

# ILA LFMU Model Solutions

## Fall 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.

### Sources:

LFV 106-07: Mergers and Acquisitions, Chapter 4 (Sections 4.1-4.6)

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

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

### Commentary on Question:

*This question tested the candidates' understanding of the fundamental principles of capital management and allocation. Candidates were expected to know how to measure the cost of capital and to utilize the cost information to assess the value creation potential of various competing projects.*

*Candidates generally did well. A few candidates did not state the formula for WACC or make the correct adjustment for the capital allocation. Some candidates failed to convert the equity growth rate result into a 1 year result for use in comparisons with yearly costs of capital and ROE.*

### Solution:

- (a) Calculate ABC's weighted average cost of capital. Show all work.

$$WACC = e * E/(D+E) + d * D/(D+E) \text{ where}$$

e is the cost of equity

d is the cost of Debt

E is the amount of Equity capital and

D is the amount of Debt

$$WACC = 15\%*(300/(300+100)) + 5\%*(100/(300+100)) = 12.50\%$$

## 1. Continued

- (b) Determine the direction of adjustment (if any) of the capital allocation to each business unit to increase the economic value of ABC, using the weighted average cost of capital calculated in part (a). Justify your answer.

### Unit A

The equity growth rate is greater than the ROE ( $13.19\% > 10\%$ );

Free cash flow is not being generated.

ROE is less than the WACC ( $10\% < 12.50\%$ );

Economic value is not being created.

The company should reduce the growth of this unit (Decrease allocation)

### Unit B

The equity growth rate is greater than the ROE ( $21.64\% > 15\%$ )

Free cash flow is not being generated.

ROE is greater than the WACC ( $15\% > 12.50\%$ )

Economic value is being created.

The company should continue its current course with this unit (No Change)

### Unit C

The equity growth rate is less than the ROE ( $18.56\% < 20\%$ )

Free cash flow is being generated

ROE is greater than the WACC ( $20\% > 12.50\%$ )

Economic value is being created.

The company should allocate more capital to this unit (Increase allocation)

## 2. 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.
- (4c) Explain and apply methods in determining risk based capital and economic capital.
- (4d) Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital.

### Sources:

LFV-106-07: Chapter 4 of Insurance Industry Mergers & Acquisitions (Sections 4.1-4.6)

LFV-131-14: Economic Capital Overview: Chad Runchey, August, 2012

Economic Capital for Life Insurance Companies, SOA Research Paper, Feb 2008,

### Commentary on Question:

*This question tested the candidates' understanding of actuarial appraisal value (AAV) components and their calculation. The candidates were expected to demonstrate their knowledge by evaluating statements.*

### Solution:

- (a)
  - (i) Describe the main components of an actuarial appraisal.
  - (ii) Determine the actuarial appraisal value as of 12/31/2016, using the CAPM method to determine the discount rate. Show all work.

### Commentary on Question:

*Candidates generally understood the main components of AAV. Some candidates confused AAV with economic value terms and assumptions and received partial credit as a result. Full credit was given for stating the term correctly and explaining it or defining how it was calculated.*

*Most candidates calculated ROE and WACC correctly. Some candidates did not calculate the WACC and used ROE as the discount rate for AAV and received partial credit as a result.*

*In calculating AAV, candidates often included the interest on required capital or cost of capital. They were not needed given the information provided.*

## 2. Continued

- (i) Adjusted Book Value - The ABV is equal to the net worth of the insurance company on a statutory basis (i.e. the excess of statutory assets over statutory liabilities).

Value of Inforce Business - The present value of future statutory profits arising from the business that is on the books as of the valuation date. Use best estimate assumptions and discount at WACC.

Value of Future Business Capacity - The present value of future profits arising from the business that is expected to be written subsequent to the valuation date.

- (ii) CAPM Formula: Return on Equity =  $r_{fr} + \beta * (\text{market rate} - r_{fr})$   
 $= 2\% + 1.2 * (8\% - 2\%)$   
 $= 9.2\%$

$$\begin{aligned} \text{WACC} &= \text{Required return of Debt} * (D / (D + E)) + \text{Return on Equity} * (E / (D + E)) \text{ where } D = \text{MV of debt}; E = \text{MV of equity} \\ &= 5\% * (30/(30+90)) + 9.2\% * (90/(30+90)) \\ &= 5\% * 0.25 + 9.2\% * 0.75 \\ &= 8.15\% \end{aligned}$$

$$\begin{aligned} \text{AAV} &= \text{NPV(DE)} = \text{Excess Capital}(t=0) + \text{NPV(AT Earnings - Inc in RC)} \\ &= \text{ABV} + (\text{DCF in 2017} + \text{future NPV(DE)}) / (1 + \text{WACC}) \end{aligned}$$

$$\begin{aligned} \text{DCF in 2017} &= \text{AT Earnings} - \text{increase in RC for 2017} = 10 - (9 - 6) = 7 \\ \text{AAV} &= 100 + (7 + 200)/1.0815 = 291.4\text{M} \end{aligned}$$

- (b) Critique the consultant's statements.

### Commentary on Question:

*Most candidates did well on this part of the question. Candidates were expected to relate each statement to the stated objectives of the company. Full credit was received if the candidates stated whether each statement was appropriate, explained why or why not, and provided alternative approaches if necessary.*

- A. Liability approach is not appropriate. One-year time horizon approach would be more appropriate since the owner is more interested in the outcome within the next year.
- B. The Stochastic approach is not appropriate for all assumptions. The Stochastic approach is resource intensive and is more appropriate for economic assumptions. For assumptions like mortality and lapse rates, Stress Test may be a better method.
- C. Consultant's recommendation is not appropriate of using CTE(99.5) because the CTE is the average of the tail and therefore is more conservative than a "1-in-200-year event. VaR(99.5) would appropriate.

## 2. Continued

- D. It is inappropriate to do a simple sum because diversification is ignored. An aggregation method that includes correlation such as a correlation matrix will be appropriate.
- E. The consultant's statement is not appropriate because holding excess capital will create additional frictional cost, reduction in shareholder value. Consideration for multi-stakeholder view need to be considered when determining capital level.

### 3. Learning Objectives:

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

#### Learning Outcomes:

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

#### Sources:

Life, Health and Annuity Reinsurance by Tiller, 3rd Edition, Chapters 4

#### Commentary on Question:

*This question tested the candidates' understanding of reinsurance.*

#### Solution:

- (a) Describe the primary advantages and disadvantages of the following methods of reinsurance:
- (i) yearly renewable term (YRT)
  - (ii) coinsurance
  - (iii) modified coinsurance (mod-co)

#### Commentary on Question:

*This part of the question tested the candidates' knowledge of the advantages and disadvantages of each reinsurance type. Candidates that did well commented on risk transfer, capital and surplus relief, cost and level of administrative difficulty. Some criteria could be considered both an advantage or a disadvantage. Candidates who did not do well failed to explain the reasoning behind their choices.*

#### YRT

##### Advantages

- Low cost
- Easy to administer

##### Disadvantages

- Can only be used to transfer mortality and morbidity risks
- Limited or no capital/surplus relief

### 3. Continued

#### Coinsurance

##### Advantages

- Can be applied to any type of insurance
- Transfers proportion of all risks to reinsurer
- Provides surplus/capital relief

##### Disadvantages

- If reinsurer is unauthorized, may not be able to obtain reserve credit
- More complex to administer than YRT

#### Modified Coinsurance

##### Advantages

- Same benefits as coinsurance
- Able to obtain reserve credit regardless of reinsurer authorization since assets stay with ceding company

##### Disadvantages

- Very complex administration

- (b) Determine which of the three reinsurance options will maximize TNY's 2017 statutory income for this policy. Show all work.

