ILA LFVU Model Solutions
Fall 2013

1. Learning Objectives:

4. The candidate will be able to explain and apply the methods, approaches and tools of financial management and value creation in a life insurance company context.

Learning Outcomes:

(4b) Perform financial analysis on a product line or company.

(4e) Explain and apply methods and approaches of surplus management and earnings management.

(4f) Describe and apply the principles of how insurance companies create value from a financial economics perspective.

Sources:

Life Insurance Products and Finance, Chapter 16 Financial Management, Strategic Management of Life Insurance Company Surplus

Commentary on Question:

The question is testing knowledge of basic analysis of a line of business (profit center) in the overall context of a total company. Whether a profit center is creating or destroying value or generating or consuming free cash flow are basic building blocks of a company's operation.

Solution:

(a)

(i) Determine whether each profit center creates or destroys embedded/economic value. Show all work.

(ii) Determine whether each profit center generates or consumes free cash flow. Show all work.

(iii) Rank the profit centers in the order of capital allocation to maximize the company's performance. Justify your answer.

Commentary on Question:

Candidates performed relatively well on (i). The main issues on (ii) related to not realizing the provided beginning and ending equity amounts were for a 5-year period (rather than one year), therefore an adjustment in the formula is necessary.

1. Continued

A few candidates did not realize free cash flow is a comparison of the ROE ("supply" of earnings each year) to the Equity Growth ("demand" for earnings each year). The answers for (iii) reflected the level of understanding in (i) and (ii) and sometimes did not include a qualitative discussion of the various profit centers and how to manage them for optimal company performance. Some candidates also did not realize there is a clear order of best to worst profit centers.

(i)

If ROE > Cost of Capital then profit center is creating value.
If ROE < Cost of Capital then profit center is destroying value.
ROEs were provided for each profit center A-D.
Cost of Capital = Risk Discount Rate = 12%.
A: 15% > 12%, A is creating value.
B: 13% > 12%, B is creating value.
C: 8% < 12%, C is destroying value.
D: 9% < 12%, D is destroying value.

(ii)

If ROE > Equity Growth then profit center is generating free cash flow.
If ROE < Equity Growth then profit center is consuming free cash flow.
Equity amounts were provided for a 5-year period for each profit center.
Equity Growth = (Ending Equity / Beginning Equity) ^ (1/5) – 1.
A: Equity Growth = (4,300 / 1,000) ^ 0.2 – 1 = 33.9%.
A: 15% < 33.9%, A is consuming free cash flow.
B: Equity Growth = (2,500 / 2,000) ^ 0.2 – 1 = 4.6%.
B: 13% > 4.6%, B is generating free cash flow.
C: Equity Growth = (3,000 / 2,000) ^ 0.2 – 1 = 8.5%.
C: 8% < 8.5%, C is consuming free cash flow.
D: Equity Growth = (800 / 1,000) ^ 0.2 – 1 = -4.4%.
D: 9% > -4.4%, D is generating free cash flow.

(iii)

Most attractive profit center creates value AND generates free cash flow.
Least attractive profit center destroys value AND consumes free cash flow.

A: Creates value, consumes free cash flow. A is the future growth of the company as long as ROE can be maintained and there is enough free cash flow in the company to support the profit center.

B: Creates value, generates free cash flow. B is the most attractive profit center. Recommend taking steps to increase profit center B to enhance company performance.

1. Continued

C: Destroys value, consumes free cash flow. C is the least attractive profit center. Recommend finding ways to increase profitability and decrease growth.

D: Destroys value, generates free cash flow. Recommend finding ways to increase profitability OR decrease growth.

Profit Center	Value	Free Cash Flow
A	Creates	Consumes
B	Creates	Generates
C	Destroys	Consumes
D	Destroys	Generates

Profit center order from best to worst: B, A, D, C

(b)

(i) Explain whether Profit Center E creates or destroys embedded/economic value. Show all work.

(ii) Explain whether Profit Center E generates or consumes free cash flow. Show all work.

(iii) Determine the maximum allowable 2012 overhead expenses to maintain the company's embedded/economic value when Profit Center E is added. Show all work.

Commentary on Question:
Candidates generally could fill out the provided table of values. When an incomplete table is provided it is always to facilitate easy answering. Candidates performed better on (i) than on (ii) and (iii). Some candidates didn't realize an NPV calculation was not necessary for (ii). The adjustment to the overhead expenses in (iii) was the most difficult.

(i)

Year	**2012**	**2013**	**2014**	**2015**	**2016**
Overhead Expenses	-1,446	0	0	0	0
Profits from 2012 Sales	-2,000	1,400	1,400	0	0
Profits from 2013 Sales	0	-6,000	4,200	4,200	0
Annual Profit	-3,446	-4,600	5,600	4,200	0

All these values from multiplying profits per unit sold by expected sales by year in terms of units.

1. Continued

NPV = Present Value of annual profits discounted at 12% Cost of Capital
NPV = -88.73 {= (-3,446)/(1.12)^1 + (-4,600)/(1.12)^2 + (5,600)/(1.12)^3 + (4,200)/(1.12)^4+ (0)/(1.12)^5 }
NPV < 0, therefore ROE < 12%, therefore proposed profit center destroys value.

(ii)

Equity Growth = 0%.
Sum {Annual Profits} > 0 therefore ROE > 0%.
ROE > Equity Growth, propose profit center generates free cash flow.

(iii)

Overhead expenses must be reduced by NPV * (1+CoC).
Expense reduction = -88.73 * (1.12) = -99
Overhead expenses must be 1,347 instead of 1,446.

2. Learning Objectives:

4. The candidate will be able to explain and apply the methods, approaches and tools of financial management and value creation in a life insurance company context.

Learning Outcomes:

(4d) Apply methods of valuation to business and asset acquisitions and sales. This includes explaining and applying the methods and principles of embedded value.

(4e) Explain and apply methods and approaches of surplus management and earnings management.

