guaranteed
Assumptions	Prudent Best Estimate	Prudent Estimate
Maximum Hedge Effectiveness	95%	70%

(ii)

Standard Scenario	C-3 Phase II	AG 43
Scenario	Drop-and-recovery	Smaller drop & Faster recovery
Discount Rate	10-yr CMT + 50bps with 9% cap and 3% floor	Standard Valuation Law, Plan Type A, guaranteed duration 10 to 20 years
Net Revenue-Sharing	Not Allowed	Guaranteed only
Margins	Defined	Higher margins
Mortality	Defined	Lower mortality
Election Rates	15% for all ITM bands	Varies by ITM

(d)   (*3 points*) You are given the following information for a single scenario under AG43:

Time	0	1	2	3
Working Reserves	95,000	90,000	81,000	0
Projected Assets	35,000	24,000	10,000	10,000
Discount Rate		5%	3%	4%

5. Continued

      (i)   Calculate the greatest present value of accumulated deficiencies (GPVAD) under this single scenario. Show your work.

      (ii)   Calculate the AG43 reserves, assuming the CTE (70) is 2.5 million and the standard scenario reserve is 2.7 million. Show your work.

Commentary on Question:
Part (i) asks what the GPVAD is given a stochastic scenario result. As it relates to actual practice, what would be calculated is an adjustment to the Starting Asset for a potential model rerun to confirm the adjustment more or less removes the Accumulated Deficiencies. As this would actually be performed over many scenarios and the stochastic amount is based on CTE (70) this rerun will likely not result in exactly zero Accumulated Deficiencies. Most candidates received significant partial credit. Most candidates made it to the Accumulated Deficiencies, while fewer could find the PV with the discount rate varying by year and even fewer candidates made it to the final step of adding the Starting Asset to the Maximum PV.

Part (ii) asks what the final AG43 reserve is given the Standard Scenario Amount and the Stochastic Amount. Some candidates incorrectly added the stochastic amount to the standard scenario amount instead of using the desired formula (the two components are not additive).

(i)

For an individual stochastic scenario:

Accumulated Deficiency $_t$ (AD $_t$) = Working Reserve $_t$ – Projected Asset $_t$

$PVAD_0 = AD_0$

$PVAD_1 = AD_1 / \{(1.05)\}$

$PVAD_2 = AD_2 / \{(1.05)*(1.03)\}$

$PVAD_3 = AD_3 / \{(1.05)*(1.03)*(1.04)\}$; $AD_3 < 0$, $PVAD_3$ can be ignored

Time	0	1	2	3
Working Reserve	95,000	90,000	81,000	0
Projected Asset	35,000	24,000	10,000	10,000
AD	60,000	66,000	71,000	-10,000
Discount Rate		5%	3%	4%
PV at time 0	60,000	62,857	65,650	-8,891

Maximum PV = 65,650

GPVAD = Maximum PV + Starting Asset = 65,650 + 35,000 = <u>100,650</u>

5. **Continued**

Note: If the model were rerun with the extra starting 65,650 earning the discount rate then all the Accumulated Deficiencies would be eliminated. It might be similar to the following results shown only to illustrate:

Time	0	1	2	3
Working Reserve	*95,000*	*90,000*	*81,000*	*0*
Projected Asset	*100,650*	*92,933*	*81,000*	*83,840*
AD	*-5,650*	*-2,933*	*0*	*-83,840*
Discount Rate		*5%*	*3%*	*4%*
PV at time 0	*-5,650*	*-2,793*	*0*	*-74,541*

Because many scenarios are run with a CTE (70) calculated it is not likely any specific amount exactly eliminates all Accumulated Deficiencies.