#### **Commentary on Question:**

*This part of the question tested the candidates' understanding of the financial impacts of each type of reinsurance agreement on a company's statutory income statement. Candidates who did well were able to identify each piece that goes into the income statement and how it would be affected by the different agreements. Common mistakes were failure to recognize the coinsurance percentage based on the company's retention limit, and not understanding that the policy fee is paid by the policyholder to the insurer and not from the insurer to the reinsurer.*

### 3. Continued

		YRT		Coinsurance
Gross Premium	a	8020	a	8020
Ceded Premium	b	550	c	7218
Investment Income	d	50	d	50
Reinsurance Allowance	e	11	f	7362.36
<b>Total Revenue</b>	g	7531	g	8214.36
Gross Reserve Increase	h	900	h	900
Ceded Reserve Increase	i	675	j	810
Commissions	k	7218	k	7218
Expenses		430		430
Premium Tax	l	160.40	l	160.40
<b>Total Expenses</b>	m	8033.40	m	7898.40
<b>Net Income</b>	n	-502.40	n	315.96

Ceded percentage = (Face Amount – Retention Limit)/Face Amount = 90%

- (a) Prem rate per 1000 \* face/1000 + policy fee =  $8 * 1000 + 20 = 8020$
- (b) FY YRT prem per 1000 \* ceded face/1000 + cession fee =  $.6 * 9000 + 10 = 550$
- (c) Ceded percentage \* Gross Premium =  $90\% * 8020 = 7218$
- (d) Initial Surplus \* Investment rate of return =  $1000 * 5\% = 50$
- (e) Premium Tax % \* Ceded Premium =  $.02 * 550 = 11$
- (f) (FY Expense Allowance + Premium Tax %) \* Ceded Premium =  $(100\% + 2\%) * 7218 = 7362.36$
- (g) Gross Premium – Ceded Premium + Investment Income + Expense Allowance
- (h) FY Mean Reserve per 1000 \* Face/1000 =  $.9 * 1000 = 900$
- (i) FY YRT Mean Reserve per 1000 \* Ceded Face/1000 =  $.75 * 9000 = 675$
- (j) Reinsurance Percentage \* Gross Reserve =  $90\% * 900 = 810$
- (k) Gross Premium \* FY Commission % =  $8020 * 90\% = 7218$
- (l) Gross Premium \* Premium Tax % =  $8020 * 2\% = 160.40$
- (m) Gross Reserve – Ceded Reserve + Commissions + Expenses + Premium Tax
- (n) Total Revenue – Total Expenses

Due to the fact that the Mod-co interest rate equals TNY's investment rate of return, Mod-co and Coinsurance will have the same statutory income.

Both Coinsurance and Mod-co maximize TNY's 2017 statutory income.



### 3. Continued

- (c) Recommend one reinsurance option for TNY's new whole life product. Justify your recommendation.

**Commentary on Question:**

*This part of the question tested the candidates' understanding of reinsurance by defending which reinsurance type is most appropriate given a specific situation. There is no right or wrong answer to this question. Candidates who did well were able to recommend one form of reinsurance and relate it to TNY and its new product release. However, many candidates failed to relate their recommendation to TNY's current situation and instead simply restated their answer to part (a).*

I recommend TNY use coinsurance for their new whole life product. TNY only has a surplus of \$1,000, so the surplus relief given by coinsurance would be important to avoid capital strain. TNY has only sold term insurance in the past and is a young company, therefore they might not have the expertise to handle all of the risks involved with selling a whole life product (e.g., investment, persistency, etc.). Coinsurance would transfer a proportion of all risks associated with the product, not just the mortality risk. While Mod-co reinsurance will also transfer the risks, TNY may not want to deal with its additional complexity and may not have the asset management experience needed for such a long duration product. YRT would allow transferring the mortality risk, but would not offer the surplus relief that TNY should be looking for.

#### 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.
- (2c) Recommend and justify appropriate valuation assumptions.

#### Sources:

LFV-802-07: US Tax Reserves for Life Insurers:

Ch 2 Tax-Based Reserves & Ch 7 Section 807(f)

Valuation of Life Insurance Liabilities: Ch 1 Overview of Valuation Requirements

#### Commentary on Question:

*The question tested the candidates' knowledge of tax reserves. Candidates generally did well.*

#### Solution:

- (a) List six of the items the IRS mentioned in Rev. Rul. 94-74 that constitute a change in basis under Section 807(f).

#### Commentary on Question:

*This part of the question tested the candidates' knowledge of what changes qualify for change in basis treatment. Most candidates mentioned at least some items that constitute a change in basis, while a few candidates received full credit.*

*Candidates who did poorly on this section frequently mentioned items that might change the tax reserve on an individual in-force policy. A change in basis can only apply to a group of in-force policies where one of the listed changes happens to the entire group.*

*If the policyholder can call the insurer to make a policy change it won't be a change in basis (the tax reserve next reporting period for that policy will just reflect that policy change), while if an actuary or auditor wants to change the parameters in a tax reserve calculation for a group of policies it quite possibly may be a change in basis.*

*A change in credited interest rate is not a reason for a change in basis even though it affects a group of policies. Similarly, a change in mortality rate will occur as an insured ages and is not a reason for a change in basis even though it affects a group of policies. The credited interest rate and the mortality rate changes through normal operation of policies.*

#### 4. Continued

*Although nine reasons are listed only six reasons were required for full credit:*

1. Change in valuation interest rate
2. Change in valuation mortality rate
3. Change in factors under AG33
4. Change in method regarding substandard and group conversion from non-actuarial to actuarial
5. Change resulting from adjustment of prevailing commissioners standard mortality or morbidity to reflect other risks
6. Change in assumption of death benefit timing
7. Correction in active life reserves on individual disability income table
8. Correction for failure to include cost-of-living rider reserves in active life reserves
9. Correction of an error in “actuarial judgement”

(b)

- (i) Calculate the tax reserve at issue for each option. Show all work.
- (ii) Recommend which credited interest rate option is preferable for each of the following company objectives:
  - 1) To minimize the difference between the statutory reserve and the tax reserve at issue.
  - 2) To minimize the tax reserve at issue.

Justify your recommendation.

