ILA LFVU Model Solutions
Spring 2018

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:

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

Sources:

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

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

Commentary on Question:

This question tested candidates' knowledge of embedded value.

Solution:

(a)

(i) Calculate the total return on MCEV. Show all work.

(ii) Calculate the operating return on MCEV. Show all work.

Commentary on Question:

Generally, candidates spent minimal effort writing out the formulas for the items requested. Some candidates did not list any formula, and a few used non-standard abbreviations in the formulas making it difficult to assess understanding. Adding or subtracting a series of numbers without context does not convey understanding of the concept, especially if the candidate does not arrive at the correct numerical answer. Candidate should list the appropriate formula and substitute the correct values to demonstrate understanding of the connection of the terms and the values provided. In this way, if candidates make a substitution or conceptual mistake, partial credit may be received.

(i)

Total return on MCEV = (A) Total MCEV Earnings / (B) Opening MCEV
= 17 / 300
= 5.7%

1. Continued

(A) Total MCEV Earnings consist of the following components:

New Business Value =	1	(given)
+ Operating Variances =	8	(given)
+ Economic Variances =	-5	(given)
+ (C) Unwinding MCEV =	13	(calculated below)
Total MCEV Earnings =	17	

(B) Opening MCEV = 300 (given)

(C) Unwinding MCEV consists of the following components:

Expected existing business contribution using the reference rate =	7 (given)
+ Expected existing business contribution in excess of the reference rate =	2 (given)
+ Transfer or release of profits in the value of in-force business =	3 (given)
+ Release of required capital =	1 (given)
Total Unwinding MCEV =	13

(ii)

Operating return on MCEV = Operating MCEV Earnings / Opening MCEV
= 22 / 300
= 7.3%

Operating MCEV Earnings = Total MCEV Earnings – Economic variances
= 17 (from part (a)(i)) – (–5) (given)
= 22

Opening MCEV = 300 (given)

(b) Assess concerns with performing an actuarial appraisal of XYZ using its latest EV results.

Commentary on Question (b):
Generally, candidates recognized the importance of including future new business capacity in an actuarial appraisal and that there are differences in assumptions in calculating EV vs those used in an actuarial appraisal. Some candidates mentioned that the company being appraised can be a "going concern" and therefore include future new business whereas if it is not, then new business is not included. Some candidates discussed how EV could be modified (i.e., not used directly) and the value of new business added which is also an acceptable approach.

1. Continued

EV cannot be used directly as a basis for an actuarial appraisal because:

(1) An actuarial appraisal value should include both the value of in-force business and the value of future new business capacity if the company is a "going-concern" and it intends to write new business.
(2) The assumptions used in the calculation of EV are not the same as those used in an appraisal.

It may be possible to modify EV by changing assumptions, considering future growth, performing various sensitivity modeling and then selecting a multiple of modified value of new business to be added to modified EV.

(c) The following assumptions appear in XYZ's EV report:

A. Persistency, mortality, and expense assumptions are best-estimate with provisions for adverse deviation.
B. Mortality improvement is included in the mortality assumptions. This is common industry practice.
C. Expenses consist of acquisition expenses (to the extent associated with existing business) and maintenance expenses. Overhead and one-time expenses are excluded.
D. Since non-economic assumptions used to calculate EV should be "entity-specific", the company's experience data was exclusively used to develop persistency, mortality, and expense assumptions. No industry data was used.

Critique the appropriateness of each statement.

Commentary on Question (c):
Generally, candidates did well on this part of the question. Candidates demonstrated knowledge of what should or should not be included in EV calculations along with justification.

A. FALSE. Persistency, mortality and expense assumptions are non-economic assumptions and therefore should be best estimate. The use of provisions for adverse deviations for these assumptions is not appropriate for EV.

B. TRUE. Using mortality improvement in the EV projection is appropriate to the extent it can be supported and falls under a best estimate approach. It is common industry practice. Care should be taken in considering changes in the mix of business over time and possible anti-selection occurring at renewal periods.

1. Continued

C. FALSE. This is not appropriate. All expenses should be included in the EV calculation including overhead expenses. Although specific one-time expenses may not recur, new and/or unanticipated one-time expenses may arise and take the place of current one-time expenses.

D. Could be TRUE or FALSE. It is supportable to use company experience if it is credible. If not fully credible, the actuary should set an assumption based on a blend of company and industry experience. Expenses are typically company specific but mortality assumptions are typically a blend of company data and industry data due to lack of credibility of the company's own data. Persistency assumptions can be blended with industry data but due to product differences, most persistency assumptions are company specific.

2. 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, Tiller, 4th Edition, 2015, Ch. 5

Commentary on Question:

This question tested the candidates' knowledge of reinsurance, in particular coinsurance and mod-co, and their use on in-force business. Candidates had to demonstrate how coinsurance and mod-co affected the income statement.

Solution:

(a) Create LNT's projected 2018 term life income statements for each of the proposed reinsurance arrangements. Show all work.

Commentary on Question:

Candidates generally did poorly on this part of the question. Many candidates assumed all the premiums and claims were transferred to the reinsurer in 2018, which is not correct since the reinsurance transaction did not occur until the end of the year.

2. Continued

	Coinsurance	Mod-Co
Premium		
Gross	4000	4000
Ceded	9500	9500
Net	(5500)	(5500)
Investment Income	800	800
Reinsurance Allowance	950	950
Mod-co Adjustment	0	9500
Total Revenue	(3750)	5750
Claims and Surrenders		
Gross	1500	1500
Ceded	0	0
Net	1500	1500
Reserve Increase		
Gross	1000	1000
Ceded	9500	0
Net	(8500)	1000
Expenses	300	300
Total Benefits and Expenses	(6700)	2800
Net Income	2950	2950

(b) Calculate the projected 2019 net income for the block under each reinsurance arrangement. Show all work.

Commentary on Question:

Candidates generally demonstrated an understanding of premium, reinsurance allowance, benefits and expenses. Most candidates also demonstrated an understanding of the mod-co adjustment. Most candidates had difficulty with investment income, basing it upon something other than the year-end 2018 asset balance.

2. Continued

	Coinsurance	Mod-Co
Premium		
Gross	3500	3500
Ceded	3500	3500
Net	0	0
Investment Income	324	1084
Reinsurance Allowance	350	350
Mod-co Adjustment	0	335
Total Revenue	674	1769
Claims and Surrenders		
Gross	500	500
Ceded	500	500
Net	0	0
Reserve Increase		
Gross	1000	1000
Ceded	1000	0
Net	0	1000
Expenses	250	250
Total Benefits and Expenses	250	1250
Net Income	424	519

Supporting data and calculations

Year-end 2018 Balance Sheet			
	No Reinsurance	Coinsurance	Mod-co
Assets	12600	4050	13550
Liabilities	9500	0	9500
Surplus	3100	4050	4050

Coinsurance Investment Income =
Coinsurance Assets at Year-end 2018 x 8% =
4050 x 8% = 324

Mod-co Investment Income =
Mod-co Assets at Year-end 2018 x 8% =
13550 x 8% = 1084

2. Continued

Mod-co Adjustment =
Ending Reserve – Beginning Reserve – Interest on Beginning Reserve =
10500 – 9500 – 7% * 9500 = 335

3. 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.