(ii)

Reserve equals Standard Scenario Amount plus the excess, if any, of Stochastic CTE (70) Amount over the Standard Scenario Amount

Reserve = Standard Scenario + Max (0, CTE (70) – Standard Scenario)

CTE (70) = 2.5m
Standard Scenario = 2.7m

Reserve = 2.7m + Max (0, 2.5m – 2.7m) = 2.7m

6. **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:
Analysis of Methods for Determining Margins for Uncertainty Under a Principle-Based
Framework for Life Insurance and Annuity Products, Ch. 3, 4, 5.1, 5.5-5.6, 6

Commentary on Question:
This question tests the candidate's knowledge of a principle-based framework.
Candidates answered part (a) relatively well. Candidates demonstrated an
understanding of the top-down and bottom-up approaches to setting margins. In Part
(b), many candidates failed to address the question. The question asked candidates to
critique the level of margin and the appropriateness of the method used to determine the
margin. Most candidates focused on the appropriateness of the assumption itself.

Solution:
(a)

(i)   List the advantages and disadvantages of the top-down and bottom-up
         approaches to setting margins.

(ii)   Identify the approach being used for setting the mortality margin and lapse
         margin.

(i)   Top-down approaches
         > advantages
         • implicitly reflect diversification
         • might implicitly reflect risks not considered in many bottom-up
           approaches
         > disadvantages
         • do not provide clear and transparent feedback on deviations of actual
           experience from expected

6. **Continued**

Bottom-up approaches
> advantages
- provide explicit feedback by assumption on deviations of actual experience from expected

> disadvantages
- might overstate margin in aggregate due to challenges in reflecting diversification
- don't consider all risks

(ii) Approach used is the bottom-up approach, since margins are specified at the individual assumption level

(b) Critique the level of margin and the appropriateness of the method used to determine the margin for each of the following:

(i) Mortality margin

(ii) Lapse margin

(iii) Interest margin

(i) Level of margin
> too low
> should be greater than commissioner's valuation margin due to lack of experience data

Appropriateness of method
> factor based method has been used to set margin
> pros
- not heavily reliant on historical data
- easy to communicate
> cons
- not consistent with principle-based approach due to implicit incorporation of conservatism
- not transparent

6. Continued

(ii) <u>Level of margin</u>
> absolute size is too low due to:
- low credibility of experience data due to limited amount of data
- future experience difficult to estimate due to guarantee

> may not be signed properly
- margin should be set to increase or decrease assumption depending upon what increases the reserve
- margin which decreases the assumption will decrease the reserve when the guarantee is out of the money

> 50% shock lapse should be covered by required capital instead of the reserve margin

> lapse rate should be modeled dynamically due to guarantee, with margin added for uncertainty surrounding the relationship between policyholder behavior and the degree to which the guarantee is in-the-money

<u>Appropriateness of method</u>
> quantile method has been used to set margin
> pros
- easy to communicate
- transparent

> cons
- may not be consistent with principle-based approach since underlying risk factors do not follow clearly defined probabilistic distributions
- heavily reliant on historical data

(iii) <u>Level of margin</u>
> interest rate risk
- no explicit margin for uncertainty
- explicit margin not needed since risk is hedgeable and interest rates have been stochastically modeled

> equity volatility risk
- 1% margin has been reflected in interest rates
- margin is not necessary since risk is hedgeable and equity performance has been stochastically modeled

<u>Appropriateness of method</u>
> stochastic method has been used to implicitly set margin
> pros
- consistent with principle-based approach
- not heavily reliant on historical data

> cons
- not easy to communicate
- not transparent

7. **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.

(4c) Explain and apply methods in determining risk based capital and economic capital.

Sources:
LFV-131-14: Economic Capital Overview

A Multi-Stakeholder Approach to Capital Adequacy

Economic Capital for Life Insurance Companies

Commentary on Question:
This question tested the candidate's knowledge addressing certain risks in an economic capital framework and the use of economic capital by other stakeholders.

Solution:
(a) You are asked to set up an economic capital model for lapse risk in a large universal life block. Persistency studies are done annually.

Describe the common approaches used to model lapse risk.

Commentary on Question:
Most candidates were able to address some at least one of the approaches.