Sources:

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

ILA-C106-07: Mergers and Acquisitions: Chapter 4 (Sections 4.1 – 4.6)

Life Insurance Products & Finance, Chapter 16

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)

(i) Calculate the after-tax U.S. GAAP return on equity (ROE).

(ii) Explain why the U.S. GAAP ROE may not correspond to the internal rate of return used in pricing.

Commentary on Question:

Part (a) is designed to test knowledge of GAAP earnings and was well answered by most candidates. Some candidates were unable to come up with the proper reasons GAAP ROE does not equal IRR.

GAAP ROE = GAAP Earnings/GAAP Surplus
GAAP Surplus = Statutory Surplus +Statutory Reserve – GAAP reserve
+Unamortized GAAP Deferred Acquisition Cost
= 190 + 100 – 97 + 7 = 200
Then GAAP ROE = 22/200 = 11%

GAAP ROE may not equal IRR because:

- Some acquisition costs may not be deferrable
- Differences in investment earnings rates and cost of capital
- Margins for adverse deviation

2. Continued

(b) Describe the components and uses of an actuarial appraisal.

Commentary on Question:
Part (b) was intended to test the candidate's knowledge of how the value of a company might be established along with alternative uses of an appraisal. Candidates did not do as well on this part as the calculation parts. Many did not identify the uses of an appraisal or missed the idea of the components.

An actuarial appraisal establishes the value of a company as the adjusted book value plus the value of in force business plus the value of future business where

- Adjusted book value is statutory assets less statutory liabilities
- Value of in force is the present value of future earnings less an adjustment for cost of capital for business already on the books
- Value of new business is the present value of earnings adjusted for cost of capital for business that is intended to be sold (usually limited to a certain number of years of new business)

An actuarial appraisal is often used to:

- Establish the purchase price of a company or block of business during a merger or acquisition
- Test sensitivities to various risks
- Allocate capital in the most efficient manner
- Monitor business and performance management

(c) Calculate the embedded value for DEF as of the acquisition date assuming ABC will establish the same solvency reserves as DEF. Show all work.

Commentary on Question:
Part (c) was answered well by many candidates. Some candidates lost points for errors in the Tax formula and a few dropped marks by not identifying the parts of an equation before plugging in numbers.

Purchase Value = Solvency Reserves – Assets
= 1950 – 1860 = 90

Tax = (Solvency Reserve – Tax Reserve – Purchase Value – Transaction Costs)*tax rate
= (1950 – 1775 – 90 – 4)*.3 = 81*.3 = 24.3

Embedded Value = Purchase Value + Taxes + Required Capital + Transaction Costs
= 90 + 24.3 + 165 + 4 = 283.3

3. Learning Objectives:

5. The candidate will understand the Risk Based Capital (RBC) regulatory framework and the principles underlying the determination of Regulatory RBC and Economic Capital.

Learning Outcomes:

(5c) Explain and describe the concept and roles of Economic Capital including:
- (i) Identification of the significant risk components
- (ii) Selecting calculation methods appropriate to stakeholder's perspectives
- (iii) Describing how a company would implement an Economic Capital Program

Sources:

Economic Capital for Life Insurance Companies (Society of Actuaries)

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) List and define the key aspects of Economic Capital.

Commentary on Question:

Although most candidates were able to list the key aspects, many did not provide sufficient definitions or details to demonstrate knowledge of the subject. For instance, many candidates identified VAR/CTE as risk measures but didn't detail the difference.

Economic Capital is a company specific measure of risk over a defined time period at a certain level of security.

- Time Horizon
  - Liability Runoff Approach
    - Project asset/liability cashflows and balance sheets for 1000+ real world stochastic scenarios to determine asset level to satisfy all obligations through the end of the projection period
  - One Year Marked-to-Market Approach
    - Assets and Liabilities are projected forward one year for a number of scenarios (10000+) to generate an economic balance sheet at the end of the period
- Measure of Risk
  - Value at Risk (VaR)
    - Measure of the probability of ruin
  - Conditional Tail Expectation (CTE)
    - Measure of the cost of ruin or the extent of loss

3. Continued

- Level of Security/Risk Tolerance
  - e.g. 95%, 99%, 99.5%
  - Designed to provide a easily and meaningfully communicated level of protection
- Other key aspects of economic capital include the fact that it is company specific, allowing management to make better decisions on business units, and that it can reflect diversification/correlations when aggregating capital.

(b) Outline considerations for successfully implementing an Economic Capital framework as it pertains to the company's primary risks.

Commentary on Question:
*In general, this was a poorly answered question by candidates. The question addresses implementing an EC framework "**as it pertains to the company's three primary risks**". Most candidates provided high level lists of EC implementation concerns, but few Candidates addressed these risks specifically and/or how those three risks affect the implementation on an EC framework.*

- Common Elements:
  - All 3 risks could be modeled either stochastically or deterministically
  - Both mortality and morbidity include: catastrophe, volatility, miss-estimation or parameter risk, and trend risk
- Equity risk
  - Size of risk depends on asset liability matching, expected return and level of volatility
  - Data availability: Where availability of market data is limited, assumptions and higher confidence levels may be needed
- Mortality risk: Catastrophe data is limited
- Morbidity risk: The nature of risk and impact of various risk factors is highly dependent on the specific type of product sold

(c) Outline the appropriateness of each approach from both a total company and business unit perspective.

Commentary on Question:
This question was answered well by a small sample of candidates. Common mistakes in answering this question include (1) not providing any rationale on the appropriateness of the recommended method at the product level (2) not addressing the approaches at a company level. Alternative solutions were acceptable as long as the candidate provided well thought out reasoning.

3. Continued

Investment Product with Equity Guarantees: CTE99 One-year Stochastic

- The higher confidence level is appropriate for the one-year approach
- The CTE measure is appropriate to reflect the loss distribution in the extreme tail of the distribution
- Stochastic models make sense with products with guarantees, which are scenario dependent and subject to market assumptions.