(2c) Recommend and justify appropriate valuation assumptions.

Sources:

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

LFV-133-16: Cluster Analysis: A Spatial Approach to Actuarial Modeling, Milliman, 2008

Commentary on Question:

This question tested the candidates' understanding of the AG43 reserve calculation and cluster analysis. Candidates generally did well in the calculation sections, but struggled in the descriptive and analytical sections.

Solution:

(a) Describe how the following items are limited within each component of the AG 43 reserve calculation:

(i) Revenue sharing

(ii) Hedging

Commentary on Question:

This part of the question tested candidates' understanding of the AG43 reserve calculation and the differences between the Standard Scenario and the CTE calculation. Most candidates struggled to give a comprehensive description of the limitations on the two approaches, and how those limitations differ between the two.

(i)

Revenue Sharing in CTE amount calculation:

- Only contractually guaranteed revenue sharing payments may be included in their entirety
- Non-contractually guaranteed revenue sharing are multiplied by a haircut factor that reduces the revenue by up to half
- Margins should be added to reduce revenue sharing according to the uncertainty of their future payment

3. Continued

- A cap of 0.25% is the maximum amount allowed for non-guaranteed amount in the 6th and later projection years.

Revenue sharing in Standard Scenario calculation:
- It may only include guaranteed payments in the Margin calc.

(ii)
Hedging in the CTE amount calculation
- Offsetting of risks against product lines not included in the scope of AG43 cannot be reflected
- Ongoing hedging may only be reflected if the dynamic strategy meets the specifications of a CDHS, meets AG34 appendix 7 requirements and is currently in use by the company.
- Further, the CTE amount assuming dynamic hedging must be credibility weighted with the CTE amount assuming static run-off of existing hedges. The credibility weight for the dynamic amount is capped at 70%.

Hedging in the Standard Scenario calculation
- Only those hedges that fit the criteria of ""approved"" may be included. Only the change in value within the first year that is included, and no credit is given for any dynamic hedging.

(b) Calculate the AG 43 reserve. Show all work.

Commentary on Question:
Candidates generally did well on this part of the question.

Scenario Amount = Starting Asset + GPVAD

The worst 30% of scenarios amounts are the worst 6 scenarios
CTE(70) = Average(4150,4100,4000,3850,3800, 3750) = 3958
Reserve = Max [standard scenario, CTE(70)]
Therefore, reserve = 3958

(c)

(i) Calculate the distance between the two policies in Segment A. Show all work.

(ii) Determine which policies will be included in the first step of Segment B's clustering algorithm. Show all work.

Commentary on Question:
Most candidates generally did well on part (i), but struggled with part (ii) if they were not able to map policies to find the lowest importance.

3. Continued

(i)
The distance between any two variables is the n-dimensional sum of squares
Squared differences are
(100-150)^2 = 2,500
(20-50)^2 = 900
(50-200)^2 = 22,500
square root of (2,500+900+22,500) = 161

(ii)
To map policies, the process finds the policy with the lowest importance and maps it to its nearest neighbor (the destination policy), adjusting the size of the destination policy in the process. The importance is determined as the size variable * distance from the nearest policy.
Policy 3 importance = 40 *120 = 4,800
Policy 4 importance = 50 * 100 = 5,000
Policy 5 importance = 35 * 155 = 5,425
Policy 6 importance = 70 * 100 = 7,000
Policy 3 is the one with the least importance
it should be mapped to its nearest neighbor, which is Policy 4

(d) Critique the following statements:

A. The largest policy in each cluster represents the entire cluster in the compressed in-force file.
B. After a clustered in-force file has been validated for AG 43 reserves, the same policy cluster mappings can be applied to the in-force files in any of the company's other Variable Annuity models. This is a good stress test because the CTE amount is based on the results of the worst economic scenarios.
C. Increasing the number of segments will increase the clustering algorithm runtime because each segment needs to be clustered separately from all of the others.

Commentary on Question:
Candidates generally did well on statements A and B. For statement C candidates who did not understand the concepts behind the algorithm struggled to explain how the runtime would be affected.

The first statement is false.
The most representative policy in each cluster, which is the policy that is closest to the average location of all cells in the cluster, represents the entire cluster in the compressed in-force file. Using the largest policy would bias the compressed file toward large policies.

3. Continued

The second statement is false.
A model is calibrated to reproduce certain location variables closely. If a different model requires very different results, different location variables are likely needed. The validation section explains that if the user creates a new model as a general-purpose replacement for the original model, he or she should compare all components of the income statement and balance sheet for all years.

The third statement is false.
The runtime is typically proportional to the sum of the squares of the number of policies in each segment. Therefore, the runtime would actually go down with an increased number of segments

4. 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:

(1c) Describe, apply and evaluate regulatory documentation and disclosure requirements.

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

Sources:

ASOP 10 Methods and Assumptions for Use in Life Insurance Company Financial Statements Prepared in Accordance With GAAP (excluding Transmittal Memo and Appendixes)

US GAAP for Life Insurers, Herget et. Al., Ch. 6

Commentary on Question:

This question tested the candidates' knowledge of valuation principles.

Solution:

(a) For each pattern:

(i) Determine whether an SOP 03-1 reserve needs to be established. Justify your answer.

(ii) Determine whether an Unearned Revenue Liability (URL) needs to be established. Justify your answer.

(iii) Describe the interaction, if any, in the calculations of the URL, SOP 03-1, and DAC.

Commentary on Question:

Candidates generally did well on this part of the question. Successful candidates clearly explained when SOP03-1 and URL were required, as well as how their interactions with each other and DAC changed depending on whether both, one, or neither are present. Candidates received partial credit if they described the concepts in general, but did not describe how each COI pattern is affected.

4. Continued

(i) [Pattern A] No SOP 03-1 as the COI charges are increasing and covers the mortality so the insurance benefit feature is expected to have profits in all years.

[Pattern B] A SOP 03-1 reserve needs to be set up because the insurance benefit feature is expected to have profits in early years followed by losses in future years when mortality is higher than the COI charges.

[Pattern C] A SOP 03-1 reserve needs to be set up because the insurance benefit feature is expected to have profits in early years followed by losses in future years when mortality is higher than the COI charges.

(ii) [Pattern A] No URL is necessary as the COI charges follow a “normal” mortality pattern.

[Pattern B] A URL MAY need to be established as the COI charges do not follow a "normal" mortality pattern, but are not decreasing / front-end loaded.

[Pattern C] A URL needs to be established as the COI charges do not follow a "normal" mortality pattern and are decreasing / front-end loaded.

(iii) [Pattern A] Only the DAC would be calculated with no interaction, as the SOP 03-1 or URL were not needed.

[Pattern B] The DAC calculation will be affected by SOP 03-1, as the change in reserve flows through to the estimated gross profits. If the URL is required as well, it will affect both the DAC and SOP 03-1. The change in URL will affect the SOP 03-1 assessments, causing a circular issue.