-Consider stress testing – using data from the persistency studies for a best estimate run scenarios with high and low lapses

-Consider stochastic modeling with dynamic lapses based on whether funds "in-the-money"

(b) Calculate the economic capital for the company. Show all work.

7. Continued

-Lapses: Asset Market Value doesn't change- just take liability difference
   Standard UW – high lapse increases liability – EC = -80-(-200) = 120
   Simplifies UW – low lapse increases liability – EC = 400-300 = 100
   EC = 100 + 120 = 220

-Interest – baseline MV surplus = 250 –(-200+300) = 150
   MV Surplus – Low Interest = 300-(-240+380) = 160
   MV Surplus – High Interest = 170-(-150+200) = 120
   Worst Scenario is High Interest – Interest EC = 150 – 120 =30

-Aggregated EC (no correlation between lapse and interest)
   = (220^2+30^2)^0.5 = 222

(c) Critique the following statement:

"*The weakness of regulatory capital is it tends to produce a lower capital requirement as it is factor based and too straight forward to calculate. Economic capital results are reasonable as it is higher than the minimum regulatory capital. Holding higher capital will receive favorable views from policyholders, regulators, debtholders, and shareholders. If capital is held lower than peer companies with the same rating, the company will get downgraded by the rating agencies. The company will need to hold more than the current minimum regulatory capital as soon as possible before the regulators take action.*"

7. Continued

-Being factor based and straight forward are not the weaknesses of regulatory capital – it is more that certain risks are not addressed nor does it deal with the specific risk profile of a particular company including any risks that may be mitigated by diversification.

-It is not always true that Economic Capital is always higher than regulatory – other parameters may be involved.

-Policyholders and debtholders will welcome higher capital as it increases their chances of financial obligations being met – similarly regulators will prefer the higher capital as it increases the company's solvency outlook.

-Shareholders will have a mixed outlook – higher capital will decrease the chance of the company going bankrupt – on the other hand too much capital will lower the return percentage.

-Rating agencies would look at capital but they have several other items they would look at as well, such as future profitability.

-Regulator will take action if holding capital. lower than certain thresholds – typically some percentage greater than 100 of the minimum regulatory.

8.   **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:
(4b)   Apply methods and principles of embedded value.

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

Commentary on Question:
This question tested the candidate's knowledge of embedded value concepts.

Solution:
(a)   Describe the differences in how economic and non-economic assumptions are developed.

   Commentary on Question:
   Most candidates tended to focus on the similarities between economic and non-economic assumptions instead of focusing on the differences.

   Noneconomic assumptions should be "entity specific", and are developed based on a company's own experience, combined with industry data if the company's experiences are not credible enough.
   Noneconomic assumptions need not be consistent with what the market's perception of what such assumptions should be.

   Economic assumptions are readily observable in the market.
   Economic assumptions are developed based on past experience and economic environment as it exists on the valuation date.
   Economic assumptions apply broadly across the economy

b)   Describe considerations when setting the following:

   (i)   Lapse rates

   (ii)   Investment assumptions

   Commentary on Question:
   Most candidates did well describing considerations when setting lapse rates but weren't as well versed on the investment assumption considerations.

8. **Continued**

      (i)   Lapse Rates
Lapse rate typically set by considering both industry data and a company's own experience, but tend to rely more on company-specific data, because of differences of product design, distribution systems and policyholder service models observed across companies.
Particularly consider the relationship between customer behavior, product design and investment performance. For example, shock lapse at the end of surrender charge period, or end of renewal term period; for flexible-premium products, consider both the distribution channel and the economic environment.
Generally lapse rates are set by both product type and duration.

      (ii)   Investment assumptions
Investment returns are typically derived from a combination of the performance of the actual asset portfolios, company investment expenses, and expected default risks.
Investment expense should reflect the local territory accounting.
Reinvestment assumptions should be considered unless liability and assets are matched perfectly. Like investment return, reinvestment rate is adjusted for investment expenses and default Risk.
Investment assumptions should not capitalize excess return without reflecting any additional risk. For example, increasing the investment return by assuming higher credit spreads should be offset by making an additional allowance for increased risk, possibly through the cost of capital and the RDR.