**Commentary on Question:**

*This part of the question tested the candidates’ knowledge of tax reserve calculation when simplifying assumptions are present and the application of statutory and tax reserves.*

*Most candidates received some level of partial credit on this part, while a few candidates received full credit.*

*Candidates who performed poorly on this part of the question attempted a calculation with Account Values. All reserves are based on what the company would owe at a point in time and simplifying assumptions were provided to make the actual reserve calculation less complicated. Cash Value is the obligation (amount owed), not Account Value. Cash Values were provided in the question statement and, thus, there was no need to recalculate.*

#### 4. Continued

*Another frequent error was not correctly discounting tax reserves. Tax reserve is minimized by using the maximum discount rate in the comparison between Guaranteed Interest, PSAR and AFR (some candidates also dropped one of these rates from the comparison). A number of candidates used the minimum discount rate in the comparison, which would result in a tax reserve that is too high. Partial credit was given for discounting at the wrong rate.*

*A less frequent error was answering correctly for Option B tax reserve while not correct for Option A tax reserve. Some candidates did not account for the 5.00% first year guaranteed rate in Option A. Since Option B was the same guaranteed interest rate each year and lower than PSAR, it took incrementally less knowledge to calculate Option B tax reserve compared to Option A tax reserve.*

*Some candidates received most or all of the credit for (ii) even with significant errors in (i). In the model solution it can be seen how (ii) can be answered without calculating the right values for (i) by reasoning on the discount rates.*

*Most data in the question was presented in a table form. While certainly not required, candidates who include the table structure in their solution tended to have better success organizing their calculations, resulting in fewer mistakes.*

(i)

Option A:

Tax discount rate = Max (Guarantee, PSAR, AFR)

Tax discount rate (1) = Max (5.00%, 3.50%, 2.50%) = 5.00%

Tax discount rate (2+) = Max (2.00%, 3.50%, 2.50%) = 3.50%

	Cash Value	Rate	Calculation	PV(Issue)	Max
At Issue	97,000.00	-----	97,000.00	97,000.00	
End of Year 1	102,900.00	5.00%	102,900.00 / (1.05)	98,000.00	←
End of Year 2	106,029.00	3.50%	106,029.00 / (1.05)(1.035)	97,565.22	
End of Year 3	109,242.00	3.50%	109,242.00 / (1.05)(1.035)(1.035)	97,122.45	

Option A Tax Reserve (Issue) = Max (Reserve Candidates) = **98,000.00**

Because tax discount rate is higher than stat discount rate in first year (and equal other years): Tax Reserve (Issue) < Stat Reserve (Issue)

## 4. Continued

### Option B:

Tax discount rate = Max (Guarantee, PSAR, AFR)

Tax discount rate (1) = Max (2.99%, 3.50%, 2.50%) = 3.50%

Tax discount rate (2+) = Max (2.99%, 3.50%, 2.50%) = 3.50%

	Cash Value	Rate	Calculation	PV(Issue)	Max
At Issue	97,000.00	-----	97,000.00	97,000.00	
End of Year 1	101,930.20	3.50%	101,930.20 / (1.035)	97,517.10	
End of Year 2	105,008.71	3.50%	105,008.71 / (1.035)(1.035)	98,026.75	
End of Year 3	109,240.88	3.50%	109,240.88 / (1.035)(1.035)(1.035)	98,529.01	←

Option B Tax Reserve (Issue) = Max (Reserve Candidates) = **98,529.01**

Because tax discount rate is the same stat discount rate in all years:

Tax Reserve (Issue) = Stat Reserve (Issue)

(ii)

1)

- Stat discount rate = PSAR = 3.50% (as given)
- Tax discount rate = 3.50% (all years for Option B)
  
- If discounting at the same rate between Tax and Stat, therefore same reserve at issue
- Use Option B (Level all years) for this purpose.

2)

- From (i): Option A Tax Reserve (0) < Option B Tax Reserve (0)
- Alternatively reason that since cash values are nearly the same between the two options, discounting  $\{A: (1.05)((1.035)^{(n-1)})\} > \{B: (1.035)^n\}$ , results in Option A Tax Reserve (Issue) < Option B Tax Reserve (Issue)
- Use Option A (High First Year, Low Remaining Years) for this purpose.

## 5. Learning Objectives:

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

- (1d) Describe, apply and evaluate the appropriate accounting treatments for insurance products, separate accounts, assets, and derivatives.
- (2b) Evaluate, calculate, and interpret liabilities and DAC assets.

### Sources:

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

US GAAP For Life Insurers, Second Edition, Ch 14 (SFAS 115)

### Commentary on Question:

*This question tested the candidates' knowledge on the capitalization and amortization of DAC and URL under FAS 97 and FAS 115.*

### Solution:

- (a) Calculate any effect of retrospective unlocking on the FAS 97 balances at the end of year 2. Show all work.

### Commentary on Question:

*Many candidates ignored the impact of the URL. Clearly defining the appropriate formulas demonstrated knowledge.*

*Candidates in general did well on this part of the question and demonstrated knowledge on how a K factor is calculated. Many candidates knew the appropriate formulas to calculate the DAC balances. Partial credit was given if the candidates followed the process necessary to update and unlock the DAC and URL balances, even they did not calculate the correct answer as a result of a computation error. Credit was lost on EGM and deferred expense timing by candidates who ignored the fact that such timing was dictated in the question itself (expense BOY, margins EOY).*

The only change that happens between the original projection and the updated (actual) projection is that the year 2 deferred acquisition costs end up being higher than originally expected. Deferred premium load experience is in line with originally expected. The result is that there will be a DAC unlocking event due to the deferred acquisition expense change but no Unearned Revenue Liability (URL) unlocking. DAC and URL are amortized at the credited rate of 4.0%

## 5. Continued

Amortization rate for DAC is typically called K% and is equal to the PV of deferred costs divided by the PV of margins.

Original K% at issue based on expected

$$\text{PV acq (a BOY expense)} = 100 + 25 / 1.04 = 124.04.$$

$$\text{PV margins (a EOY item)} = 25 / 1.04 + 40 / 1.04^2 + 50 / 1.04^3 + 55 / 1.04^4 = 152.48$$

$$\text{K\%(DAC)} = \text{PV Defd} / \text{PV EGMs} = 124.04 / 152.48 = 81.34\%$$

Updated K% two years in based on actuals so far + projected

$$\text{PV acq (a BOY expense)} = 100 + 35 / 1.04 = 133.65.$$

$$\text{PV margins (a EOY item)} = 25 / 1.04 + 40 / 1.04^2 + 50 / 1.04^3 + 55 / 1.04^4 = 152.48$$

$$\text{K\%(DAC)} = \text{PV Defd} / \text{PV EGMs} = 133.65 / 152.48 = 87.65\%$$

DAC balances can be calculated retrospectively using a year by year rollforward or prospectively using PVs of future EGMs and deferred expenses. PV of deferred expenses are zero at the end of year two so the DAC balance under the original schedule and the revised schedule are simply K% times the PV of margins.

Original

$$\text{DAC} = \text{K\%} \times \text{PV Future EGMs}$$

$$\text{PV Future EGMs} = 50 / 1.04 + 55 / 1.04^2 = 98.93$$

DAC balance at end of year 2 using original assumptions

$$98.93 \times 81.34\% = 80.47$$

DAC balance at end of year 2 using original assumptions

$$98.93 \times 87.65\% = 86.71$$

DAC unlocking is the difference between new and old =  $86.71 - 80.47 = 6.24$ .

So with DAC unlocking DAC increases 6.24 at the end of year 2

## 5. Continued

- (b) Explain how a profit-neutral unrealized capital gain would affect each of the following items when calculating a shadow DAC adjustment:
- (i) Current and historical gross profits
  - (ii) Future gross profits
  - (iii) Amortization factor
  - (iv) Shadow DAC asset.