[Pattern C] The DAC calculation will be affected by SOP 03-1 and URL, as the change in SOP 03-1 reserve flows through to the estimated gross profits, EGP affects the URL and change in URL affects the assessments used in the SOP 03-1, thus causing a circular issue.

4. Continued

(b) Critique each guideline with respect to ASOP 10, Methods and Assumptions for Use in Life Insurance Company Financial Statements Prepared in Accordance With GAAP.

A. Where best-estimate assumptions will be used, we shall use conservative estimates to reflect the most likely outcome of events.

B. For these best-estimate assumptions, we will consider the following in their creation:
- Characteristics and magnitude of the company's business
- Maturity of the company and the rate of growth
- Last 6 months of experience of the company
- For future assumptions, ignore outside influences such as technological development that might affect future experience

C. Where data is not available or is not credible, the actuary should defer to the judgment of other actuaries at our company

Commentary on Question:
Candidates received full credit if they correctly identified whether the statements were true or false and provided recommended changes for inaccuracies. Some candidates only recommended changes to inaccurate statements, thus only receiving partial credit since the question asked the candidate to 'critique each guideline' which implies assessing whether each is true or false.

A. False, conservative estimates shouldn't be used. Instead "the actuary should choose assumptions that, in his or her judgment, reflect the most likely outcome of events."

B. The first two bullet points are true. The third bullet point is false and can be corrected by including a non-rigid time period for the experience instead of 6 months. The fourth bullet point is false and can be corrected by stating that technological developments, as well as medical, economic, and social developments, that might affect future experience should be considered.

C. False, instead of the judgement of other actuaries at the company, they should consider industry data or data from other similarly situated companies.

(c)

(i) Calculate the actual DAC Balance at end of year 3.

(ii) Calculate the impact of the retrospective unlocking.

Show all work.

4. Continued

Commentary on Question:
Candidates generally did well on the recalculating the year 3 DAC. Candidates generally struggled to correctly calculate the retrospective unlocking, defined as the revised DAC balance at the beginning of the year 3, not the end of year 3. Candidates received partial credit if they stated that the unlocking impact was the difference between a restated DAC balance and the previous DAC balance.

(i) First recalculate the PV of EGPs.

$PV(_{new}EGP) = PV(_{old}EGP) + (_{new}EGP_3 - _{old}EGP_3) * (1 + i)^{-3}$
$= 66{,}224 + (25{,}000 - 13{,}069) * (1.05)^{-3}$
$= 76{,}531$

Then recalculate the amortization ratio (k-factor).

$_{new}$k-factor = $PV(Deferrals) / PV(_{new}EGP)$
$= 35{,}000 / 76{,}531$
$= 45.7\%$

Then recalculate the year 3 DAC balance.

$DAC_t = (DAC_{t-1} + Deferrals_t) * (1 + i) - (k\text{-factor} * EGP_t)$
$DAC_1 = (0 + 35{,}000) * 1.05 - (45.7\% * 14{,}882) = 29{,}944$
$DAC_2 = (29{,}944 + 0) * 1.05 - (45.7\% * 13{,}972) = 25{,}051$
$DAC_3 = (25{,}051 + 0) * 1.05 - (45.7\% * 25{,}000) = 14{,}871$

(ii) The retrospective unlocking impact represents the difference between the prior year balance (which is not restated), and the balance that would have been calculated for the prior year using the new amortization rate.

In this case this would be the difference in the Year 2 DAC balances.

= Recalculated Year 2 DAC – Original Year 2 DAC
$= 25{,}051 - 22{,}945$
$= 2{,}106$

Hence, the retrospective unlocking impact is a 2,106 increase in the DAC.

4. Continued

(d) If the block of business experiences significantly worse mortality than expected:

(i) Describe how the mortality assumption should be changed as a result of this experience according to ASOP 10.

(ii) Explain how the change in mortality assumption would affect the amortization ratio, DAC balance, and future DAC amortization.

Commentary on Question:
Candidates generally did well on this part of the question.

For part (i), most candidates identified that an unlocking should occur. However, most candidates did not discuss how a new assumption should be developed.

For part (ii), most candidates correctly identified smaller EGPs and a higher amortization factor. However, most candidates did not distinguish between previous DAC balances and the projected DAC balances which determine future amortization. The key difference is that for previous DAC balances the new higher amortization factor would be applied to unchanged AGPs and would be lower. In contrast, future DAC balances and amortization depend on the degree of change with the higher amortization factor applied to the lower EGP.

(i) At the end of the reporting period, the future assumption for mortality should be reviewed given the large change in actual vs. expected. The new assumption should be a blend of the previous assumption and the experience, based on how much exposure there was in the past year.

(ii) Given the new experience, it would suggest the future EGP would be smaller.

- If future EGP is smaller, then the overall amortization factor would be higher.
- The DAC balance would be lower because of the higher amortization factor being applied to the same AGP amounts.
- Future amortization would most likely be lower as well, due to the lower EGP. However, it could be higher in some periods if the higher amortization factor was enough to overcome the lower EGP.

5. Learning Objectives:

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

Learning Outcomes:

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

Sources:

US GAAP For Life Insurers, Second Edition, Ch 13 (excl. 13.7)

Commentary on Question:

This question tested the candidates' understanding of investment accounting treatment related to debt securities under various situations, as well as demonstrating how to determine the amortized cost for a collateralized mortgage obligation (CMO) under two different principal paydown schedules. The candidates were required to calculate the true-up which resulted from the change in amortized costs between the two different principal paydown schedules. There are multiple approaches to solving the mathematical portion of this question that results in the same final results with each receiving full credit, if demonstrated properly.

Solution:

(a) Critique the following statements related to investment accounting treatment for debt securities under US GAAP:

A. At acquisition, debt securities are recorded in the general ledger at the amount that will be repaid at maturity
B. US GAAP requires that premiums and discounts be factored into the income recognition process while a security is held
C. For securities classified as Trading and Available For Sale, the changes in the fair values are recognized in other comprehensive income
D. If the security is impaired, a write-down of the security is required

Commentary on Question:

Candidates were required to critique each statement as to its accuracy and explain any inaccuracies.

Candidates performed relatively well on this part of the question. Candidates who did not perform well were focused the classification of debt securities with regard to "held-to-maturity", "available for sale", and "trading" for each statement, and as a result provided misleading explanations.

5. Continued

A. Given statement is false because debt securities are recorded in the general ledger at cost or purchase price, rather than at the amount that will be repaid at maturity.

B. Given statement is true.

C. Given statement is false because the changes in fair value to securities classified as "Available for Sale" are recognized in other comprehensive income, but the changes in fair value to securities classified as "Trading" are recognized in the profit/loss, or income, statement.

D. Given statement is false because a write-down of the security is only required if the impairment of the security is considered to be "not temporary", or "permanent". Such a write-down is not necessary for securities with impairments that are considered to be "temporary".

(b) Calculate the projected amortized cost at the end of year 1. Show all work.

Commentary on Question:
This part of the question required candidates to determine the amortized cost based on a specified principal paydown schedule.