(c)   Calculate:

      (i)   The risk discount rate.

      (ii)   The inforce book value at the beginning of the current year.

      (iii)   The book profit from new business in the current year. Assume expected inforce book value at the end of the current year is 1,000 million, and total book profit for the current year is 500 million.

    Show all work.

8. **Continued**

Commentary on Question:
Most candidates struggled with all 3 parts of this question. Candidates needed the answer from part (i) to get to the solution in part (ii) and part (iii) and needed the answer in part (ii) to get to the solution in part (iii). Credit was provided for part (ii) and part (iii) even if one of the earlier parts were answered incorrectly. Some candidates provided equations within each part to pick up partial credit. Many candidates did not calculate the New Business Expected Contribution which was the first step to answering the question.

Aggregate Expected Contribution (EC) = New Business EC(t) + Inforce Business EC(t) + Free Surplus EC(T)

$$EC_t = [VNB_t \times (1+RDR)^{0.5}] + [(IBV_{t-1} + RC_{t-1}) \times RDR] + [FS_{t-1} \times i_t]. \quad (28)$$

Since:
NB EC = 0.5 IFB EC
EC(t) = 290
FS(t-1) = 200
Pretax Investment Return = 12.5%
Effective Tax Rate = 20%

290 = NB EC(t) + 2 x NB EC(t) + 200 x 12.5% x (1 − 20%)
NB EC(t) = 90

(i)   VNB * SQRT(1+ RDR) = NB EC(t)
        85 * SQRT(1+ RDR) = 90
        RDR = 12.1%

(ii)   IFBEC = 2 x NB EC
        (IBV(t-1) + RC(t-1)) * RDR = 2 x NB EC(t)
        (IBV(t-1) + 350) * .121 = 2 x 90
        IBV(t-1) = 1137.60

(iii)   Expected Inforce Book Value (EIBV) at the end-of period = Accumulation of beginning-of-period Inforce Book Value (IBV) at the RDR − Expected in-force Book Profit (BP) + Cost of Capital

$$_{IFB}EIBV_t = [IBV_{t-1} \times (1+RDR)] - {}_{IFB}BP_t + [(RDR - i_t) \times RC_{t-1}]. \quad (18)$$

        RC(t-1) = 350
        $_{IFB}$EIBV(t) = 1000

8. Continued

$1000 = 1137.60 \times (1 + 12.1\%) - {}_{IFB}BP(t) + (12.1\% - 12.5\% \times (1 - 20\%)) \times 350 \, {}_{IFB}BP(t) = 281.7$

Total BP(t) = New Business PB(t) + Inforce BP(t)

New Business BP(t) = 500 - 281.7 = 218.3

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.

Learning Outcomes:
(2c)   Recommend and justify appropriate valuation assumptions.

Sources:
Valuation of Life Insurance Liabilities, Lombardi, 4th Edition, Ch. 15

LFV-803-14: NAIC Standard Valuation Law

Commentary on Question:
This question tested the candidate's knowledge of the Actuarial Opinion and Memorandum Regulation and the upcoming Principles-based Reserving framework.

Solution:
(a)   Assess the appropriateness of each of the following excerpts from the Actuarial Opinion and Memorandum of XYZ Life, a U.S. insurance company. Justify your response.