Life Insurance: VaR98 Lifetime Deterministic

- In general lower confidence levels are appropriate for the lifetime approach. VaR98 is acceptable.
- The lifetime approach is appropriate for long duration contracts

Disability Insurance: CTE95 Lifetime Stochastic

- The lower confidence level is appropriate for the lifetime approach
- CTE takes into account the shape of the risk distribution

Total Company

- VaR is more easily understood
- CTE is a more coherent risk measure, leading to more consistent results when aggregating capital across different business units.
- Using a consistent time horizon would allow for more consistent aggregation of risks and would support calculations measuring diversification benefits

(d)

(i) Calculate the allocated post-diversified EC for each business using both allocation methods.

(ii) Using these results, provide a recommendation that takes into account the factors to consider in developing an EC Program.

Commentary on Question:

(i) Candidates were generally able to get full credit for the pro rata methodology, while the marginal methodology was not as well done.

(ii) Most candidates were able to provide a thought out recommendation. Alternative solutions were accepted as long as the candidate provided well thought out reasoning.

(i)

Pro-rata calculation

Total pre-diversified EC = 950+800+575=2325

Investment Products Allocated Post-Diversified EC

= (950/2325)*1700 = 695

Insurance Products Allocated Post-Diversified EC

= (800/2325)*1700 = 585

3. Continued

Disability Products Allocated Post-Diversified EC
= (575/2325)*1700 = 420

Marginal Contribution calculation
Investment Products Marginal Contribution = 1700-1280=420
Insurance Products Marginal Contribution = 1700-1140=560
Disability Products Marginal Contribution = 1700-1240=460
Total of All Product Lines' Marginal Contribution = 420+560+460=1440

Investment Products Allocated Post-Diversified EC
=(420/1440)*1700 = 496
Insurance Products Allocated Post-Diversified EC
=(560/1440)*1700 = 661
Disability Products Allocated Post-Diversified EC
=(460/1440)*1700 = 543

(ii)

Pro-rata approach recommendation

- Proportionate to stand-alone risk levels
- Aligns with risk management at the business unit level

(OR Alternative Recommendation)
Marginal Contribution allocation recommendation

- Reflects the lower correlation that exists between the equity and insurance risks

4. Learning Objectives:

1. The candidate will understand financial statements and reports of U.S. life insurance companies and be able to analyze the data in them.

4. The candidate will be able to explain and apply the methods, approaches and tools of financial management and value creation in a life insurance company context.

7. The candidate will understand the professional standards addressing financial reporting and valuation.

Learning Outcomes:

(1e) Describe, use and recommend methods for performing reviews of reserves.

(4c) Explain and create a product line "gains by source" analysis.

(7c) Identify and apply actuarial standards of practice relevant to financial reporting and valuation.

Sources:

Sources of Profit 1996 Val Act Symposium, pages 147 – 162

ILA-C102-09: Actuarial Review of Reserves and Other Annual Statement Liabilities

ASOP #21 Responding to the Auditor

Stochastic Analysis of Long Term Multiple-Decrement Contracts, Clark and Runchey, Jan 2008 (Exclude Appendices)

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) You are updating the stochastic mortality model to reflect the health care reform. Explain the impact on each of the stochastic mortality factors.

Commentary on Question:

The question requires candidate to identify and describe four risk factors. Each risk factor needs to be related to the two aspects listed in the question.

- Underwriting Risk
  - Little impact
  - Reflects the risk that best estimate assumptions are incorrect
  - Consider quality of underwriting -- lower parameter for high quality UW (or vice versa)
  - Consider higher parameter for newer product -- higher parameter for newer product (or vice versa)

4. Continued

- Volatility
  - Potentially more volatile due to the inconsistent implementation of the new law (exemption of some jurisdictions)
  - Impact on the life expectancy of people from different regions redistribution of resources could have different impacts to different groups of people
  - Actual experience will vary around the central value defined as the best estimate (or, random fluctuation around the best estimate)
  - Consider size of portfolio -- larger portfolio => lower parameter (or vice versa)
  - Consider face amount distributions -- wider distribution => higher parameter (or vice versa)
- Catastrophe Risk
  - No impact
  - Populations are exposed to events that result in a sharp increase in mortality for a short period of time. e.g. pandemics, natural disasters and terrorist attacks
  - Severity and frequency are difficult to predict
  - Historic events may not be indicative of the future
- Trend
  - No impact

(b) The year-end 2012 reserve was incorrectly understated by $1.8M due to a block of policies being erroneously excluded and counted as lapsed without a Cash Surrender Value (CSV).

(i) Describe the impact of the reserve correction on the earnings reported in the Source of Earnings for 2012.

(ii) Calculate the revised actual lapse rate assuming the only impact the reserve error has on the analysis is in gains from persistency & surrenders.

(i)

Commentary on Question:
On This part, not many candidates received full credit, but most

- Reserve correction affects the ending reserve.
- Adding in missed reserve will increase the ending reserve, and decrease earnings.
- Ending reserve is part of deaths and persistency calculation.

4. Continued

- Since the missing reserve is from a block of erroneously lapsed policies, no impact on actual mortality rate, so increasing in ending reserve will decrease the positive earnings or increase the negative earnings from death.
- Actual lapse rate may decrease, if the missing policies were part of studies that produced the actual lapse rate
- If the actual lapse rate decreased, then gain from surrenders will increase
- Harder to judge the impact on gain from persistency because (actual lapse rate - expected lapse rate)*ending reserve and actual lapse rate decreased but ending reserve increased.

(ii)

Commentary on Question:
On This part, not many candidates received full credit, but most candidates received partial credit. Most of the candidates recognized either the $1.8M increase in reserve or the $1.8M decrease in earning. Most of the candidates did well in listing the formula for source of earning from Surrenders/Persistency.