Candidates generally did not do well on this part of the question. A common error was not understanding that a yield-to-maturity interest rate was required to determine the amortized cost and instead used the stated interest rate. Another common error was not understanding how to calculate the yield-to-maturity interest rate to determine the amortized costs for the CMO based on the specified principal paydown schedule. Candidates did not demonstrate an understanding of what cash flows were to be included in the determination of the amortized cost.

Candidates who did well on the question relied on their calculators to determine the yield-to-maturity interest rate, rather than use the formula for solving a quadratic equation. In addition, those candidates understood each element of the formula to determine the amortized cost as well as the required cash flows needed to determine the amortized cost accurately.

To determine the yield-to-maturity interest rate:
Amortized Cost(t) = Amortized Cost (t-1) – Principal Payment (t)
– Amortization (t), where
Amortization (t) = Interest Payment (t) - Interest Income (t), where
Interest Payment (1) = stated interest rate x Principal Payment (1)
= 0.06 x 300,000 = 18,000
Interest Income (1) = yield-to-maturity interest rate x Amortized Cost (0)
= r x 310,000

5. Continued

Amortized Cost (1) = Amortized Cost (0) – Principal Payment (1)
– Amortization (0)
= 310,000 – 150,000 – (18,000 – r x 310,000)
= 310,000r + 142,000
Amortized Cost (2) = Amortized Cost (1) – Principal Payment (2)
– Amortization (2)
0 = (310,000r + 142,000) – 150,000 – (0.06 x 150,000 – (310,000r + 142,000) x r)

0 = 310,000r + 142,000 – 150,000 – 9,000 + 310,000r^2 + 142,000r

0 = 310,000r^2 +452,000r – 17,000

To solve for r, use the equation for solving quadratic equations:
r = (- b +/- (b^2 – 4 x a x c) ^ (1/2)) / 2a
r = (-452,000 +/- (452,000^2 – 4 x (310,000) x (-17,000))^(1/2)) / (2 x 310,000)
r = (-452,000 +/- (204,304,000,000 + 21,080,000,000) ^ (1/2)) / 620,000
r = (-452,000 + 225,384,000,000 ^ (1/2)) / 620,000
r = (-452,000 + 474,746.2480104503) / 620,000 = 0.0366874967910489
r = 3.66875%

Alternatively, the yield-to-maturity interest rate can be determined as follows:

Amortized Cost (0) = ((Principal Payment (1) + i x Principal (0))) x v
+ (Principal Payment (2) + i x (Principal (0) – Principal Payment (1)) x v^2, where v = (1+i) ^ (-1)
310,000 = (150,000 + 0.06 x 300,000) x v + (150,000 + (300,000 – 150,000) x 0.06) * v^2
310,000 = 168,000v + 159,000v^2
0 = 159,000v^2 + 168,000v – 310,000

To solve for v, use the equation for solving quadratic equations:

v = (-168,000 +/- (168,000^2 – 4 x (159,000) x (-310,000)) ^ (1/2)) / (2) x (159,000)
v = (-168,000 + (28,224,000,000 + 197,160,000,000) ^ (1/2)) / 318,000
v = 0.9646108428001582 = 1 / (1+r)
r = (1 – 0.9646108428001582) / 0.9646108428001682 = 3.66875%

To determine the amortized cost at the end of year 1:

5. Continued

Amortized Cost (1) = Amortized Cost (0) x (1+r) – (Principal Payment (1) + i x Principle (0))
Amortized Cost (1) = 310,000 (1.0366875) – 150,000 – 0.06 x 300,000
Amortized Cost (1) = 321,373.13 – 168,000 = 153,373.13

Alternatively, the amortized cost at the end of year 1 can be determined as the present value of cash flows in year 2 back to the beginning of year 2, or the end of year 1:

Amortized Cost (1) = (Principal Payment (2) + i x (Principal (0) – Principal Payment (1))) / (1+r)
Amortized Cost (1) = (150,000 + 0.06 x (300,000 – 150,000))/ (1 + 0.0366875)
= (150,000 + 0.06 x 150,000) / 1.0366875
= 159,000 / 1.0366875 = 153,373.12 (off due to rounding)

(c) Calculate the following:

(i) True-up at the end of year 1 based on the requirement of SFAS 91.

(ii) Revised amortized cost at the end of year 1.

Show all work.

Commentary on Question:
This part of the question required candidates to calculate the amortized cost based on a different principal paydown schedule and to calculate the "true-up" due to the change in the principle paydown schedule from Part (b) of this question.

Candidates generally did not demonstrate an understanding of the true-up calculation and how it relates to determining the amortized cost.

(i)
To determine the yield-to-maturity interest rate:
Amortized Cost(t) = Amortized Cost (t-1) – Principal Payment (t) – Amortization (t), where
Amortization (t) = Interest Payment (t) - Interest Income (t), where
Interest Payment (1) = stated interest rate x Principal Payment (1)
= 0.06 x 300,000 = 18,000
Interest Income (1) = yield-to-maturity interest rate x Amortized Cost (0)
= r x 310,000

5. Continued

Amortized Cost (1) = Amortized Cost (0) – Principal Payment (1)
– Amortization (0)
= 310,000 – 200,000 – (18,000 – r x 310,000)
= 310,000r + 92,000
Amortized Cost (2) = Amortized Cost (1) – Principal Payment (2)
– Amortization (2)
0 = (310,000r + 92,000) – 100,000 – (0.06 x 100,000 – (310,000r + 92,000) x r)

0 = 310,000r + 92,000 – 100,000 – 6,000 + 310,000r^2 + 92,000r

0 = 310,000r^2 +402,000r – 14,000

To solve for r, use the equation for solving quadratic equations:
r = (- b +/- (b^2 – 4ac) ^ (1/2)) / 2a
r = (-402,000 +/- (402,000^2 – 4x (310,000) x (-14,000)) ^ (1/2)) / 2(310,000)
r = (-402,000 +/- (161,604,000,000 + 17,360,000,000) ^ (1/2)) / 620,000
r = (-402,000 + 178,964,000,000^(1/2)) / 620,000
r = (-402,000 + 423,041.3691354546) / 620,000 = 0.0339376921539591
r = 3.39377%

Alternatively, the yield-to-maturity interest rate can be determined as follows:

Amortized Cost (0) = ((Principal Payment (1) + i x Principal (0))) x v
+ (Principal Payment (2) + i x (Principal (0) – Principal Payment (1)) x v^2, where v = (1+i) ^ (-1)
310,000 = (200,000 + 0.06 x 300,000) x v + (100,000 + (300,000 – 200,000) x 0.06) * v^2
310,000 = 218,000v + 106,000v^2
0 = 106,000v^2 + 218,000v – 310,000

To solve for v, use the equation for solving quadratic equations:

v = (-218,000 +/- (218,000^2 – 4 x (106,000) x (-310,000)) ^ (1/2))/ (2) (106,000)
v = (-218,000 + (47,524,000,000 + 131,440,000,000) ^ (1/2)) / 212,000
v = 0.9671762695068615 = 1 / (1+r)
r = (1 – 0.9671762695068615) / 0.9671762695068615 = 3.39377%

To determine the true-up, which is the change in investment income on purchase cost due to the change in the principal paydown schedule.