**Commentary on Question:**

*Candidates generally did not do well on this part of the question. Candidates failed to identify that historical profits in the past are not impacted by things going forward. The relationship between the current period impact and future period impact was not well understood by many candidates (in particular lower reinvestment rates being the primary driver of lower future profits). Candidates that did not fully describe the inner workings of the shadow DAC balance did not receive full credit.*

- (i) Historical margins are in the past so there's nothing we can do to change them after the fact. The current period capital gain would increase margins for the current period.
- (ii) The event is profit neutral so that implies a future period loss will offset the current period gain. This occurs when the unrealized gain occurs because of a market value increase on a security that comes about from an interest rate drop. The implication for the future is that this interest rate drop lowers future reinvestment earnings.
- (iii) Although profits are pushed from year 3 to year 2 and the PV of margins will increase slightly, the amortization factor will in large part remain the same. In practice, the timing difference is ignored and the amortization is done using the original K%.
- (iv) The positive unrealized gain will result in additional amortization of DAC using K% times the unrealized gain. This will lower the total DAC balance via a negative shadow DAC balance.



## 6. Learning Objectives:

2. The candidate will understand valuation principles and methods of individual life insurance and annuity products issued by U.S. life insurance companies.
4. The candidate will understand basic financial management, capital management and value creation principles and methods in a life insurance company context.

### Learning Outcomes:

- (2b) Evaluate, calculate, and interpret liabilities and DAC assets.
- (4a) Assess financial performance, including analyzing and interpreting the financial performance of a product line or company.

### Sources:

Valuation of Life Insurance Liabilities, Lombardi, Ch. 5&7

US GAAP for Life Insurers, Herget et. Al., Ch. 4

LFV-818-15: Introduction to Source of Earnings Analysis, Vande Vrede, July 2014

### Commentary on Question:

*The question tested candidates' understanding of the basic statutory and GAAP reserve calculations and their ability to analyze financial statements.*

### Solution:

- (a) Calculate the statutory reserve at the end of year 3 for a policy with 100,000 face amount using the Commissioners Reserve Valuation Method (CRVM). Show all work.

### Commentary on Question:

*Generally, candidates were able to demonstrate their knowledge of the formulas to calculate statutory CRVM reserves. Some candidates had difficulty selecting values from the proper duration to produce the correct results. There were a number of candidates who noticed that level premiums will generate only one segment for the calculation of such reserves. There were a number of candidates who properly compared their calculated statutory reserve with the cash value and reported the larger amount as the statutory reserve to be reported. Candidates struggled to determine the CRVM expense allowance.*

Since gross premiums are level, there is only one segment.

$$\begin{aligned} V\text{-CRVM}(48,2) &= \text{Present Value of Future Benefits} - \text{Present Value of Future} \\ &\quad \text{CRVM Net Premiums} \\ &= \text{PVFB}(48,2) - \text{CRVM-NP} \times a\text{-double dot}(48,2) \end{aligned}$$

## 6. Continued

$$\begin{aligned}\text{CRVM-NP} &= \text{Net Level Premium} + \text{Annual Level Amount to amortize} \\ &\quad \text{Expense Allowance over policy term (5 years)} \\ &= \text{NLP} + \text{EA} / a\text{-double dot}(45,5)\end{aligned}$$

$$\begin{aligned}\text{EA} &= \text{minimum of Full Preliminary Term Net Premium for a 20-Pay Life Policy} \\ &\quad \text{and Full Preliminary Term Net Premium for Plan (5-Year Term), less one-year} \\ &\quad \text{cost of insurance} \\ &= \text{minimum}(20P(45)\text{-FPT}, P(45,5)\text{-FPT}) - c(45,1)\end{aligned}$$

$$\begin{aligned}20P(45)\text{-FPT} &= \text{Net Level Premium for 19-Pay Life at issue age 46} \\ &= 1000 \times A(46) / a\text{-double dot}(46,19) \\ &= 665.1353 / 8.49454 = 78.29358241\end{aligned}$$

$$\begin{aligned}P(45,5)\text{-FPT} &= \text{Net Level Premium for a 4-Year Term at issue age 46} \\ &= 1000 \times A(46,4) / a\text{-double dot}(46,4) \\ &= 152.7518 / 3.5888 = 42.56347526\end{aligned}$$

$$\begin{aligned}c(45,1) &= 1000 \times q(45) / (1 + i), \text{ where } i = \text{Statutory interest rate} = 4\% \\ &= 1000 \times (20/1000) / (1 + 0.04) = 19.23076923\end{aligned}$$

$$\begin{aligned}\text{EA} &= \text{minimum}(78.29358241, 42.56347526) - 19.23076923 \\ &= 42.56347526 - 19.23076923 = 23.33270603\end{aligned}$$

$$\begin{aligned}\text{Annual Level Amount to amortize Expense Allowance over policy term} \\ &= \text{EA} / a\text{-double dot}(45,5) \\ &= 23.33270603 / 4.3818 = 5.324913513\end{aligned}$$

$$\begin{aligned}\text{NLP} &= A(45,5) / a\text{-double dot}(45,5) \\ &= 163.170 / 4.3818 = 37.23812132\end{aligned}$$

$$\begin{aligned}\text{CRVM-NP} &= \text{NLP} + \text{EA} / a\text{-double dot}(45,5) \\ &= 37.23812132 + 5.324913513 = 42.56303483\end{aligned}$$

$$\begin{aligned}\text{V-CRVM}(48,2) &= \text{PVFB}(48,2) - (\text{CRVM-NP} \times a\text{-double dot}(48,2)) \\ &= 1000 \times A(48,2) - 42.56303483 \times a\text{-double dot}(48,2) \\ &= 106.0466 - (42.56303483 \times 1.9135) = 24.60223285 \text{ per 1000}\end{aligned}$$

$$\begin{aligned}\text{Since face amount} &= 100,000, \\ \text{then CRVM Statutory Reserve} &= 100,000 \times \text{V-CRVM}(48,2) / 1000 \\ &= 100,000 \times 24.60223285 / 1000 \\ &= 2,460.223285\end{aligned}$$

## 6. Continued

But Reported Statutory Reserve = Maximum of Cash Value and CRVM Statutory Reserve

$$\begin{aligned}\text{Cash Value} &= \text{Face Amount} \times \text{Cash Value}(48,2) / 1000 \\ &= 100,000 \times 28 / 1000 = 2,800\end{aligned}$$

Thus, Reported Statutory Reserve = Maximum(2,800, 2460.22) = 2,800.

- (b) Calculate the GAAP benefit reserve and DAC balance at the end of year 3. Show all work.