- Source of earning from Surrenders/Persistency: (w exp - w act)*(CSV - V)
  0.45 = (0.082 - 0.09)*(CSV - V)
  CSV - V = -56.25
- CSV' = CSV because the reserve error was due to a block w/o CSV.
- V' = V+1.8, reserve was left out, so to correct, need to add back in, thus increase in reserve
- Reserve increase by 1.8 due to the correction will also mean the earning from surrenders/persistency will decrease by 1.8 since the earnings impact on reserve change is one for one. Revised gain=0.45-1.8=-1.35
  0.45-1.8 = (0.082-w')*(CSV'-V')
  -1.35=(0.082-w')*(CSV-V-1.8), -1.35=(0.082-w')*(-56.25-1.8)
  w'=0.082-1.35/(56.25+1.8)=0.05874

(c) Describe methods which may be used in the reserve review to help identify any reserve errors.

Commentary on Question:
This question is straight forward. Candidates in general were able to answer this part properly and concisely.

4. Continued

- Relationship with reserve items to other financial items and trend in that relationship over time
- Spot check – (test calculations, transactional checks and policy traces)
- Test calculations - policy audit (may not necessary find the missing policies) (Transaction Checks or Policy Trace)
- Trends in subtotals process of reserve from one period to the next.

(d) List the key points to include in the report to the auditor regarding the error, based on "ASOP #21, Responding to the Auditor," if the reserve error was only found by an independent auditor.

Commentary on Question:
Candidates in general did very well in this part.

- Possible change in method that led to the mistake
- Possible change in procedure that led to the mistake (reserve subtotals were not checked)
- Possible change in operating environment (inexperienced personnel)
- Possible error in data used (data review for inconsistency and incompleteness)

5. Learning Objectives:

1. The candidate will understand financial statements and reports of U.S. life insurance companies and be able to analyze the data in them.

2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issue by U.S. life insurance companies.

Learning Outcomes:

(1e) Describe, use and recommend methods for performing reviews of reserves.

(2a) Describe and differentiate between valuation assumptions under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

(2b) Recommend and justify appropriate valuation assumptions under the following standards
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

Sources:

Actuarial Standard of Practice No. 10

U.S. GAAP for Life Insurers, Second Edition
- Chapter 4 Traditional Life Insurance
- Chapter 6 Universal Life Insurance

Valuation of Life Insurance Liabilities, Fourth Edition
- Chapter 1 Overview of Valuation Requirements

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

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)

(i) List key considerations when selecting best estimate assumptions, according to ASOP #10.

(ii) State the sources of data that should be considered when developing best estimate assumptions, according to ASOP #10.

5. Continued

(iii) Similar to U.S. statutory reporting, reserves under U.S. GAAP reporting are subject to actuarial review. List the techniques that should be considered when reviewing actuarial reserves.

Commentary on Question:
Candidates generally did well on this part.

(i) Key considerations:
- Characteristics and magnitude of the company's business
- Maturity of the company and its rate of growth
- Prior experience of the company and trends in that experience
- Medical, economic, social, and technological developments that might affect future experience

(ii) Sources of data:
- If possible and appropriate, consider data specific to the company
- If company data is not available or credible, consider data from industry or similar companies, modified appropriately

(iii) Techniques:
- Spot checks
- Independent full recomputations
- Tests of aggregate progress of reserves from one fiscal period to the next
- Tests of relationship of reserve items to other financial items
- Tests of inventory
- Tests of reserve adequacy

(b)

(i) Since mortality experience can vary, we should add a provision for adverse deviation (PAD) to the best estimate mortality assumption of both products.

(ii) According to our marketing department, Marmot pays high commissions on the WL product. Since these commissions are a significant expense, a PAD should be added to the commission assumption.

(iii) We must use an interest rate prescribed by law for our WL valuation.

(iv) According to our investment department, the likelihood of various investment return rates for UL business is as follows:

5. Continued

Rate	Likelihood	Resulting Net GAAP Liability
2%	40%	300,000
3%	40%	265,000
4%	20%	230,000

For our UL valuation, we should use the weighted-average rate of 2.8%.

(v) We must be as accurate as possible when setting assumptions for both products because we are only allowed to change our assumptions if there is a loss recognition event.

Critique each of the above statements.

Commentary on Question:
Candidates generally did well on this part. Most candidates received full credit for sections (i) and (ii). Most candidates struggled with section (iii), perhaps due to confusion over the meaning of the word "prescribed".

(i) Correct for WL
- Per FAS 60, assumption is locked in and should include a PAD

Incorrect for UL
- Per FAS 97, assumption is not locked in and should not include a PAD

(ii) Incorrect
- Commissions are capable of exact determination, so the commission assumption should not include a PAD

(iii) Incorrect
- Per FAS 60, the interest rate assumption should be the best estimate assumption plus a PAD
- A prescribed interest rate is required under Statutory valuation but not U.S. GAAP

(iv) Incorrect
- Per ASOP 10, if two assumptions are equally likely, use the one that produces the largest liability or smallest asset
- 2% and 3% are equally likely, but 2% produces the higher liability, so don't use 3% in the calculation
- Recommend using 2.4% = (0.8 x 2%) + (0.2 x 4%)

5. Continued

(v) Correct for WL

- Per FAS 60, assumptions are only allowed to change if there is a loss recognition event

Incorrect for UL

- per FAS 97, assumptions should be periodically reviewed and updated to reflect emerging experience

(c)

(i) Explain the purpose of the mortality/morbidity significance test.

(ii) You are given the following present values for a block of UL policies at issue:

Premiums	1,600,000
Excess Payments	600,000
Cost of Insurance Charges	700,000
Interest Margins	600,000
Expense Charges	650,000

Assume a 25% significance threshold.

Determine if this block has significant mortality risk. Show all work.

Commentary on Question:
Answers to section (i) were often not complete enough to earn full credit, and most candidates did not understand how to do section (ii).