True-Up = 310,000 x (0.0339377 – 0.0366875) = -852.44

5. Continued

(ii)
Amortized Cost (1) = Amortized Cost (1) from Part (b) + True-Up – (Principle Paydown (1) from Part (b) – Principle Paydown (1) from Part (c))

Amortized Cost (1) = 153, 373.13 - 852.44 – (200,000 – 150,000) = 102,520.69

Alternatively, the amortized cost at the end of year 1 can be determine as follows:

Amortized Cost (1) = Amortized Cost (0) x (1+r) – (Principal Payment (1) + i x Principle (0))
Amortized Cost (1) = 310,000 (1.0339377) – 200,000 - .06 x 300,000
Amortized Cost(1) = 320,520.69 – 218,000 = 102,520.69

Alternatively, the amortized cost at the end of year 1 can be determined as the present value of cash flows in year 2 back to the beginning of year 2, or the end of year 1:

Amortized Cost (1) = (Principal Payment (2) + i x (Principal (0) – Principal Payment (1))) / (1+r)
Amortized Cost (1) = (100,000 + 0.06 x (300,000 – 200,000))/ (1 + 0.0339377)
= (100,000 + 0.06 x 100,000) / 1.0339377)
= 106,000 / 1.0339377 = 102,520.68 (off due to rounding)

(i)
Also, the True-Up can alternatively be determined as follows:

True-Up = Amortized Cost (1) from Part (c) – Amortized Cost (1) from Part (b) + (Principle Paydown (1) from Part(c) – Principle Paydown (1) from Part (b))
= 102,520.69 – 153,373.13 + (200,000 – 150,000) = -852.44

6. 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:

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

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

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

Sources:

Valuation of Life Insurance Liabilities, Lombardi, 4th Edition, Ch. 2, 5 & 6

LFV-102-09: Actuarial Review of Reserves and Other Annual Statement Liabilities (exclude appendices)

Commentary on Question:

This question tested the candidates' knowledge of valuation and financial reporting requirements

Solution:

(a) Calculate the direct premium on an accrual basis (earned premium) for 2016 by constructing Exhibit 1 in the Annual Statement, using the methodology that went into effect after codification. Show all work.

Commentary on Question:

Candidates generally did not correctly calculate the change in deferred premium and the change in advanced premium.

earned premium =
collected premium +
change in deferred premium –
change in advanced premium

collected premium (actual cash collected during 2016):
350 * 7 (7 quarters from 1/1/2016 to 7/1/2017) = 2450

deferred premium (uncollected premium due before next anniversary)
December 31, 2015: 350*2 (1/1/2016 and 4/1/2016) = 700
December 31, 2016: 0

6. Continued

advanced premium (collected premium due on or after next anniversary)
December 31, 2015: 0
December 31, 2016: 350 (7/1/2017)

earned premium = 2450 + (0 – 700) – (350 – 0) = 1400

(b) Calculate the statutory mean reserve and deferred premium asset as of December 31, 2016. Show all work.

Commentary on Question:
Some candidates did not include the current year net premium in the mean reserve calculation. Most candidates did not calculate that the deferred premium asset equals 0.

mean reserve = [(prior year terminal reserve + current year net premium) + current year terminal reserve] x 0.5
= [(5000 + 0.8 x 1400) + 6500] x 0.5 = 6310

deferred premium asset = uncollected net premium due before next policy anniversary
= 0 (paid-to-date on December 31, 2016 is beyond next policy anniversary)

(c) Critique the following statements:

A. The statutory mean reserve is reported in Exhibit 1 and also appears in the liabilities section of the balance sheet

B. The deferred premium asset is reported in Exhibit 5 and is not permitted to be recognized on the balance sheet

Commentary on Question:

Candidates generally did well on this part of the question.

A. The mean reserve is reported in Exhibit 5; it is correct that it also appears in the liabilities section of the balance sheet.

B. The deferred premium asset is reported in Exhibit 1; it also appears in the assets section of the balance sheet.

6. Continued

(d) Describe two techniques to confirm the reasonableness of the reserve calculations.

Test of relationships of reserve items to other financial items

- Develop ratios to spot unusual trends
- Example: reserve per unit inforce

Test of aggregate progress of reserve from one fiscal period to the next

- Use analysis of increase in reserves formulas from Annual Statement to spot unusual trends
- Example: relate the change in reserve to actual mortality experience

7. 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:

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

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

(2c) Recommend and justify appropriate valuation assumptions.

Sources:

US GAAP for Life Insurers, Herget et. Al., Ch. 3, 4 & 13 (excl. 13.7)

Commentary on Question:

This question tested candidates' knowledge of US GAAP financial reporting requirements.

Solution:

(a) Describe the treatment of each of the following items on the income statement and balance sheet:

(i) Costs associated with the development of a new illustration system

(ii) Payments made to wholesalers on the sale of variable annuities

(iii) First year commission on a level commission variable annuity

(iv) Termination and policy processing expenses

(v) Salaries and bonuses of actuarial staff

(vi) Charges associated with managing the bond portfolio

Commentary on Question:

Candidates had to identify the treatment of the expense on the financial statements to receive full credit. The phrase "expensed as incurred" or similar is required for full credit.

7. Continued

Candidates generally did not do well on this part of the question. Most candidates listed the type of expense without identifying its treatment. Many candidates did not differentiate between the income statement and balance sheet. For part (iii), many candidates described the treatment for heaped commission and did not receive credit.

i) Non-deferrable acquisition costs
Income statement: expensed as incurred
Balance sheet: not capitalized

ii) Deferrable acquisition costs
Income statement: expensed over time via amortization of DAC asset
Balance sheet: capitalized in DAC asset

iii) Similar to maintenance costs
Income statement: expensed as incurred
Balance sheet: included in benefit reserve calculation, which will result in an accrual if not a level percentage of revenue

iv) Maintenance costs
Income statement: expensed as incurred
Balance sheet: included in benefit reserve calculation, which will result in an accrual if not a level percentage of revenue

v) Overhead
Income statement: expensed as incurred
Balance sheet: not capitalized

vi) Investment expenses
Income statement: expensed as incurred (deducted from investment income)
Balance sheet: not capitalized

(b) Critique the following statements pertaining to PMR's term life block:

A. *It is good practice to establish a new era for each year of business issued.*

B. *The discount rate for the benefit reserve should be set at the current investment yield level.*

C. *Benefit reserve calculations should assume no lapses.*

D. *Benefit reserve calculations should assume no federal income taxes.*

7. Continued

Commentary on Question:
Candidates generally did well with statements C and D.

For statement A, candidates received partial credit for identifying the statement as false. Proper justification was required for full credit. The justification of assumptions locked in at issue did not receive credit.

Statement B required candidates to identify factors that influence the level of the discount rate. Most candidates received partial credit for identifying the statement as false. To receive full credit, candidates had to identify two of the four additional factors. A common error was stating the discount rate should equal the best estimate assumption with a provision for adverse deviation.

A: False – a new era should be created when assumptions materially deviate from those assumed at issue

B: False – the discount rate should also take into account the following:

- historical yields
- trends in yields
- portfolio mix and maturities
- experience level of the portfolio manager

C: False – benefit reserve should assume best estimate lapses with a provision for adverse deviation

D: True – federal income taxes are excluded from the benefit reserve calculation

(c) Calculate the premium deficiency reserve on the valuation date. Show all work.