### **Commentary on Question:**

*This part of the question tested candidates' understanding of how to calculate GAAP benefit reserves and the Deferred Acquisition Cost (DAC) Asset. Credit was given for candidates that performed a GAAP recoverability test. Most candidates demonstrated their understanding of how to calculate such reserves and DAC assets by providing the correct formulas. The biggest challenge for candidates was selecting the appropriate values from the proper duration.*

*Most candidates used the "K-Factor" approach, where GAAP benefit net premiums and DAC net premiums were not directly determined and were not acknowledged in the reserve and DAC asset calculations, which is acceptable.*

*Many candidates did not include the recurring acquisition expenses, which are also classified as maintenance expenses, as part of the GAAP benefit reserve calculations. Such recurring acquisition expenses only impacted GAAP benefit net premiums and did not impact GAAP benefit reserves because such expenses were a level percent of premium and under FAS 60 has no impact on reserves. Such expenses are incurred and expensed immediately in GAAP income statements. It is also acceptable to include such recurring acquisition expenses with the deferred acquisition expenses in the calculation of the DAC asset rather than as maintenance expenses in the GAAP benefit reserves. The GAAP Audit Guide requires that all acquisition expenses, like commissions, should be deferred and amortized in proportion to premiums under FAS 60. The portion of acquisition expenses that are a level percentage of premium will only impact the DAC net premium and not the DAC asset, since such expenses will be expensed, or amortized, immediately as a result of the mathematics involved in the calculations.*

*There were candidates who attempted to determine the GAAP benefit reserves and DAC assets retrospectively. This is acceptable, but this was more challenging due to their assumption as to the timing of the various variables. Those candidates who performed calculations on a prospective basis had morer success.*

## 6. Continued

GAAP Benefit K Factor = Present Value at Issue of Death Benefits, Surrender Benefits, and Maintenance Expenses / Present Value at Issue of Gross Premiums.

Present Value at Issue of Death Benefits =  $1000A(45,5) = 123.2433$

Present Value at Issue of Surrender Benefits = 2.6309

Present Value at Issue of Maintenance Expenses = Renewal Commission

Percentage x Gross Premium x a-double dot(45,5) =  $.05 \times 45 \times 3.8656 = 8.6976$ .

Present Value at Issue of Gross Premiums = Gross Premium x a-double dot(45,5)  
=  $45 \times 3.8656 = 173.952$

Thus, GAAP Benefit K Factor =  $(123.2433 + 2.6309 + 8.6976) / 173.952 = 134.5718 / 173.952 = 0.77361456$ .

GAAP Benefit Net Premium = GAAP Benefit K Factor x Gross Premium =  
 $0.77361456 \times 45 = 34.81265522$

GAAP Benefit Reserve(48,2) = (PVFDB(48,2) + PVFSB(48,2) + PVFME(48,2))  
– Present Value of Future GAAP Benefit Net Premiums

PVFDB(48,2) =  $1000 \times A(48,2) = 91.0776$

PVFSB(48,2) = 1.3714

PVFME(48,2) =  $.05 \times 45 \times 1.8524 = 4.1679$

Present Value of Future GAAP Benefit Net Premiums = GAAP Benefit K Factor  
x Gross Premium x a-double dot(48,2) =  $0.77361456 \times 45 \times 1.8524 = 64.48696249$

Thus, GAAP Benefit Reserve(48,2) =  $(91.0776 + 1.3714 + 4.1679) - 64.48696249 = 32.12993751$  per 1000

With Face Amount = 100,000, then Total GAAP Benefit Reserve(48,2) =  $100,000 \times 32.12993751 / 1000 = 3,212.993751$ .

GAAP DAC K Factor = Present Value at Issue of Deferred Acquisition Expenses  
/ Present Value at Issue of Future Gross Premiums

Present Value at Issue of Deferred Acquisition Expenses = (First-Year  
Commission Percentage – Level Renewal Commission Percentage) x Gross  
Premium =  $(100\% - 5\%) \times 45 = 42.75$

Present Value at Issue of Future Gross Premiums = 173.952 (from GAAP benefit  
reserve calculation above)

GAAP DAC K Factor =  $42.75 / 173.952 = 0.24575745$

GAAP DAC Net Premium = GAAP DAC K Factor x Gross Premium =  
 $0.24575745 \times 45 = 11.05908526$

## 6. Continued

GAAP DAC Asset(48,2) = Present Value of Future GAAP DAC Net Premiums(48,2) – Present Value of Future Deferred Acquisition Expenses(48,2)

Present Value of Future GAAP DAC Net Premiums = GAAP DAC K Factor x Gross Premium x a-double dot(48,2) = 0.24575745 x 45 x 1.8524 = 20.48584952

Present Value of Future Deferred Acquisition Expenses(48,2) = 0, since there are no future deferred acquisition expenses as of the end of policy year 3.

Thus, GAAP DAC Asset(48,2) = 20.48584952 – 0 = 20.48584952 per 1000

With Face Amount = 100,000, then Total GAAP DAC Asset(48,2) = 100,000 x 20.48584952 / 1000 = 2,048.58

GAAP Recoverability Test

GAAP Recoverability Ratio = GAAP Benefit K Factor + GAAP DAC K Factor  
= 0.77361456 + 0.24575745 = 1.01937201 > 1

Thus, there is a recoverability issue, where not all deferred acquisition expenses can be deferred and the Total GAAP Deferred Acquisition Cost Asset at end of policy year 3 should be reduced to  $(0.24575745 - (1.01937201 - 1)) \times 45 \times 1.8524 \times 100,000 / 1000 = 1,887.10$ .

- (c) Calculate the statutory and GAAP differences between actual and expected mortality experience in year 4. The expected mortality rates are given in parts (a) and (b). Show all work.

### Commentary on Question:

*The part of the question was the most challenging for candidates. Many candidates assumed that the gain from mortality experience was just the difference in actual and expected mortality rates, or the difference in actual and expected death claims, and did not account for the net amount at risk.*

Gain from Mortality =  $q(x,t) \times \text{Net Amount at Risk} = q(x,t) \times (\text{Death Benefit} - \text{End of Year Reserve Released at Death}) = q(x,t) \times (DB(x,t) - EOYV(x,t))$

Expected Gain from Mortality =  $\text{Exp-}q(x,t) \times (DB(x,t) - EOYV(x,t))$

Actual Gain from Mortality =  $\text{Act-}q(x,t) \times (DB(x,t) - EOYV(x,t))$

Expected Gain from Mortality – Actual Gain from Mortality

=  $\text{Exp-}q(x,t) \times (DB(t) - EOYV(t)) - \text{Act-}q(x,t) \times (DB(x,t) - EOYV(x,t))$

=  $(\text{Exp-}q(x,t) - \text{Act-}q(x,t)) \times (DB(x,t) - EOYV(x,t))$

## 6. Continued

To evaluate experience to include Lives Inforce,

$$\begin{aligned}\text{Expected Gain from Mortality Experience} - \text{Actual Gain from Mortality} \\ \text{Experience} &= l(x) \times (\text{Exp-}q(x,t) - \text{Act-}q(x,t)) \times (\text{DB}(x,t) - \text{EOYV}(x,t)) \\ &= (\text{Exp-}q(x,t) - \text{Act-}q(x,t)) \times (l(x,t) \times \text{DB}(x,t) - l(x,t) \times \text{EOYV}(x,t))\end{aligned}$$

$$\begin{aligned}\text{Act-}q(x,t) &= \text{actual death claims} / \text{actual inforce} = 40,800 / 850,000 = 0.048 \\ \text{Beginning Inforce} &= l(x,t) \times \text{DB}(x,t) = 850,000\end{aligned}$$

$$\begin{aligned}l(x,t) \times \text{EOYV}(t) &= \text{EOY Reserve grossed up to BOY Reserve} \\ \text{EOY Inforce} &= \text{BOY Inforce} - \text{Actual Death Claims} - \text{Face Amount Decrease due} \\ \text{to Surrenders} &= 850,000 - 40,800 - 0 = 809,200\end{aligned}$$