   A. *I, John Actuary, am Appointed Actuary of XYZ Life. I was appointed by the CEO of XYZ;*

   B. *I am a Fellow of the Society of Actuaries and am familiar with the valuation requirements applicable to life and health insurance companies;*

   C. *The variable annuity liabilities are determined using a net level premium GAAP reserve;*

   D. *The asset adequacy for the UL block is determined using cash flow testing with a 5 year projection period;*

   E. *All whole life products are excluded from the asset adequacy testing because they only represent 10% of XYZ's total liabilities;*

   F. *All short term products used cash flow testing to determine asset adequacy;*

   G. *Federal income taxes may or may not be included in the asset adequacy analysis;*

   H. *A 9/30/15 yield curve was used for the level scenario and a 12/31/15 yield curve was used as the basis for all other scenarios;*

9. **Continued**

Commentary on Question:
This part of the question required the candidate to analyze the appropriateness of various approaches to portions of the business. Candidates generally did well on this part. Maximum credit was received by justifying why a statement was appropriate or not.

A. The appointed actuary should be appointed by the board of directors of the company as specified by the definition of the appointed actuary under the Valuation Manual.

B. To qualify as an appointed actuary, one must be a member in good standing with the American Academy of Actuaries and must meet the qualifications of the Academy.

C. The Actuarial Memorandum and Opinion is based on statutory valuation; the applicable standard to be used for statutory reserves for variable annuities is AG43.

D. The cash flow testing method is suitable for the UL block but the projection period is too short for the long-term duration of a UL product.

E. The whole life product may need to be included as 10% is a significant portion of total liabilities that may impact the result of asset adequacy analysis.

F. ASOP 22 makes it clear that cash flow testing is not always necessary. However, it is up to the actuary to make that judgment. For short-term contracts, cost flow testing may not be necessary.

G. One of the requirements of the analysis section of the memorandum is to describe whether the impact of federal income taxes was considered. The appointed actuary should know if they were used and state it clearly in the memorandum.

H. This is not appropriate; NY Regulation 126 specifies that the beginning yield curve and associated interest rates should be consistent.

9. Continued

(b)   John has been asked to implement a new Principle-based Reserving (PBR) framework for the calculation of life insurance policy reserves as proposed in the NAIC standard valuation law.

   (i)   Describe how assumptions are derived for incorporation into a PBR valuation.

   (ii)   Describe PBR regulatory safeguards that assure reserves are adequate.

Commentary on Question:
Most candidates did well on section (i) but struggled to fully describe all aspects of section (ii). Maximum credit was received with relevant and accurate descriptions that conveyed understanding of the topics.

   (i)   Assumptions for incorporation into a PBR valuation are derived in the following way:
   1) The assumption is prescribed in the valuation manual
   2) For assumptions that are not prescribed, the assumptions shall:
      a. Be established by utilizing the company's available experience, to the extent it is relevant and statistically credible, or
      b. To the extent that company data is not available, relevant, or statistically credible, be established utilizing other relevant statistically credible experience.

   (ii)   The PBR approach is subject to numerous safeguards:
   1) It only applies to new business, meaning it will take effect gradually, giving regulators time to make changes to the Valuation Manual if necessary.
   2) It involves a dynamic process where assumptions (and therefore reserve levels) change as the economic environment and other risk factors change. There are prescriptive and limiting elements that will add some conservatism to PBR reserve levels.
   3) There is a minimum floor based on assumptions set by the NAIC.
   4) Reserve assumptions are subject to significant disclosure requirements and regulatory oversight.

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.

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

Learning Outcomes:

(2b)   Evaluate, calculate, and interpret liabilities and DAC assets.

(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:

US GAAP for Life Insurers, Second Edition, Ch. 6 and 17.4 to 17.7

Commentary on Question:

This question tests the candidate's understanding of how to determine estimated gross profits, deferred acquisition cost assets and unearned revenue liabilities for a UL cohort, both before and after consideration for YRT reinsurance based on the net reinsurance method. For death benefit option, some candidates assumed Type 1 (level face amount), whereas other candidates assumed Type 2 (level net amount at risk). Either approach was acceptable and eligible for full credit.

Solution:

(a)   Calculate the estimated gross profits (EGPs) for the first policy year. Show all work.

        Commentary on Question:
        Candidates did well demonstrating their understanding via formulaic explanations and narratives describing the process. However, candidates struggled to perform the required mathematics successfully, primarily due to a lack of consideration for when various cash flows are incurred.

