# SOCIETY OF ACTUARIES
## Individual Life & Annuities United States – Company/Sponsor Perspective

# Exam CSP-IU

## MORNING SESSION

**Date:** Friday, April 27, 2012
**Time:** 8:30 a.m. – 11:45 a.m.

### INSTRUCTIONS TO CANDIDATES

**General Instructions**

1. This examination has a total of 120 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 60 points).

   a) The morning session consists of 7 questions numbered 1 through 7.

   b) The afternoon session consists of 6 questions numbered 8 through 13.

   The points for each question are indicated at the beginning of the question.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.

3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

**Written-Answer Instructions**

1. Write your candidate number at the top of each sheet. Your name must not appear.

2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.

3. The answer should be confined to the question as set.

4. When you are asked to calculate, show all your work including any applicable formulas.

5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets since they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam CSP-IU.

6. Be sure your essay answer envelope is signed because if it is not, your examination will not be graded.


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Exam CSP-IU Front Cover

****BEGINNING OF EXAMINATION****
**Morning Session**

**1.** (*5 points*) ABC, a stock life insurance company experiencing rapid growth, evaluates its capital adequacy using a Financial Rating Risk Replication Technique (FRRRT) and requires that sufficient capital be held such that:

(i) The probability that Risk Based Capital (RBC) becomes less than 100% of the Authorized Control Level over a 5-year horizon is 0.1%.

(ii) The probability of a ratings downgrade by S&P triggered by a falling Capital Adequacy Ratio over a 5-year horizon is 0.1%.

(a) (*2 points*) Explain why the FRRRT approach might be useful to ABC for assessing capital adequacy.

(b) (*3 points*) Identify and explain the steps for implementing the FRRRT.

**2.** (*9 points*)

(a) (*1 point*) Define the following with respect to the validation of a forecast model:

(i) Known Error Measurement

(ii) Unknown Error Measurement

(b) (*2 points*) Define static and dynamic validation of models and list advantages and disadvantages of each.

(c) (*6 points*) You are responsible for the financial reporting for a block of 200,000 ordinary life insurance policies. Senior management now requires calculations of Present Value of Future Profit and Value-Based Reserves on a quarterly basis rather than annual. Given resource constraints, you are considering some model simplifications.

You have determined the following reported and modeled values for the block. Assume the base model is the benchmark for all subsequent models.

| | | All Values in Millions | | | | |
|---|---|---|---|---|---|---|
| | | Model Values | | | | |
| | Description | Annual Premium | Current Statutory Reserve | Present Value of Future Profits | Value-Based Reserve | Quarterly Modeling Costs |
| Base Model | All policies | 250 | 3,000 | 180 | 2,100 | 2.00 |
| Model 1 | Issue ages 20 to 70 in groups of 5 | 255 | 3,072 | 184 | 2,140 | 1.80 |
| Model 2 | Issue ages 20 to 70 in groups of 10 | 247.5 | 3,060 | 177 | 2,140 | 1.60 |
| Model 3 | Issue ages 30 and 50 only | 272.5 | 2,790 | 198 | 2,249 | 1.55 |
| Model 4 | Issue age 43 only | 249 | 2,970 | 153 | 2,350 | 1.20 |
| Model 5 | Same as Model 2 but substituting average gross premium for actual gross premium | 250 | 3,075 | 177 | 2,150 | 1.28 |
| Model 6 | Same as Model 5 but substituting average policy size for actual policy size | 250 | 3,090 | 174 | 2,190 | 1.15 |

Senior management has stated that they would be willing to accept an error rate of 2% as long as the savings from a simplification warrant it.

Analyze these results and recommend a model simplification. Justify your recommendation.

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**3.** (*12 points*)

(a) (*5 points*) Three methods available to Random Life Insurance for use in determining reinsurance retention on a YRT basis are:

1. Pro Rata
2. Level/Constant Retention
3. Constant Risk Reinsured

For each method:

(i) Explain the allocation of risk between reinsurer and ceding company if the net amount of risk decreases.

(ii) You are given:

- Face amount is 100,000
- Reinsured amount at time 0 is 80,000
- Reserve at time 5 is 25,000

Calculate the amount retained by the ceding company at time 5. Show all work.

(b) (*3 points*) Random Life's draft reinsurance treaty includes the following provisions:

(i) Neither party may unilaterally terminate the existing reinsurance agreement. Either party may terminate the treaty with respect to new business upon proper notification.

(ii) Active lives are recaptured, disabled lives are not recaptured.

(iii) Once the recapture process has begun, the ceding company may not stop it.

(iv) If the reinsurer raises rates, Random Life has the right to recapture and seek reinsurance with another company.

(v) Recapture is required if Random Life becomes insolvent.

Comment on the appropriateness of each statement from Random Life's perspective and recommend changes needed before this draft is finalized.

**3. Continued**

(c) (*1 point*) Random Life created a stochastic model to study the impact of the reinsurance agreement on its year-end asset balance. The model results showed that the draft reinsurance agreement increased the ending asset balance if the claims exceeded the 90$^{th}$ percentile of the claim distribution. However, below the 90$^{th}$ percentile, the impact of the agreement on the assets was negative.