(i) Purpose:

- Per SOP 03-1, the test is used to classify contracts at issue as insurance or investment contracts
  - Insurance contracts are accounted for under either FAS 60 or FAS 97
  - Investment contracts are accounted for under either FAS91 or FAS 97
- Contracts with significant mortality or morbidity risk are classified as insurance contracts
- Contracts with insignificant (nominal) mortality or morbidity risk are classified as investment contracts

5. Continued

- Significance is determined by comparing the PV of excess payments to the PV of assessments
  - Excess payments are benefit payments to be made in excess of the policyholder's account balance
  - Assessments include all amounts to be assessed against the policyholder
  - There is no specific threshold for defining significance; actuarial judgment must be used

(ii) Calculation:

- Significance ratio = PV(excess payments) / PV(assessments)
- Assessments include cost of insurance charges, interest margins, and expense charges
- Significance ratio = (600,000) / (700,000 + 600,000 + 650,000) = (600,000) / (1,950,000) = 31%
- Since the significance ratio is over the threshold, yes, this business has significant mortality risk

6. Learning Objectives:

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

Learning Outcomes:

(6a) Describe the considerations and evaluate the appropriate form of reinsurance from the ceding and assuming company perspectives.

Sources:

Life and Health Reinsurance, Advance Methods of Reinsurance, Chapters 4, 5 and 10

Commentary on Question:

The question was testing whether the candidate understood some of the nuances of the types and uses of reinsurance. It looked at the different types of Reinsurance and their effectiveness in providing capital relief. It asked the candidate to describe the advantages and disadvantages of using reinsurance with an authorized and un-authorized company. The concept of an Experience Refund was tested. Specific questions about the uses and appropriateness of Experience Refunds within a Reinsurance agreement we asked along with a calculation for experience refunds.

Solution:

(a) The following reinsurance arrangements are considered for an inforce block of Whole Life business in an attempt to strengthen the company capital position:

- YRT
- Coinsurance
- Modified coinsurance

(i) Comment on the effectiveness of using the above reinsurance arrangements for capital relief.

(ii) For each of the reinsurance arrangements, discuss the appropriateness of having an Experience Refund feature as part of the terms of the treaty.

(iii) Discuss the advantages and disadvantages of using an un-authorized reinsurer.

Commentary on Question:

Part (i) many understood the differences here. More high level answers than detail. Part (ii) was poorly answered. Very few demonstrated an in depth understanding of when or why Experience Refunds are used. Part (iii) generally candidates demonstrated their knowledge of the differences and advantages and disadvantages of using an un-authorized reinsurer.

6. Continued

(i) YRT

- Not generally used
- Used mostly for mortality relief
- Does provide limited relief for C2 requirement and limited to 1st year reserve, so amount is small

Coinsurance

- Good for all products
- Provides relief as long as registered in the state of domicile
- Have to transfer assets backing reserves
- Easy to administer
- May run into losses on wind up if have to transfer assets back

Modco

- Similar to coinsurance but ceding company holds reserves
- No need to transfer/liquidate assets
- Removes credit issue if reinsurer is un-authorized
- More exposed to counterparty credit risk
- More complicated accounting

(ii) Experience Refund only shares in gains not losses
Used to encourage better underwriting
YRT

- Generally not used – one year time frame only

Coinsurance

- Premiums are usually higher than if no experience refund existed
- Generally not used – share in gains only

Modco

- Used mostly for this format

(iii) Cost of LOC, funds withheld or other form of trust to get around the relief issue

Advantages:

- May offer cheaper rates
- Ability to get reinsurance where otherwise could not
- Can still get credit if use modco with funds withheld

6. Continued

Disadvantages:

- May not be able to get capital credit
- Regulators have no authority or control over reinsurer
- Larger counterparty risk exposure

(b) Calculate the ceding company's net income before experience refund and the amount of experience refund it will receive from the reinsurer in all years. Show all work.

Commentary on Question:
Majority answered this section best. Had a clear understanding of the mathematics behind reinsurance and the fact that if there is a loss, no experience refund. The loss carry forward concept was well understood. The calculation including the loss carry forward was a little tricky to execute. But many were able to get the intricacies of it and receive full marks.

Income = Net Premium – Net Death Benefit – Expenses + Reinsurance Allowance

Expenses = Gross premium * Expense Margin
Allowance = Net Premium * Reinsurance Allowance

	Year 1	Year 2	Year 3
Gross Prem	1000	950	900
Ceded Prem	200	320	400
Net Prem	800	630	500
Gross Benefit	300	420	450
Cede Benefit	150	210	225
Net Benefit	150	210	225
Reinsurance Allowance	100	32	40
Expense	100	95	90
Income Before Refund	650	357	225

Reinsurer Profit = Premium - Benefit - Allowance - Expense

	-50	78	135
Profit Sharing		15.6	27
Loss Carry Forward	-10	-10.4	-
Experience Refund	0	5.2	27

7. Learning Objectives:

1. The candidate will understand financial statements and reports of U.S. life insurance companies and be able to analyze the data in them.

2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issue by U.S. life insurance companies.

Learning Outcomes:

(1a) Construct financial statements for a life insurance company under U.S. GAAP accounting methods and principles

(1b) Construct financial statements for a life insurance company under U.S. Statutory accounting, methods, including describing the structure of the U.S. Annual Statement and explain the purpose of its major exhibits and schedules.

(2a) Describe and differentiate between valuation assumptions under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

(2c) Calculate liabilities for life and annuity products and their associated riders under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

(2d) Calculate DAC assets for life and annuity products and their associated riders under the standard: U.S. GAAP.

Sources:

U.S. GAAP for Life Insurers, Second Edition
- Chapter 6 Universal Life Insurance

Valuation of Life Insurance Liabilities, Fourth Edition
- Chapter 1 Overview of Valuation Requirements
- Chapter 8 Universal Life Insurance

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Compare and contrast U.S. SAP and U.S. GAAP with respect to the following:

7. Continued

- Key audience
- Primary emphasis
- Financial statement focus
- Types of valuation methodologies and assumptions used

Commentary on Question:
Most candidates did well on this part, with only a few candidates confused between SAP and GAAP.

- Key audience
  - SAP: insurance regulators
  - GAAP: shareholders, rating agencies
- Primary emphasis
  - SAP: solvency
  - GAAP: matching of current revenue with current costs
- Financial statement focus
  - SAP: balance sheet
  - GAAP: income statement
- Types of valuation methodologies and assumptions used
  - SAP: methodologies and assumptions are prescribed fairly precisely, and assumptions include significant PAD
  - GAAP: methodologies are less prescriptive, and assumptions are generally based on company experience with more modest PAD

(b) With respect to U.S. SAP

(i) Explain why the traditional valuation methods are challenging to apply to flexible premium UL products.