10. Continued

Estimated Gross Profits(1) =
  Mortality Margin(1) + Recurring Expense Margin(1) + Interest Margin(1)

<u>Mortality Margin</u>

Mortality Margin(1) =
  (COI Charges(1) x (1+ Earned Interest Rate)) −
  (Death Benefits(1) − Account Values Released at Death(1))

For Type 1 policies, Death Benefits(1) =
  Expected Mortality Rate(1) x Face Amount

For Type 2 policies, Death Benefits(1) =
  Expected Mortality Rate(1) x (Face Amount + Account Value(1))

Account Value Released at Death(1) =
  Expected Mortality Rate(1) x Account Value(1)

Account Value(1) =
  (Annual Gross Premium(1) − COI Charges(1) − Expense Charges(1)) x
  (1 + Credited Interest Rate)

Expense Charges(1) = Expense Charge %(1) x Annual Gross Premium(1)

Expense Charges(1) = 0.25 x 2,500 = 625

Account Value(1) = (2,500 − 200 − 625) x 1.03 = 1,725.25

For Type 1 policies, Death Benefits(1) = 0.001 x 100,000 = 100

For Type 2 policies, Death Benefits(1) = 0.001 x (100,000 + 1,725.25) = 101.73

Account Value Released at Death(1) = 0.001 x 1,725.25 = 1.73

For Type 1 policies, Mortality Margin(1) =
  200 x 1.05 − (100 − 1.73) = 111.73

For Type 2 policies, Mortality Margin(1) =
  200 x 1.05 − (101.73 − 1.73) = 110.00

10. Continued

Recurring Expense Margin

Recurring Expense Margin(1) =
  Recurring Expense Charges(1) − Recurring Expenses Incurred(1)

Recurring Expense Charges(1) =
  Renewal Expense Charge % x Annual Gross Premium(1) x
  (1 + Earned Interest Rate)

Recurring Expenses Incurred(1) =
  Renewal Commissions(1) + Maintenance Expense(1)

Renewal Commissions(1) =
  Renewal Commission % x Annual Gross Premium(1) x
  (1 + Earned Interest Rate)

Maintenance Expense(1) = Maintenance Expense x (1 + Earned Interest Rate)

Recurring Expense Charges(1) = 0.10 x 2,500 x 1.05 = 262.50

Renewal Commissions(1) = 0.05 x 2,500 x 1.05 = 131.25

Maintenance Expense(1) = 50 x 1.05 = 52.50

Recurring Expenses Incurred = 131.25 + 52.50 = 183.75

Recurring Expense Margin(1) = 262.50 − 183.75 = 78.75

Interest Margin

Interest Margin(1) = Interest Earned(1) − Interest Credited(1)

Interest Earned(1) = Earned Interest Rate x Account Value(0)

Interest Credited(1) = Credited Interest Rate x Account Value(0)

Account Value(0) =
  Annual Gross Premium(1) − COI Charges(1) − Expense Charges(1)

Account Value(0) = 2500 − 200 − 625 = 1,675

Interest Earned(1) = 0.05 x 1,675 = 83.75

10. Continued

Interest Credited(1) = 0.03 x 1,675 = 50.25

Interest Margin(1) = 83.75 – 50.25 = 33.50

Estimated Gross Profits

Estimated Gross Profits(1) =
    Mortality Margin(1) + Recurring Expense Margin(1) + Interest Margin(1)

For Type 1 policies, Estimated Gross Profits(1) =
    111.73 + 78.75 + 33.50 = 223.98

For Type 2 policies, Estimated Gross Profits(1) =
    110.00 + 78.75 + 33.50 = 222.25

(b) Calculate the following using the net reinsurance method as of the end of the first policy year:

(i)   Deferred acquisition cost asset

(ii)   Unearned revenue liability

Show all work.