Commentary on Question:
To receive full credit, candidates had to correctly identify and calculate the components for the Net GAAP Liability and Gross Premium Reserve, recognize the block is in loss recognition and demonstrate an understanding of the required remediation steps. Candidates generally did not do well this part of question. Common errors included using the gross premium in the GAAP Reserve calculation and using padded best estimate assumptions for the Gross Premium Reserve calculation. Most candidates recognized the block is in loss recognition and that provisions for adverse deviations therefore had to be removed.

GAAP Reserve (original best estimate assumptions with PAD)
= PV of Benefits – PV of Net Premiums
= 2,200 – 1,100
= 1,100

7. Continued

Net GAAP Liability
= GAAP Reserve – DAC
= 1,100 – 300
= 800

Gross Premium Reserve (GPV, current best estimate assumptions without PAD)
= PV of Benefits – PV of Gross Premiums
= 2,300 – 1,200
= 1,100

Block is in loss recognition since GPV > Net GAAP Liability. Steps taken to remediate are as follow:

Step 1: remove margins from the GAAP Reserve

GAAP Reserve (original best estimate assumptions without PAD)
= 2,000 – 1,200
= 800

Net GAAP Liability
= 800 – 300
= 500

Step 2: since GPV > Step 1 Net GAAP Liability + DAC, the entire DAC is written off

DAC = 0

Net GAAP Liability = GAAP Reserve = 800

Step 3: since GPV > Step 2 Net GAAP Liability, a premium deficiency reserve must be set up for the difference

Premium Deficiency Reserve
= GPV – Step 2 Net GAAP Liability
= 1,100 – 800
= 300

7. Continued

(d) Calculate the following:

(i) PMR's 2017 net income

(ii) PMR's 2017 other comprehensive income

(iii) PMR's carrying value on December 31, 2017

Show all work.

Commentary on Question:
Candidates generally did well on this part of the question. For part (i), some candidates incorrectly subtracted dividends declared and paid from PMR's net income. For part (iii), candidates received partial credit if they correctly calculated components of the carrying value.

Accounting is based on the equity method since the ownership stake is between 20% and 50% of the investment

(i) PMR's 2017 net income
= ownership stake x SAM's 2017 net income
= 40% x 10,000,000
= 4,000,000

(ii) PMR's 2017 OCI
= ownership stake x SAM's 2017 OCI
= 40% x 1,500,000
= 600,000

(iii) PMR's carrying value on December 31, 2017
= ownership stake x
(SAM's market capitalization on December 31, 2016 +
SAMS's 2017 Net Income +
SAM's 2017 OCI –
SAM's 2017 dividends declared and paid)
= 40% x (100,000,000 + 10,000,000 + 1,500,000 – 2,000,000)
= 43,800,000

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.

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

Learning Outcomes:

(2a) Compare and apply methods for life and annuity product reserves.

(3b) Compare and contrast rules-based and principles-based approaches.

Sources:

LFV-833-17: Fundamentals of the Principle – Based Approach to Statutory Reserves for Life Insurance, 2017

ULSG AG38 Valuation Research Report, The Financial Reporter, June 2013, pp. 1, 4-7

Analysis of Methods for Determining Margins for Uncertainty Under a Principle-Based Framework for Life Insurance and Annuity Products

Commentary on Question:

This question tested the candidates' knowledge of the VM-20 statutory standard and the history of what was used for statutory valuation before VM-20 for UL-SG products, specifically, Actuarial Guideline 38.

Solution:

(a)

(i) Describe how Actuarial Guideline 38 (AG 38) and its subsequent revisions have changed UL-SG statutory accounting.

(ii) Describe the assumption changes driven by the revision of AG 38 8E for each of JDB's two UL-SG product designs.

Commentary on Question:

Candidates general did not do well on this part of the question. Some candidates described the AG38 reserving methodology for Section 8A in detail, but did not describe the key changes made in Section 8D and 8E. Some candidates described the segmented calculation of premiums, but did not specify it was the same segmented methodology as term. Some candidates referenced non-safe harbor approach for Design A and safe harbor approach for Design B, but did not elaborate further.

8. Continued

For part (i):

- AG38 was written with the purpose of providing direction on the application of the model to certain product types, specifically term and UL-SG, and requires a company to reserve for secondary guarantees inherent in universal life contracts using the same segmented methodology as term insurance

- More recent additions to Actuarial Guideline XXXVIII, (8D and 8E, 2012) further specify methods of reserving for guarantees on inforce blocks of certain universal life policy types (8D) and prospective issues of these same policy types (8E). These most recent sections are intended as a bridge until a principle-based approach to valuation becomes operative.

- Section 8D applies a reserve floor derived from a modificaiton of the deterministic component of VM-20, which is a gross premium reserve utilizing prudent estimate assumptions with certain specified assumptions.

- Section 8E continues the formulaic approach under AG38 while modifying the process for minimum premium determination, either using the charge structure that minimizes the schedule of premiums (Method I), or assuming a premium pattern that maximizes initial deficiency reserves (Method II). Furthermore, guaranteed policy credits (such as interest on the no-lapse shadow fund) for business subject to Section 8E requirements are restricted to a Moody's bond yield index plus 3 percent.

For part (ii):

- The design as described in the question is #3 for the first product as it has a dual shadow account design that is made in such a way to maximize valuation net premiums and #1 for the second product as it has a single shadow account

- The dual shadow account design would calculate lower valuation premiums, because the (or) minimum premium determination would require using the charge structure that minimizes the schedule of premiums ignoring any contingences or conditions that would otherwise limit the application of those charges and credits. For the dual charge product, this would be the shadow account charges when the no-lapse fund is at or near zero. Thus, higher deficiency reserves would be calculated for the policy.

- The single shadow account design would have minimal impact from 8E, unless it was using a guaranteed interest rate much higher than the newly allowed maximum of Moody's bond yield index plus 3 percent, because the 8E requirements will not change the charges used in the calculation of net premiums.

8. Continued

(b) Critique each of the following statements in JDB's working document on VM-20 valuation of its UL-SG business :

A. The minimum reserve that we will hold for our UL-SG model segment is the Net Premium Reserve (NPR), plus the excess of the sum of the Deterministic Reserve (DR) and the Stochastic Reserve (SR), reduced by any deferred premium asset held on account of those policies
B. For certain Universal Life policies, the NPR will use a prescribed lapse rate determined by the level of base account funding
C. Alternately, the model for the DR and SR only uses company-specific assumptions
D. The SR total will be the greater of the VaR for the 90th percentile and a 80 CTE reserve level
E. Under rules-based methods, the direct writer calculates a direct reserve on each policy before reinsurance and determines the reinsurance reserve credit separately also using a rules-based methodology and prescribed assumptions
F. The expenses used for the DR and SR shall be the same in all scenarios and will use expense improvements and only fully allocated expenses

Commentary on Question:

Candidates generally did well on statements A, C, D and F. Candidates generally did not make the correct evaluation on statements B and E. For statement D, candidates who provided the incorrect CTE level received partial credit.