(ii) Your company calculates UL under the NAIC Universal Life Insurance Model Regulation. You are given the following information for a specific inforce flexible premium UL policy as of the valuation date:

- Guaranteed Maturity Fund = 29,815
- Current Fund = 29,765
- Present Value of Future Guaranteed Benefits = 55,718
- Net Level Premium = 2,480
- Present Value of a Life Annuity Due of 1 per year = 10.99

Calculate the statutory net level reserve as of the valuation date. Show all work.

7. Continued

Commentary on Question:
Most candidates struggled with section (i), while many candidates received full credit for section (ii).

(i) The typical "present value of future benefits less present value of future net premiums" formula is challenging to apply since neither future premiums nor future benefits is known for any particular policy. Some assumption as to future premiums is required.

(ii) Calculate the r-ratio

r-ratio = min(Current Fund / Guaranteed Maturity Fund, 1)
= min(29765 / 29815, 1)
= 0.9983

Calculate the present value of net level premiums (PVNLP)

PVNLP = Net Level Premium x PV of a Life Annuity Due of 1 per year
= 2480 x 10.99
= 27255

Calculate the net level reserve (NLR)

NLR = r-ratio x (PV of Future Guaranteed Benefits – PVNLP)
= 0.9983 x (55718 – 27255)
= 28415

(c) Describe similarities and differences with the presentation of the income statement and the balance sheet under FAS 60 and FAS 97 for each of the following categories:

- Liabilities
- Assets
- Revenues
- Benefits and other deductions

Commentary on Question:
Many candidates did well on Revenues and Benefits, but most candidates struggled with Liabilities and Assets.

- Liabilities
  - Presentation is similar
  - Both have benefit reserves
  - FAS 97 may have URL
- Assets
  - Presentation is similar
  - Both have DAC

7. Continued

- Revenues
  - Presentation is significantly different
  - Both have investment income
  - FAS 60 has premiums
  - FAS 97 has fee income and URL amortization
- Benefits and other deductions
  - Presentation is significantly different
  - Both have DAC amortization, commissions and other operating expenses
  - FAS 60 has benefit payments and increase in reserve
  - FAS 97 has excess benefit payments, interest credited to policyholder balances and bonus interest charge

(d) Compare and contrast retrospective deferred acquisition cost (DAC) unlocking and prospective DAC unlocking, in the context of FAS 97.

Commentary on Question:
Very few candidates fully understood the difference between the two types of unlocking. Many candidates received partial credit.

- Retrospective unlocking: at the end of each reporting period, recalculate DAC as of beginning of period
  - Compute actual gross profit for period and use in place of estimated gross profit in amortization of DAC
  - Do not change future DAC amortization assumptions
  - Retrospective unlocking equals difference between recalculated and prior DAC amounts and runs through earnings
- Prospective unlocking: at the end of each reporting period, recalculate DAC as of end of period
  - Compute actual gross profit for period and use in place of estimated gross profit in amortization of DAC
  - Review future DAC amortization assumptions and update as necessary
  - Prospective unlocking equals difference between recalculated and prior DAC amounts and runs through earnings

(e) Calculate the following DAC effects for policy year 10:

(i) Impact of retrospective unlocking

(ii) Impact of annual events

(iii) Impact of prospective unlocking

7. Continued

Commentary on Question:
Very few candidates did the calculations correctly. Most candidates did not receive any credit.

Impact of retrospective unlocking
= DAC Retrospective Unlocking (9) – DAC Original Projection (9)
= 24806 – 20672
= 4134

Impact of annual events
= DAC Retrospective Unlocking (10) – DAC Retrospective Unlocking (9)
= 15086 – 24806
= -9720

Impact of prospective unlocking
= DAC Prospective Unlocking (10) – DAC Retrospective Unlocking (10)
= 9052 – 15086
= -6034

8. Learning Objectives:

2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issue by U.S. life insurance companies.

Learning Outcomes:

(2a) Describe and differentiate between valuation assumptions under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

(2b) Recommend and justify appropriate valuation assumptions under the following standards
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

(2c) Calculate liabilities for life and annuity products and their associated riders under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

Sources:

U.S. GAAP for Life Insurers, 2nd Edition, Chapter 4

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Calculate the following expected balances at the end of year 4:

(i) U.S. GAAP Reserve

(ii) DAC Asset

Commentary on Question:

The question was trying to test the ability of the student to calculate reserves and DAC for a term life policy. Generally students performed fairly well on part (a). To get full marks, the student had to either calculate the expense reserve, or note that the expense reserve did not need to be calculated since it was a level percentage of the premium.

8. Continued

The expected balances can incorporate a persistency factor as well which would have also earned full marks since the question did not specify whether the reserves and DAC at the end of year 4 was calculated as if the person was alive then.

The 5 year term life insurance policy is valued under FAS60 as a long-duration traditional life insurance policy. The liability is thus calculated as the present value of future benefits and expenses less the present value of future net premiums. The assumptions used are locked-in best estimates plus a provision for adverse deviation.

(i) Since the maintenance expenses are a constant percentage of premium, there is no need to use the present value of expenses in the reserve calculation as the reserve will turn out the same.

The padded mortality is:

Year 1 40
Year 2 50
Year 3 60
Year 4 110
Year 5 130

The padded interest rate is 6% - 1% = 5%.