Commentary on Question:
Candidates did not do as well on this section as they did on Part (a), primarily due to a lack of understanding of the net reinsurance method as it applies to deferred acquisition costs, estimated gross profits and the unearned revenue. However, candidates were quite successful in demonstrating their understanding of the K-factor formulas and the prospective or retrospective formulas for determining the post-reinsurance deferred acquisition cost asset and unearned revenue liability. The solution below uses the prospective approach (the retrospective approach yields the same answer).

(i)   Deferred Acquisition Cost Asset(1) =
        DAC K Factor x PV Future Estimated Gross Profits(1) –
        PV Future Deferred Acquisition Expenses(1)

        DAC K Factor =
        PV Future Deferred Acquisition Expenses(0) /
        PV Future Estimated Gross Profits(0)

10. Continued

All deferred acquisition expenses are incurred at issue

Before reinsurance:

PV Future Deferred Acquisition Expenses (0) =
(First Year Commission % − Renewal Year Commission %) x
Annual Gross Premium(1) + Issue and Underwriting Expenses

PV Future Deferred Acquisition Expenses(0) =
$(0.5 − 0.05)$ x $2{,}500 + 500 = 1{,}625$

After reinsurance:

PV Future Deferred Acquisition Expenses(0) =
PV Future Deferred Acquisition Expenses Before Reinsurance(0) −
(First Year YRT Expense Allowance % −
Renewal Year YRT Expense Allowance %) x Ceded YRT Premium(1)

PV Future Deferred Acquisition Expenses(0) =
$1{,}625 − (0.20 − 0.10)$ x $60 = 1{,}619$

Before reinsurance, from Part (a):

For Type 1 policies, Estimated Gross Profits(1) = 223.98

For Type 2 policies, Estimated Gross Profits(1) = 222.25

After reinsurance:

Estimated Gross Profits(1) =
Estimated Gross Profits Before Reinsurance(1) −
(1 − Renewal Year YRT Expense Allowance %) x
Ceded YRT Premium(1) x (1 + Earned Interest Rate) +
Ceded Death Benefit Recovery(1)

For Type 1 policies, Estimated Gross Profits(1) =
$223.98 − (1 − 0.1)$ x 60 x $1.05 + 50 = 217.28$

For Type 2 policies, Estimated Gross Profits(1) =
$222.25 − (1 − 0.1)$ x 60 x $1.05 + 50 = 215.55$

PV Future Estimated Gross Profits(0) =
(Estimated Gross Profits(1) + PV Future Estimated Gross Profits(1)) /
(1 + Credited Interest Rate)

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10. Continued

For Type 1 policies, PV Future Estimated Gross Profits(0) =
$(217.28 + 3{,}000) / 1.03 = 3{,}123.57$

For Type 2 policies, PV Future Estimated Gross Profits(1) =
$(215.55 + 3{,}000) / 1.03 = 3{,}121.89$

For Type 1 policies, DAC K Factor = $1{,}619 / 3{,}123.57 = 0.51832$

For Type 2 policies, DAC K Factor = $1{,}619 / 3{,}121.89 = 0.51860$

For Type 1 policies, Deferred Acquisition Cost Asset(1) =
$0.51832 \times 3{,}000 - 0 = 1{,}554.96$

For Type 2 policies, Deferred Acquisition Cost Asset(1) =
$0.51860 \times 3{,}000 - 0 = 1{,}555.80$

(ii) Unearned Revenue Liability(1) =
URL K Factor x PV Future Estimated Gross Profits(1) −
PV Future Unearned Revenue(1)

URL K Factor =
PV Future Unearned Revenue(0) /
PV Future Estimated Gross Profits(0)

All unearned revenue is collected at issue

PV Future Unearned Revenue(0) =
(First Year Expense Charge % − Renewal Year Expense Charge %) x
Annual Gross Premium(1)

PV Future Unearned Revenue(0) =
$(0.25 - 0.10) \times 2{,}500 = 375$

From Part (b)(i):

For Type 1 policies, PV Future Estimated Gross Profits(0) =3,123.57

For Type 2 policies, PV Future Estimated Gross Profits(0) =3,121.89

For Type 1 policies, URL-K Factor = $375 / 3{,}123.57 = 0.12005$

For Type 2 policies, URL-K Factor = $375 / 3{,}121.89 = 0.12012$

10. Continued

For Type 1 policies, Unearned Revenue Liability(1) =
(0.12005 x 3,000) – 0 = 360.15

For Type 2 policies, Unearned Revenue Liability(1) =
(0.12012 x 3,000) – 0 = 360.36

11.