A. Instead of the sum of the DR and the SR, it should be the greater of the DR and the SR. The part of the statement about the deferred premium asset is accurate and can stay.
B. The NPR for certain policies uses a prescribed lapse rate based on the level of funding of the secondary guarantee, not the funding of the base account.
C. The projection for the DR uses prudent best estimate for some assumptions such as premium payment patterns, withdrawals, surrenders and premium persistency, but does have prescribed assumptions for others such as the interest rate path, reinvestment spreads, as well as certain aspects of mortality and lapse.
D. There is no VaR measure used in the final determination of the SR, it is only the CTE and in particular only 70 CTE is used - "The reserve level is expressed as a 70 CTE reserve level. The stochastic reserve is the result of taking this CTE metric on the distribution of scenario reserves" .
E. This statement is accurate.

8. Continued

F. The expense assumptions will be the same for the DR and SR, with the only exception being that differences may arise for application of inflation rates. No future expense improvements are allowed. The last part about only using fully allocated expenses is fine.

(c) It is proposed that a margin be added by increasing the lapse assumption by 5% for both products, since actual experience has been less than 5% over expected.

Evaluate this proposal.

Commentary on Question:
Some candidates recommended no change to the ULSG lapse assumption. However, this dismisses the purpose of margins which is to add additional conservatism. The reserve still has some sensitivity to lapse assumption, so the option of a smaller, negative margin should be explored (i.e., decreasing the lapse assumption to increase reserves and add conservatism).

Some candidates suggested changing the lapse assumption due to A/E ratio > 100%, but the concept being tested is setting margins, not setting best estimate assumptions via experience studies.

Most candidates did not mention WL's lapse assumption being more sensitive to lapse assumptions compared to ULSG.

Not all candidates touched on the potential lack of credibility in the WL data, due to short experience time frame.

- Adding 5% is not appropriate for the ULSG product. Based on the sensitivity test results, reserves decrease when lapses increase. Margins should be set so that the insurance liability increases. For the ULSG product, liabilities increase when lapses are lowered; thus, the margin should be subtracted from the base rate. Since the liabilities are not very sensitive to a change in lapse rate, and the product has many years of experience and thus more credibility, a small margin is likely appropriate.

- The WL product will likely require a higher margin than 5%. The sensitivity test results indicate this product's liabilities are very sensitive to a change in lapses: a lapse increase of 5% results in a reserve increase of almost 10%; a 10% increase in lapses results in a reserve increase of about 20%.

- Also, the WL product only has 6 years' worth of experience. This is a relatively short time frame and likely not very credible. The less credible the experience, the higher the margin should be.

9. Learning Objectives:

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

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:

Overview of the FASB's Proposal for Long-Duration Contracts of Insurance

US GAAP for Life Insurers, Herget et al., 2nd Edition, 2006 - Ch. 17 (sections 17.4-17.7)

Commentary on Question:

This question tested the candidates' knowledge of emerging GAAP issues.

Solution:

(a) Critique the following comments regarding the new FASB proposal for long duration contracts:

A. The cash flow assumptions for the net premium ratio would be updated at the same time that the premium deficiency test is performed.
B. The discount rate should use the expected investment yield.
C. For traditional life and limited pay products, the discount rate should be updated at each reporting date. Any resulting change in liability would be immediately recognized in other comprehensive income. For universal life products, there is no change to how the discount rates are determined.
D. Deferred balances accounted for under the insurance model would be amortized based on the discounted amount of insurance in-force.
E. The "profit followed by loss" test would be done annually.
F. The net cost of reinsurance will be amortized in the same way as the DAC.

Commentary on Question:

This part of the question tested candidates' knowledge of the FASB proposal for long duration contracts. Candidates generally could identify that a statement was "true" or "false", but some candidates had difficulty elaborating on why the "false" statements were false.

9. Continued

A. False.
- The net premium ratio would be updated annually or more frequently if actual experience or other evidence indicates a need for revision.
- Net premium ratio would be capped at 100%, replacing the premium deficiency test.

B. False.
- Use high-quality fixed-income instrument yield, replacing "expected"
- Yield maximizes the use of relevant observable inputs and reflects the duration characteristic of the liability.

C. True.

D. False.
- Amortize on a ratable basis either: a) in proportion to the undiscounted amount of insurance in-force over the expected term of the related contract, or b) on a straight-line basis, if the amount of insurance cannot be reasonably estimated.

E. True.

F. False.
- Currently unclear as this is not directly addressed in the proposal.

(b) SJU Life is considering reinsurance for its two-year term life product.

(i) (*1 point*) Identify the basic conditions that must be met under SFAS 113 in order to qualify for reinsurance accounting.

(ii) (*1 point*) Describe the "paragraph 9b" significance of loss test.

(iii) (*4 points*) You are given:

Ceded Annual Premiums:	20,000
Expense Allowance as % of premiums	35%
Expected Loss Ratio of Reinsured Business:	65%
Discount Rate	3%

Loss Ratio Range & Probability	
30%-50%	25%
50%-70%	45%
70%-90%	30%

9. Continued

Expected Loss Payment Run-off Pattern	
Year 1	85%
Year 2	15%

Determine whether this proposed structure should be treated as reinsurance under SFAS 113. Show all work.

Commentary on Question:
This part of the question tested candidates' knowledge of SFAS 113. Candidates generally did not perform well on this part of the question.

In part (i), most candidates provided some form of the two basic conditions with or without realizing two-year term is a short-duration contract. Most candidates did not take into account that timing of payment limits the qualification as significant risk.

In part (ii), most candidates struggled to describe how to show it is "reasonably possible that the reinsurer may realize a significant loss". Some candidates correctly described PVs of all cash flows as a metric for a 10% probability of a 10% loss. Many candidates incorrectly used PV of claims as a metric rather than PV of all cash flows.

In part (iii), the most common error was using the 65% expected loss ratio on reinsured business. For example, some candidates reasoned that a 35% expense allowance plus a 65% expected loss ratio = 100%, and therefore, there is no risk to the reinsurer. SFAS 113 is about the possibility of loss (tail risk), not an expectation of loss (average). Thus, the focus was on the worst situation for the reinsurer, which is the 70%-90% loss ratio range. As that range covers more than a 10% probability that loss ratio range is "reasonably probable". Very few candidates reasoned that a 35% expense allowance plus an 80% loss ratio (midpoint of 70%-90%) = 115% and with effect of expected loss run-off and discounting the potential loss will likely be at least 10%.

While each loss ratio range is shown below, only the 0.70 - 0.90 Loss ratio range needs to be calculated as that range has a 30% probability. "Reasonably possible" is frequently 10%, 30% is greater than 10%, thus it can be assumed the loss ratio range of 70% to 90% has at least a 10% probability. Recognizing this fact greatly simplifies the question.

9. Continued

(i)

- Two-year term life is considered a short-duration contract.

- Two basic conditions that must both be met:
  - The reinsurer assumes significant insurance risk under the reinsured portions of the underlying insurance contracts *(paragraph 9a)*,
  - It is reasonably possible that the reinsurer may realize a significant loss from a transaction *(paragraph 9b)*.