The present value of of premiums is 900 + 900 x (1-0.04)/1.05 + 900 x (1-0.04) x (1-0.05)/1.05^2 + 900 x (1-0.04) x (1-0.05) x (1-0.07)/1.05^ 3 + 900 x (1-.04) x (1-0.05) x (1-0.06) x (1-0.11) = 3698.8

The present value of benefits is 10,000 x (0.04/1.05 + 0.05 x (1-0.04) / 1.05^2 + 0.06 x (1-0.04) x (1-0.05) / 1.05^3 +0.11 x (1-0.04) x (1-0.05) x (1-0.06) + 0.13 x (1-0.04) x (1-0.05) x (1-0.06) x (1-0.11)) = 2842

The net level premium is equal to 900 x 2842 / 2698.8 = 691.5

The reserve at the end of year 4 is the present value of benefits at the end of year 4 - present value of future net premiums at the end of year 4 = 10,000 x 0.13 / 1.05 - 691.5 = 546.6.

(ii) The deferrable expenses are amortized over premiums using the same assumptions used to calculate the net reserve.

8. Continued

The DAC k-factor is calculated as the present value of deferrable expenses divided by the present value of future premiums = 500 / 3698.8 = 500 / 3698.8 = 0.1352

The DAC at the end of year 4 = 900 x .1352 = 121.6.

(b) Describe how each expense component affects the profit emergence over the life of the policy, given that experience emerges as expected.

Commentary on Question:
The description of how the deferrable and non-deferrable expenses impacted profits was done well by the majority of the students. To get full marks on the overhead and maintenance expenses, the students need to note that although the impact of the overhead expense and maintenance expense are the same for this policy, the fashion in which this is achieved is different.

Profits will emerge as a level percentage of the annual premiums as well as a release of provisions from adverse deviations. The 1st year deferrable expense is amortized over the 5 year period as a level percentage of premiums and thus would be a hit to income each year. The non-deferrable expense of 200 is a hit to income at policy inception. The annual maintenance expense is expensed as a level percentage of premium; in this case the maintenance expense hit to income will be 60 per year. Overhead expenses are not reserved for, and thus will reduce income by 40 per year.

(c) In your calculation of the U.S. GAAP reserves and DAC asset, all of the following were ignored:

(i) Lapse Rates
(ii) Inflation
(iii) Mortality Improvement
(iv) Commissions

Explain the appropriateness and implications of ignoring each of the above.

Commentary on Question:
To get full marks on this question, students need to state and justify whether the practice was appropriate (or not) for this specific product, and note the impact on reserve and/or DAC.

8. Continued

(i) Lapse rates could play a material impact in the calculation of USGAAP reserves and DAC as they impact the amount of premiums received and benefits paid, thus it is not appropriate to ignore lapse rates in the calculation of reserves and DAC. Ignoring the lapse rates will most likely overstate the DAC and reserves given this product has level premiums and no surrender benefits.

(ii) Inflation impacts the annual expenses and thus would generate a maintenance expense reserve as the expenses are increasing but the premiums are level. However, the product has a fairly short term, and thus the impact from inflation is small and is appropriate to ignore.

(iii) It is rare to include mortality improvement in a short term life insurance product, and thus is appropriate to ignore. Ignoring mortality improvement for this product has little impact, and decreasing the PADs can achieve the same impact.

(iv) Commissions are primarily related to the acquisition of new business and thus it is inappropriate to ignore them in the calculation of the DAC. As commissions are generally deferred and amortized, ignoring the commission in the calculation of the DAC will cause the DAC to be understated.

9. Learning Objectives:

2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issue by U.S. life insurance companies.

Learning Outcomes:

(2a) Describe and differentiate between valuation assumptions under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

(2b) Recommend and justify appropriate valuation assumptions under the following standards
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

(2c) Calculate liabilities for life and annuity products and their associated riders under the following standards:
- (i) U.S. Statutory
- (ii) U.S. GAAP
- (iii) U.S. Tax

Sources:

U.S. GAAP for Life Insurers, 2nd Edition, Chapter 9

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Identify the applicable U.S. GAAP accounting standard for this payout annuity product. Justify your answer

Commentary on Question:

To identify which US GAAP standard to apply, the key criterion is whether the product has significant mortality risk. Most candidates got that part. However the level of "significance" is expected to be demonstrated through calculation, not by judgment. The probability of paying out mortality-related benefit should be calculated and compared to a threshold.

Payout annuities can fall into either SFAS 91 or SFAS 97, depending on whether significant mortality risk exists.

9. Continued

For this product, the life contingent payments only start when the surrender benefit reaches zero. This happens between the 19th and 20th year of the policy; as the accumulated single premium at end of year 19 is 1000 * 1.04 ^ 19 = 2,107, and the accumulated single premium at the end of year 20 is 1.04 ^ 20 = 2,191; and the accumulated payout at the end of year 19 is 75 * (1.04 ^ 19 - 1) / 0.04 = 2,075 and the accumulated payout at the end of year 20 is 75 * (1.04 ^ 20 - 1) / 0.04 = 2,233
The probability of the policyholder surviving to the 20th year is (1- mortality rate) ^ 20 * (1 - lapse rate) ^ 20 = 1.5% therefore the present value of payments made after the 20th year is insignificant compared to the present value of all payments made (at a 6% interest rate)
This policy should therefore be accounted for in a manner consistent with accounting for interest-bearing instruments; so SFAS 91 should apply

(b) Describe how the expected reserves and DAC balances in future periods for this particular policy are calculated under the standard identified in (a).

Commentary on Question:
The answer is dependent on (a). Candidates who answered SFAS 91 for (a) also did well on part (b).

Constant Yield Method is used to calculate reserves
Project anticipated cash flows, such as premiums, expenses, and benefits, using best estimate assumptions (no PAD)

- Solve for the interest rate so that present value of future cash flows equal to the net proceeds. Net proceeds are generally the consideration received less any commissions or acquisition costs.
  PV (cash flows) = 1000-50=950 @ r1
- At each future period, the Net GAAP reserve = present value of the cash flows using r1
- Solve for another interest rate so that present value of future cash flows equal to the gross premium.
  PV (cash flows) = 1000 @ r2
- Benefit reserve + Maintenance expense reserve = present value of the benefit and expense cash flows using r2
- Net GAAP reserve = Benefit reserve + Maintenance expense reserve - DAC
- So DAC asset = (Benefit reserve + Maintenance expense reserve - net GAAP reserve

10. Learning Objectives:

3. The candidate will be able to understand and analyze the implications of emerging financial and valuation standards.

Learning Outcomes:

(3c) The candidate will be able to describe and assess the impact on reserves, capital, and/or income of emerging developments in U.S. principle-based reserve regulation.