Explain the results of the model.

(d) (*3 points*) Random Life's management has recently established an ERM department to meet the company's risk management needs.

Explain how the use of reinsurance is reflected in each of the following four themes of the enterprise Risk Management process as discussed in the *ERM Specialty Guide*.

(i) Risk Control

(ii) Strategic Risk Management

(iii) Catastrophic Risk Management

(iv) Risk Management Culture

**4.** (*8 points*) You are an actuary for Magnificent Life Insurance Company and one of your main tasks is to evaluate capital adequacy for the company. Magnificent currently uses Risk Based Capital (RBC) as its primary measure of capital adequacy; however, the Actuary has proposed that the company consider implementing an Economic Capital model.

(a) (*4 points*) Magnificent's regulator has made the following statements about the role of RBC.

(i) "The purpose of RBC is to provide a 'cushion' that will enable a company to survive over the short term."

(ii) "RBC should not be used as the sole basis for determining Magnificent's target surplus."

(iii) "Even if Magnificent's RBC ratio falls to 140%, Magnificent is in good shape financially."

Evaluate each of the statements.

(b) (*4 points*) The Actuary has presented the following ideas on how Magnificent Life should model Economic Capital.

(i) "We should use Value at Risk (VaR) to measure our risk because it is adequate from our shareholders' perspective."

(ii) "Since life insurance liabilities have long-term risk exposure, it is best to use a multi-year, liability runoff approach."

(iii) "The Economic Capital model will consider all of our risks and allow us to always have much lower capital requirements due to the diversification effect."

Evaluate each of the statements.

**5.** (*9 points*) Everest Life had been using Actuarial Appraisal Value (AAV) for many years prior to its decision to switch to an Embedded Value (EV) framework.

(a) (*1 point*) Identify the similarities and differences between AAV and EV.

(b) (*5 points*) Everest is reviewing the implicit and explicit recognition of debt in a cost of capital framework.

(i) Identify each of the following statements as either explicit or implicit:

1. Can be expanded to include other sources of capital
2. Risk discount rate is the weighted average cost of capital
3. Spread over the after-tax rate of return on invested assets is used

(ii) List the conditions that need to be satisfied for the results of the implicit and explicit methods to be identical.

(iii) Recommend a method for recognition of debt if only the book values of debt and equity are available and the value of debt is expected to fluctuate. Justify your recommendation.

(c) (*3 points*) All Mountains Capital, the parent company of Everest Life, requested Everest to submit its target In-Force Business Value (IBV) for year-end 2011, based on the given information:

- IBV (2010) = 250,000
- Value of new business (2011) = 10,000
- Book Profit (2011) = 10,000
- 20% of Book Profit is attributed to new business
- Required capital (2010) = 30,000
- Risk discount rate = 5%
- After-tax rate of return on invested assets supporting surplus for 2011 = 3%

Calculate the target IBV for 2011. Show all work.

**6.** (*8 points*) Lake Shore Life Insurance Company has been reviewing its enterprise risk management (ERM) practices.

(a) (*2 points*) List and explain four objectives for pursuing ERM.

(b) (*3 points*) Lake Shore Life offers a variable annuity product with a Guaranteed Minimum Death Benefit. The company currently monitors changes in account values caused by volatile equity markets.

(i) Identify and explain other risks associated with this type of product.

(ii) List additional ways the company can monitor its equity risk.

(c) (*3 points*) Lake Shore Life recently experienced a large systems failure, which led to numerous customer complaints.

Recommend an action plan to help the company control these types of risks in the future.

**7.** (*9 points*) DF Life, a U.S. life insurance company has a block of Universal Life (UL) business. At the end of the first year, the actual and expected future values for the UL block are as follows:

| ***All values are the present value at Time 0*** | **Year 1 (actual results)** | **Year 2 (expected)** | **Year 3 (expected)** | **All later years combined (expected)** |
|---|---|---|---|---|
| Deferrable Expenses & Commissions | 900 | 200 | 0 | 0 |
| Assessments | 1,000 | 800 | 600 | 600 |
| Investment Income | 500 | 500 | 400 | 400 |
| Excess SOP 03-1 Benefits | 200 | 200 | 300 | 500 |
| Revised EGPs | 600 | 500 | 400 | 700 |

Assume:

- GAAP discount rate is 5%
- Revised EGPs include impact of SOP 03-1 liabilities
- The product has no Unearned Revenue Liabilities

(a) (*2 points*) Calculate the total DAC balance at the end of Year 1.

(b) (*2 points*) DF Life expects this product to have profits followed by losses. Calculate the SOP 03-1 liability at the end of Year 1.

(c) (*2 points*) The actual results for Year 2 are now known, and the actual Revised EGP in Year 2 is 0 due to additional non-deferred expenses.

Calculate the impact of the retrospective unlocking on the Year 2 total DAC balance.

(d) (*3 points*) At the end of Year 2, due to opportunities in the bond market, investment income in all future periods is expected to be 25% greater.

Calculate the impact of the prospective unlocking on the SOP 03-1 liability.

Show all work.

****END OF EXAMINATION****
**Morning Session**

**USE THIS PAGE FOR YOUR SCRATCH WORK**

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