- A reinsurer shall not be considered to have a significant insurance risk if:
  - Probability of significant variation in either the amount or timing of payments by the reinsurer is remote.
  - Timing of payments such as withholding payment until a certain threshold is met or treaties that settle less than once a year.

(ii)

- The ceding enterprise's evaluation of whether it is reasonably possible for a reinsurer to realize a significant loss shall be based on the PV of all cash flows between the ceding and assuming enterprises under reasonably possible outcomes, without regard to how individual cash flows are characterized.

- Significance of loss shall be evaluated by comparing the PV of all cash flows with the PV of the amounts paid or deemed to have been paid to the reinsurer.

- While the SFAS 113 does not give any guidance on what is reasonably probable, 10% is sometimes used.

- In calculating the size of the losses, a value of 10% or more of the PV of the amounts paid by the ceding company to the reinsurer has been assumed to be a significant loss. In practice other percentages may be used.

9. Continued

(iii)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Pol Yr	(2) Loss Ratio Range, (3) Assumed Loss Ratio		(4) Ceded Premium, (5) Expense Allowance, (6) Ceded Claims Reimbursed			Reinsurer's Net Cash Flow		PV of Net Cash Flow	PV as % of Premium
1	0.30 - 0.50	0.40	20,000	7,000	6,800	6,200	3%	5,267	26.3%
2					1,200	(1,200)		(1,165)	
1	0.50 - 0.70	0.60	20,000	7,000	10,200	2,800	3%	1,400	7.0%
2					1,800	(1,800)		(1,748)	
1	0.70 - 0.90	0.80	20,000	7,000	13,600	(600)	3%	(2,466)	-12.3%
2					2,400	(2,400)		(2,330)	

Premium & expense allowanced paid beginning of year. Claims paid end of year.

Legend:
1. Policy year
2. Loss ratio range
3. Assumed loss ratio (midpoint of range)
4. Ceded premium
5. Expense allowance = (4) * 0.35
6. Ceded claims reimbursed = (4) * (3) * 0.85 for policy year 1 and 0.15 for policy year 2
7. Reinsurer's net cash flow = (4) – (5) – (6): *Reinsurer collects (4) and pays (5) and (6)*
8. Discount rate
9. Present Value of net cash flows in (7) at 3% discount rate in (8)
10. Present value of net cash flows at beginning of first year as percent of (4)

- Assume criteria of reinsurer realizing significant loss to be 10% of premium.
- Assumed loss ratio = Average of lower and upper loss ratio range.
- Expense allowance received = Ceded premium * Ceding allowance%
- Claims reimbursed = Ceded premium * Assumed loss ratio * Current year loss payment run-off rate.
- Reinsurer net cash flow = Ceded premium – Expense allowance – Claims reimbursed
- PV of net cash flow (year 2) = - Claims reimbursed (year 2) / (1 + discount rate)

9. Continued

- PV of net cash flow (year 1) = (- Claims reimbursed (year 1) + PV of net cash flow (year 2)) / (1 + discount rate) + Ceded premium – Expense allowance

- PV as of % of premium = PV of net cash flow (year 1) / Ceded premium

- For 70%-90% Loss Ratio Range which has a 30% chance of occurring, PV as % of Premium is 12.3% => 10% loss, there is reasonable probability of a significant loss and this proposed structure can be treated as reinsurance under FAS 113.

10. 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.

(4d) Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital.

Sources:

Valuation of Life Insurance Liabilities, Lombardi, 4th Edition, Ch. 16 (excl. 16.6)

LFV-816-13: Regulatory issues in insurance, Sigma #3/2010 Swiss Re (pp 3-24)

Commentary on Question:

This question tested the candidates' understanding of RBC calculations, the actions that would be triggered by a company finding itself in an unhealthy capital position, and how a company could actively manage an adverse regulatory event.

Solution:

(a) Describe any regulatory consequences which are triggered by CPA's RBC ratio. Show all work.

Commentary on Question:

Candidates generally did well on this part of the question. Candidates generally calculated the RBC ratio correctly and understood that regulatory action is triggered. However, the Company is required to run a trend test. A few candidates did not add 50% to the ACL RBC and partial credit was received as a result.

RBC Regulatory Ratio = Total Adjusted Capital / Authorized Control Level (ACL) RBC

Total Adjusted Capital = Surplus + AVR +0.5 * Dividend Liability =

70 + 30 + 0.5 * 40 = 120

ACL RBC = (1/2)*(C_0 + C_{4A} + sqrt((C_{1A} + C_{3A})^2 + C_{1CS}^2 + C_2^2))

10. Continued

= (1/2)*(10 + 25 + sqrt((40 + 20)^2 + 10^2 + 15^2) = 35 + sqrt(3600 + 100 + 225))
= 97.65/2 = 48.83

RBC Ratio = TAC / ACL = 120 / 48.83 = 246%

CPA Life is in the Trend test corridor (200% <= ratio <250%). No regulatory action is triggered, but the Company must run a trend test to ensure that it is projected to return to a healthy capital position (> 250%).

(b) CPA subsequently discovers its receivables are over-valued by 35. Assume that this has no effect on CPA's Authorized Control Level RBC.

Describe the immediate regulatory consequences of this discovery.

Commentary on Question:
Candidates generally solved the correct change in RBC ratio, but did not always fully state the consequences. To receive full credit, it was necessary to clearly state both the Company's and the Commissioner's responsibilities. Candidates who did not include the 50% factor in the ACL RBC received partial credit.

The drop in the receivables would reduce surplus by 35, which would have a similar impact on the TAC.

The resultant RBC ratio = (120-35) / 48.83 = 85/48.83 = 174%.

The Company is now in the Company Action Level (150% <= ratio < 200%). The Company must do further analysis regarding steps that can be taken to restore the capital position to a healthy level and submit a plan to the Commissioner, who will monitor the plan, but no immediate regulatory action is required.

(c) Describe the potential impact on CPA if the state regulators from CPA's state of domicile institute more stringent capital requirements.

Commentary on Question:
Candidates interpreted this question as to what would happen to CPA if more stringent capital requirements were imposed, what might happen to their current RBC and what steps CPA could take to improve their capital position.

Credit was received for recognizing that additional regulatory action would be required if the RBC ratio decreased and that the rating agencies could possibly downgrade CPA's rating.

10. Continued

With more stringent capital requirements, the company's RBC ratio might decrease to even further "corridors" entailing further regulatory consequences.

A lower RBC ratio may be viewed negatively by many stakeholders:

- Regulators – additional regulatory actions
- Policyholders may be concerned about the company's claim paying ability and decide to lapse
- Rating agency may downgrade the company making it harder to raise capital – access to capital will be limited as investors may be concerned about credit-worthiness

Options to increase capital position:

- De-risking by selling higher risk assets (corporate bond, equity) to assets with lower risk charges (govt. bonds etc.)
- Changing product design. Discontinue selling products contributing higher insurance risk and introduce products with higher capital efficiency – sell off certain blocks of business
- Raise capital – Increase prices, decrease expenses
- Explore reinsurance arrangements to transfer some of the risk