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

Learning Outcomes:
(1a)   Construct, analyze and evaluate basic U.S. GAAP, Statutory, and Tax financial statements for a life insurance company.

(1d)   Describe, apply and evaluate the appropriate accounting treatments for insurance products, separate accounts, assets, and derivatives.

Sources:
Valuation of Life Insurance Liabilities, Ch. 1, Overview of Valuation Requirements

Valuation of Life Insurance Liabilities, Ch. 2, NAIC Annual Statement

Actuarial Aspects of SOX 404, Financial Reporter, Dec. 2004

Commentary on Question:
This question tested a candidate's knowledge of various aspects of the financial reporting process.

Solution:
(a)   For each of the following line items:

   (i)   Total cash and invested assets

   (ii)   Annuity benefits

   (iii)   Change in unrealized gains

   (iv)   Dividends to policyholders

   Identify the primary financial statements from the NAIC Annual Statement where these line items are included.

   Commentary on Question:
   Most candidates correctly answered part (i). Candidates struggled to provide complete solutions to the other parts. Most candidates did not identify that annuity benefits and dividends to policyholders appear in more than one financial statement and only received partial grading points. Many candidates referred to the "income statement" or "other comprehensive income" in their solutions, which indicates that candidates did not understand the difference between statutory and GAAP accounting. (The statutory terminology for the "income statement" is the Summary of Operations. There is no line item named OCI in statutory accounting.)

11. Continued

      (i)   Total cash and invested assets can be found on the Balance Sheet.

      (ii)   Annuity benefits can be found on the Summary of Operations, the Cash Flow Statement, and the Analysis of Operations by Lines of Business.

      (iii)   Change in unrealized gains can be found on the Capital and Surplus Account.

      (iv)   Dividends to policyholders can be found on the Summary of Operations and the Cash Flow Statement.

(b)   Describe the documentation best practices for the SOX 404 self-assessment process.

Commentary on Question:
Candidates generally did not answer this question correctly. Many candidates discussed general practices to follow for good documentation but did not specifically answer the question regarding SOX self-assessment.

- Formal identification of the processes and sub processes in the actuarial area that impact the financial statements
- Narrative descriptions of the processes and sub processes
- Process flow charts
- A control matrix, which contains for each key control the control objective, the specific control activity, a description of the type of testing, the financial statement accounts involved, and any other relevant information
- Documentation of the testing of each control

(c)   The following control failures have occurred:

      (i)   The reserves were not updated for a block of business, resulting in an incorrect reported reserve.

      (ii)   A valuation spreadsheet was changed by someone who had no reason to open it, resulting in an incorrect reported reserve.

    Recommend corrective actions to avoid similar future failures.

Commentary on Question:
Candidates that directly addressed the failures described did well. Some candidates just provided a list of controls and did not address the situation itself. For example, for part (i), sample testing would not be an appropriate corrective action since the issue was not an incorrect reserve number, but the fact that the calculated reserve did not make it into the financial statements.

11. Continued

       (i)   Reserves not updated
- Reconciliation of control totals between input and output files (i.e. test of inventory)
- Reconciliation of general ledger and calculated balances
- Trending of reserves from one period to the next
- Formal peer review to catch errors

       (ii)   Valuation spreadsheet changed by unauthorized person
- Password protection of key spreadsheets, restricted access to work files
- Sample testing of calculations
- Formal peer review to catch errors