Sources:

ILA-C808-13: Fundamentals of the Principle Based Approach to Statutory Reserves and Risk Based Capital, Aug 2012

Commentary on Question:

Solution:

(a) VM-20 requires two separate aggregate principle-based reserves as components of the final reserve. Outline the similarities and differences between these two calculations.

Commentary on Question:

VM-20 requires calculation of Stochastic and Deterministic Reserves

Similarities:

- Model all policies in aggregate - not a seriatim calculation
- Both require cash-flow projection models
- Model liabilities and asset cashflows
- Both use starting assets between 98% and 102% of estimated final reserve

Differences:

- Deterministic uses only one scenario
- Stochastic uses multiple scenarios
- Stochastic uses worst case negative PV of year-end projected assets plus starting assets over all segments (greatest PV of the negative of the projected statement value of assets)
- The Stochastic takes CTE across a distribution of values (scenario reserves)

Determining the scenario reserve is a multi-step process:

- Project the model segment cashflows using the stochastically generated scenarios from the prescribed scenario generator
- Calculate the discounted value using treasury rates multiplied by 1.05
- Sum the amounts across all model segments at the end and beginning
- Scenario reserve is the sum of the starting assets across the model segments and maximum of the values

10. Continued

(b) Prepare guidelines to assist the company in setting the assumptions required to produce these aggregate reserves under VM-20.

Commentary on Question:

- Projected cashflows is a projection of the experience for expenses, death claims, surrender payments and asset earned rates, etc.
- VM-20 requires most assumptions established using company experience if relevant and credible
- May use industry experience if company experience is not available or credible
- The greater the uncertainty in the anticipated experience assumption, the larger the required margin
- Need assumptions for policyholder behavior (premium payment patterns, premium persistency, partial withdrawals, surrenders)
- Choose appropriate expense basis that aligns with the actual expense
- Reflect the impact of inflation
- Reflect direct cost of policies as well as appropriate portion of direct costs
- VM-20 requires the company to calculate a reserve inclusive of cash flows resulting from inforce reinsurance treaties
- Derivatives and hedging: the requirements allow the company to determine the impact of the hedging strategy
- Economic assumptions for the deterministic reserve are prescribed by VM-20

(c) VM-20 also requires the calculation of a rules-based reserve as a component of the final reserve.

(i) Outline the similarities and differences between this calculation and the net level premium reserve calculation currently required under the U.S. statutory CRVM method.

(ii) Explain the justifications given for including a rules-based calculation in a principle-based framework.

Commentary on Question:

(i) Different from CRVM
   a. Definition of net premium allowed for expense allowance different from CRVM
   b. Non-fund based policies without non-forfeiture values may utilize prescribed lapse rates

10. Continued

c. May utilize prescribed lapse rate with the rate of lapse is determined by the level of funding of the secondary guarantee

Similar to CRVM

d. Uses same prescribed valuation mortality
e. Prescribed interest rates based on the same algorithm
f. Gross premiums used in the methodology are the guaranteed gross premiums

(ii)

- Provides a floor which will not vary by company for similar product designs
- Provides the regulatory examiner an amount which is easier to audit
- May be only reserve to calculate if company can prove through specified exclusion test that other reserves will be lower
- Seriatim nature gives basis to allocate excess from aggregate reserves
- Definition of net premium reserve is better fit for current tax act

(d) Describe how the results from the two aggregate principle-based and one rules-based reserve runs are used to produce the final reserve under VM-20.

Commentary on Question:

Minimum reserve is the aggregate net premium reserve plus excess (if any) of the greater of the aggregate and deterministic reserve over the aggregate net premium reserve

11. Learning Objectives:

7. The candidate will understand the professional standards addressing financial reporting and valuation.

Learning Outcomes:

(7a) Explain the role and responsibilities of the appointed/valuation actuary.

(7b) Identify and apply relevant professional actuarial qualification standards.

Sources:

LFV-804-07: NAIC Actuarial Opinion and Memorandum Regulation

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) List the liabilities covered by the opinion.

Commentary on Question:

Candidates generally did well on this part.

- All in force business on the statement date
  - Reserves in exhibits 5-8 (formerly exhibits 8-11)
  - Equivalent items in the separate account statement

(b) Describe the paragraphs to be included in the opinion.

Commentary on Question:

Candidates generally did well on this part.

- Opening paragraph identifies appointed actuary
- Scope paragraph describes reserves and related actuarial items analyzed and any not analyzed
- Reliance paragraph describes areas of the analysis where appointed actuary has deferred to other experts
- Opinion paragraph expresses appointed actuary's opinion regarding ability of assets to mature liabilities
- Additional paragraphs are included in individual company cases as needed

(c)

(i) Determine a reasonable additional reserve amount to satisfy asset adequacy requirements. Justify your answer.

(ii) Explain what you would do if company management refuses to set up the additional reserve.

11. Continued

Commentary on Question:
Most candidates were able to write down a logical analysis. Note that the analysis needs to consider both ending surplus and minimum surplus over the projection period; some candidates missed one of the two in their analysis. A recommended value within the range of $100 million to $150 million is reasonable, as long as it is well explained. Amounts less than $100 million are not reasonable. Amounts over $150 million are questionable but not necessarily unreasonable provided they are not too much in excess of $150 million. Shown below is one possible answer.

(i) Recommended amount = $150 million

- All scenarios will satisfy PV of ending surplus >= 0
- All interim negative surplus values will be covered (PV of minimum surplus >=0)
- Will eliminate any concerns regarding asset adequacy

(ii) I would either refuse to issue an opinion or issue an adverse or qualified opinion. In the latter case, I would include a paragraph in the opinion stating why the opinion is adverse or qualified. This paragraph would follow the scope paragraph and precede the opinion paragraph.