Statutory Gain from Mortality Experience

$$\begin{aligned}\text{Expected statutory } q(x,t) \text{ in year 4} &= 50 / 1,000 = 0.05 \\ \text{Statutory Reserve Released at Death} &= 16,900 \\ \text{Statutory Reserve Released at Death grossed up to BOY inforce} \\ &= 16,900 \times 850,000 / 809,200\end{aligned}$$

$$\begin{aligned}\text{Expected less Actual Statutory Gain from Mortality Experience} \\ &= (\text{Exp-}q(x,t) - \text{Act-}q(x,t)) \times (l(x,t) \times \text{DB}(x,t) - \text{EOYV}(x,t) \times l(x,t) / l(x,t-1)) \\ &= (0.05 - 0.048) \times (850,000 - 16,900 \times 850,000 / 809,200) \\ &= 1,664.50\end{aligned}$$

GAAP Gain from Mortality Experience

$$\begin{aligned}\text{Expected GAAP } q(x,t) \text{ in year 4} &= 0.9 \times \text{statutory } q(x,t) = 0.9 \times 0.05 = 0.045 \\ \text{GAAP Reserve Released at Death} &= 19,400 \\ \text{GAAP Reserve Released at Death grossed up to BOY inforce} \\ &= 19,400 \times 850,000 / 809,200\end{aligned}$$

$$\begin{aligned}\text{Expected less Actual GAAP Gain from Mortality Experience} \\ &= (\text{Exp-}q(x,t) - \text{Act-}q(x,t)) \times (l(x,t) \times \text{DB}(x,t) - \text{EOYV}(x,t) \times l(x,t) / l(x,t-1)) \\ &= (0.045 - 0.048) \times (850,000 - 19,400 \times 850,000 / 809,200) \\ &= -2,488.89\end{aligned}$$

## 7. Learning Objectives:

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

### Learning Outcomes:

- (1e) Apply and recommend methods for performing reviews of financial statements including reserves.

### Sources:

Actuarial Aspects of SOX 404, Financial Reporter, Dec 2004

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

ASOP 21 Responding to the Auditor (excluding Transmittal Memo and Appendices)

ASOP 41 on Actuarial Communication (excluding Transmittal Memo and Appendices)

### Commentary on Question:

*This question tested the candidates' understanding of internal controls over financial reporting (ICFR), especially of SOX controls and applicable ASOPs.*

*A common error was mixing up the responses for parts (a) and (c), as noted in the commentary below.*

### Solution:

- (a) List the key steps required for a company to implement an effective evaluation process of Internal Control over Financial Reporting (ICFR) according to the COSO framework.

#### Commentary on Question:

*Not all candidates did well on this part of the question. A common error was providing the 4 components of the control evaluation process, which was required in part (c).*

- Plan and scope of implementation
- Document the controls
- Evaluate the controls
- Identify and correct deficiencies

## 7. Continued

- (b) In anticipation of the meeting with ARA's internal auditors, you have been reviewing ASOPs.
- (i) List any concerns that you think the internal auditors might have. Reference the applicable ASOPs that provide guidance in addressing these concerns.
- (ii) Recommend solutions for each concern.

### **Commentary on Question:**

*For part (i), while most candidates recognized that ARA was significantly non-compliant in its current practices, this only earned partial credit. To earn full credit candidates were required to reference specific ASOPs or comment on how ARA was non-compliant with applicable ASOPs.*

*For part (ii), many candidates made specific recommendations with respect to data quality and level of PAD. Common errors included recommending very lengthy time periods between experience studies and not recommending a high level of PAD given the lack of credibility of ARA's data.*

- (i)
- Frequency of experience studies
    - Applicable ASOPs: 10 (best estimate assumptions) and 21 (communicating source and appropriateness of assumptions to auditor)
  - Company's own experience to set up valuation assumptions
    - Applicable ASOPs: 10 (best estimate assumptions), 21 (communicating source and appropriateness of assumptions to auditor), and 23 (data quality)
  - Level of PAD in the assumptions
    - Applicable ASOPs: 10 (best estimate assumptions) and 21 (communicating to auditor reason for level of PAD chosen)
  - Data quality from 3<sup>rd</sup> party software
    - Applicable ASOP: 23 (data quality)
    - High risk of data defect
    - Data have never been validated
- (ii)
- Increase the frequency of experience studies
    - Minimum of 3 years, preferably annual
    - Assumptions should reflect management's assessment of emerging experience
    - More frequent experience studies would reflect recent experience



## 7. Continued

- Use more credible industry experience or blend ARA experience with industry data
  - ARA should consider relevant industry data or data from other similarly situated companies
- Include high level of PAD in assumptions
  - ARA should consider degree of risk and uncertainty in assumptions in total and at each future duration
  - As ARA current experience is not credible, a higher PAD would be a good recommendation
- Conduct a review of 3<sup>rd</sup> party software and validate output
  - ASOP 23 requires disclosure of extent of reliance on data supplied by others and perform reasonableness checks

(c) Describe the four components of the control evaluation process.

**Commentary on Question:**

*Most candidates did not do well on this part of the question. Many candidates replied with the steps to establishing an effective control evaluation under COSO, which was required in part (a). Some replied with general practice regarding the process to evaluate the risks.*

- Identify appropriate types of controls
- Determine whether appropriate controls exist
- Assess whether the existing controls are effective
- Consider the control environment in the entity

(d) Describe the impacts of ineffective controls.

**Commentary on Question:**

*Most candidates recognized that misstatement of financial results is a significant impact of ineffective controls. Very few candidates mentioned the risk mitigation failure.*

- Misstated, inaccurate, or misleading reports
- Risk is not appropriately mitigated
- Fraud
- Cost of taking corrective action

## 7. Continued

- (e) Describe the course of action required when an ineffective control is discovered.

**Commentary on Question:**

*Most candidates recognized the importance of remedying the control failure and the importance of documentation.*

- Control failure will require remediation by putting in changes and monitoring effectiveness over the year in real time
- Go back to drawing board to review what makes a control effective to tighten up the process
- Document what went wrong and what was done to correct the issue
- Put together mitigating controls in case the new control fails

## 8. Learning Objectives:

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

### Learning Outcomes:

- (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 candidates' knowledge of additional GAAP liabilities on variable annuity guaranteed benefits. Candidates were expected to identify and describe the reserve methodologies as well as demonstrate an understanding how and when they are used. Candidates generally did well on this question.*

### Solution:

- (a) Calculate the GMDB additional liability under SOP 03-1 as of the valuation date. Show all work.

### Commentary on Question:

*Candidates generally did well on applying either the prospective reserve calculation or retrospective reserve calculation. Either approach is valid. Some candidates missed some details, such as the different timing of assessments and excess payments.*

*It is mathematically equivalent and valid to calculate the present values for the two ratio components as of a later date, such as the valuation date.*

$$\text{Benefit Ratio} = \frac{PV_0(\text{Total Excess Payments})}{PV_0(\text{Total Assessments})}$$

$$\begin{aligned} PV_0(\text{Total Excess Payments}) &= 50000v^1 + 30000v^2 + (23000 + 1100000)v^3 \\ &= 1120152.058 \end{aligned}$$

$$\begin{aligned} PV_0(\text{Total Assessment}) &= 100000 + 70000v^1 + 40000v^2 + 1000000v^3 \\ &= 1134964.67 \end{aligned}$$

$$\text{Where } v = \frac{1}{1+i} = \frac{1}{1+0.025}$$

$$\text{Benefit Ratio} = 98.695\%$$

## 8. Continued

### Approach one: prospective reserve calculation:

$$\begin{aligned} \text{Additional GMDB liability under SOP03 -1} &= \text{PV of future claims at val. date} \\ &\text{minus benefit ratio times PV of future assessments at val. date} \\ &= (1,100,000 - 98.7\% * 1,000,000) \\ &= 113051.165 \end{aligned}$$

### Approach two: retrospective reserve calculation:

$$\begin{aligned} \text{Additional GMDB liability under SOP03 -1} &= \text{Benefit ratio at val. Date times} \\ &\text{Accumulated value of past assessments minus Accumulated value of past} \\ &\text{excess benefits} \\ &= 98.7\% * (100000 * 1.025^3 + 70000 * 1.025^2 + 40000 * 1.025) \\ &\quad - (50000 * 1.025^2 + 30000 * 1.025 + 23000) \\ &= 113051.165 \end{aligned}$$

- (b) The benefit ratio has decreased since issue, even though a recent experience study showed actual mortality rates have been higher than the assumed rates.

Explain two conditions that may have caused the decrease.

### **Commentary on Question:**

*Candidates were expected to demonstrate their knowledge of the inputs to the benefit ratio by determining a situation where the numerator (excess death benefits) decreased and/or the denominator (assessments) increased. Therefore, more than one solution was possible. One valid solution is provided.*

*This part of the question was the most challenging for candidates.*

The benefit ratio is readjusted at each reporting date as

- (1) experience emerges differently than previously expected
- (2) future expectation changes

Benefit ratio may decrease if market increases and causes expected future assessments to increase and excess DB to decrease.

Benefit ratio may decrease if there have been fewer surrenders than expected causing assessments to increase proportionately more than Excess DB amounts.

## 8. Continued

- (c) In addition to the GMDB rider, guaranteed minimum income benefit (GMIB), guaranteed minimum accumulation benefit (GMAB), and guaranteed minimum withdrawal benefit (GMWB) riders are being considered.

Explain which GAAP accounting standard will be used to value each optional benefit. Justify your response.

### **Commentary on Question:**

*Candidates generally did well on this part of the question and were able to identify the appropriate standard for the benefits. However, many candidates struggled to describe the rationale for the selected accounting standard with any detail and often missed GMDB.*

The SOP 03-1 standard is applicable under FAS 97 if the product features and benefits are triggered by "life contingent" event or "contingent upon death" of the policyholder and the mortality risk is significant.

This standard is applicable to the GMDB and GMIB as these products have inherent mortality and longevity risk respectively.

Please note that the GMIB here is paid as an annuity after the annuitization date and therefore the insurer is exposed to longevity risk (life contingent) and hence classified under SOP 03-1.

FAS 133 on the other hand applies to product features that can be defined as an embedded derivative.

GMAB does not have mortality risk and can be carved out as an embedded derivative so should be FAS133.

GMWB is also often viewed as an embedded derivative and falls under FAS133, however some GMWB riders have a lifetime guarantee which brings in a longevity component which might cause some or all of the rider to fall under SOP03-1.

## 9. 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.

### Sources:

Stochastic Analysis of long term multiple decrement contracts

LF 815-13 Understanding Profitability in Life Insurance

### Commentary on Question:

*This question tested candidates' ability to assess various risk scenarios and demonstrate how that risk could materialize into profitability impacts.*

### Solution:

- (a) With respect to the following four factors in the stochastic approach to modeling mortality:

- A. Underwriting error
- B. Volatility
- C. Catastrophe
- D. Trend

Assess the importance of each of these factors when modeling the mortality risk of:

- (i) a term life block
- (ii) a payout annuity block

### Commentary on Question:

*Candidates generally did well on assessing catastrophe and trend risk, and the rationale for their importance to the life and the payout annuity blocks.*

*Candidates had difficulty assessing the impact of underwriting and volatility on the payout annuity blocks.*

## 9. Continued

Underwriting errors represents the risk that the best estimate mortality is incorrect. On term life, the assignment to an underwriting class is key to the expected mortality on a given policy. Underwriting is generally not performed on a payout annuity; so the risk here is that the overall expectations were off.

Volatility represents the variance of actual experience around the best estimate.

On term life, volatility will decrease as the size of the block increases. For payout annuities, volatility is not important as the main risk is longevity and there is little initial negative impact of variance from best estimate.

Catastrophe is the risk of an event that results in a sharp increase in mortality over a short period of time. On the term block, catastrophe risk is important as the financial impact is severe; although assessing catastrophe can be hard since actual events are fairly rare. For payout annuities this is not a risk factor since increased mortality does not have an adverse impact.

Trend is the expectation of change in the future life expectancy. For the term block this can be important if significant future improvements are expected; otherwise this is not important as the trend is typically for improvement. For the payout annuity block, this is the key risk as trends in medical advancement are extending life expectancies.

- (b) Determine the pre-tax ROE for the 99<sup>th</sup> percentile pandemic risk scenario. Show all work.

### **Commentary on Question:**

*Candidates generally did well on this part of the question and many received full credit. The most common error was not taking into account the additional reserves release for the 99<sup>th</sup> percentile scenario to partly offset the additional death claims.*

ROE = Profit / Equity

10% = 2.5 million / Equity, so Starting Equity = 25 million

Equity at the 99<sup>th</sup> percentile is 25million as we assume that the starting equity remains constant during the pandemic scenario

Profit at 99<sup>th</sup> percentile = Starting Profit – Additional Death Claims at 99<sup>th</sup> Percentile + Additional Reserve Released at 99<sup>th</sup> Percentile

For additional deaths, Reserve Released = Total Reserve as % of Total Face x 12.5million =  $\frac{1}{4} \times 12.5m = 3.125m$  as the assumption is made that all pandemic death claims have the same NAAR (and thus the same reserve) consistent with the average of the inforce block

Profit at 99<sup>th</sup> percentile = 2.5m – 12.5m + 3.125m = -6.875m

ROE @ 99<sup>th</sup> percentile = Profit at 99<sup>th</sup> percentile / Equity at 99<sup>th</sup> percentile = -6.875m / 12.5m = -27.5%

## 9. Continued

(c) You are given the following alternatives for managing future mortality experience:

A: A yearly renewable term treaty where the reinsurer pays claims in excess of a set retention limit per life insured.

B: A multi-year stop loss treaty where the reinsurer pays claims in excess of an attachment point limit set in the treaty.

Describe how each alternative impacts the mortality risk profile.

### **Commentary on Question:**

*This part of the question was the most challenging for candidates. Many candidates did not understand what a risk profile was, and ended up describing the treaties instead of assessing the impact of the treaties on the expected ending asset position. Most candidates did not think in terms of the range of outcomes stemming from each treaty versus the base case.*

- A yearly renewable term treaty removes positive and negative tail events as uncertain death benefit payouts are swapped for certain YRT premiums to the reinsurer. There is a much narrower range of expected outcomes, and the vast majority of all scenarios end up near the expected value. The narrowness of the range will be dependent on the retention limit per life.
- The risk profile only changes moderately. The extreme negative tail events are eliminated. The shape of the risk profile looks very similar as payments by the reinsurer are not expected to be made frequently; abet shifted in the negative direction due to the cost of reinsurance paid.



## 10. Learning Objectives:

1. The candidate will understand U.S. life insurance company financial statements and reports.
3. The candidate will understand and apply emerging financial and valuation standards, principles and methodologies.

### Learning Outcomes:

- (1a) Construct, analyze and evaluate basic U.S. GAAP, Statutory, and Tax financial statements for a life insurance company.
- (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-132-14: Practical Guide to IFRS, PwC, Exclude Appendices 1, 2, and 4 (July 2013)

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

### Commentary on Question:

*This question tested the candidate's understanding of the IFRS 4 Phase II standards.*

### Solution:

- (a) The following statements have been made regarding the changes IFRS 4 Phase II will have on reserves and net income recognition:
  - A. *Changes in the present value of expected cash flows related to future service should be recognized in earnings when the change becomes known.*
  - B. *Insurance contract revenue and expense should be presented in the statement of comprehensive income with revenue recognized as earned including investment components.*
  - C. *An entity should choose to present the effect of changes in discount rates in profit and loss or in Other Comprehensive Income (OCI) as its accounting policy. The same accounting policy should be applied to all similar insurance contracts that are backed with similar investments.*
  - D. *A contract which is deemed to be onerous at time of issuance will be deemed to be onerous throughout the term of the contract.*

Critique each of the above statements and recommend changes where appropriate.

## 10. Continued

### **Commentary on Question:**

*Candidates generally did well on this part of the question. However, some candidates did not receive full credit as a result of not specifically stating whether they agreed or disagreed with the statement.*

A – False or Partially False – changes in the present value are first recognized in the Contractual Service Margin (CSM) – however, if the CSM becomes 0, the change would then be reflected in earnings

B – False – the investment component is excluded and shown separately

C – False or True – the text generally says that a change in discount rate should be shown in Other Comprehensive Income, but there is also some indication that a company can choose profit and loss as an accounting policy decision

D – False – negative CSMs need to be tracked to see if they become positive and thereby make the policy no longer onerous

- (b) Identify which product graph and earnings emergence bar series corresponds to each of the following:
- (i) 10-year term life under IFRS
  - (ii) 10-year term life under U.S. Statutory
  - (iii) Deferred annuity under IFRS
  - (iv) Deferred annuity under U.S. Statutory

Justify your answers.

### **Commentary on Question:**

*Candidates generally did well on this part of the question. In situations where the product or valuation methodology was misidentified, the justification was generally off base as well.*

- (i) Product B Series 2
  - Smooth emergence of earnings indicates IFRS
- (ii) Product B Series 1
  - Large first year loss followed by smaller renewal year profits is typical of term life under U.S. Statutory due to high first year expenses and commissions

## 10. Continued

- (iii) Product A Series 2
  - Smooth emergence of earnings indicates IFRS
- (iv) Product A Series 1
  - Large first year profit followed by smaller renewal year profits is typical of deferred annuity under U.S. Statutory due to front end load

## 11. 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-823-16: ORSA Guidance Manual, NAIC, 2014

### Commentary on Question:

*This question tests the candidates' knowledge of the ORSA Guidance Manual and its practical implementation within a company's business planning process.*

### Solution:

- (a) Describe the two primary goals of ORSA.

#### Commentary on Question:

*Most candidates identified at least one of the two goals.*

1. Foster an effective level of enterprise risk management
2. Provide a group-level perspective on risk and capital

- (b) Describe the major areas that should be discussed in Section 1 of the ORSA Summary Report.

#### Commentary on Question:

*Full credit was given for describing four of the five major areas. A common mistake was to provide a general description of the ORSA Summary Report instead of giving the specific items to be included in Section 1 of the report.*

1. Risk culture and governance – describes roles, responsibilities and accountabilities relative to risk taking
2. Risk identification and prioritization – describes risk assessment process
3. Risk appetite, tolerance and limits – describes alignment of risk taking activities with risk strategy
4. Risk management and controls – describes process for monitoring risk levels
5. Risk reporting and communication – describes process for sharing risk information to facilitate risk taking decisions

## 11. Continued

- (c) Assess the validity of each of the following statements and correct any incorrect statements:
- A. *The manner and depth in which the insurer addresses the key risk principles is dependent upon its own risk-management processes.*
  - B. *In the U.S., a specific risk assessment technique is prescribed for each risk category.*
  - C. *The goal of the group capital assessment is to calculate the minimum amount of capital before regulatory action will result.*
  - D. *The ORSA Summary Report should be the medium of reporting enterprise risk management (ERM) to the Board of Directors.*
  - E. *The Commissioner may provide assumptions and scenarios to be used in the assessment.*
  - F. *All insurers are required to file an ORSA Summary Report at least annually.*
  - G. *The ORSA Summary Report should acknowledge that model validation was performed, but does not need to provide any further details regarding the validation.*
  - H. *For assumptions that are stochastically modeled, the insurer does not need to set expected values based on current anticipated experience.*

### **Commentary on Question:**

*Candidates were expected to provide a clear indication as to whether each statement was correct or incorrect. If the statement is incorrect, candidates were expected to provide a clear explanation of why. A common mistake was to discuss the statement without clearly indicating whether it was correct or incorrect.*

*In general, most candidates assessed statements B, C and G correctly but did not do well assessing statements E and H.*

*When correcting a statement, most candidates were not able to provide a clear explanation of why the statement was incorrect. Many candidates confused regulatory solvency requirements with economic capital.*

## 11. Continued

A – True

B – False – each insurer should utilize techniques appropriate for its unique risk profile

C – False – the goal is to provide an assessment of risk capital needs relative to available capital

D – False – format may be altered to better meet the specific needs of the Board

E – True

F – False – exemptions apply for smaller companies

G – False – must include a general description of process, including factors considered and model calibration

H – True

(d) Describe how ORSA is incorporated into a company's business planning process.

### **Commentary on Question:**

*This part of the question tested candidates' knowledge using ORSA in group capital forecasting and future risk exposure identification, and how the capital forecast and identified risk exposures can be used in the business planning process.*

*Most candidates only reiterated the goals of ORSA, assumptions used for ORSA and other details of ORSA. A common mistake was the failure to connect ORSA back to the business planning process.*

ORSA includes a prospective solvency assessment (PSA):

- looks at normal and stressed environments
- identifies risk exposures and whether they are increasing or decreasing

The PSA serves as a feedback loop within the business planning process:

- helps identify any capital adequacy concerns
- plans can be adjusted to mitigate these concerns