
SOCIETY OF ACTUARIES
Life Finance & Valuation – U.S.

Exam ILALFVU

MORNING SESSION

Date: Thursday, May 5, 2016

Time: 8:30 a.m. – 11:45 a.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).
 - a) The morning session consists of 6 questions numbered 1 through 6.
 - b) The afternoon session consists of 5 questions numbered 7 through 11.

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

Tournez le cahier d'examen pour la version française.

****BEGINNING OF EXAMINATION****

Morning Session

- 1.** (10 points) Assess the accuracy of each of the following statements with regard to the use of performance metrics for value-based management of insurance business. Include any necessary recommendations to correct the statements.
- A. *Economic value added (EVA) and risk-adjusted return on capital (RAROC) are good performance metrics for life insurance.*
 - B. *There is an important connection between the cost of capital and solid enterprise risk management (ERM).*
 - C. *The cost of capital can be interpreted as the minimum rate of return on equity capital that is required by the shareholders to make it worthwhile to invest in a company. The correct cost of capital rate is essential to measuring performance.*
 - D. *Traditional accounting-based performance measures such as return on equity (ROE) or return on investment (ROI) evaluate performance and provide good indications for relative performance measurement and value creation.*
 - E. *Businesses should distinguish forward-looking objectives, such as target setting and decision making, from backward-looking objectives, such as performance evaluation and compensation schemes.*
 - F. *Market-based measures of return are superior to accounting-based measures of return.*
 - G. *The market consistent embedded value (MCEV) corresponds to the value of the business at one specific point in time and is a good measure for managerial performance.*
 - H. *For operating variances there is no need to separate between experience variances and assumption changes. The MCEV methodology makes implicit allowances for change in all assumptions as it is based on market consistent values.*
 - I. *The total MCEV earnings should be used for managerial performance evaluation.*
 - J. *In order to measure the true value creation of MCEV earnings, the unwinding of the inforce business needs to be included since there is no additional value creation by the expected business contribution.*

2. (10 points)

- (a) (2 points) Explain how an insurance company can use reinsurance on an inforce block as part of its financial strategy.
- (b) (2 points)
- (i) Describe the characteristics of modified coinsurance (mod-co).
- (ii) List two advantages and two disadvantages of mod-co.
- (c) (4 points) JZ Life has a large inforce block of universal life (UL) business, which it plans to cede to CM Re in the form of mod-co. The UL block has a total net amount at risk (NAAR) of 50 billion and total annual premiums of 200 million. The block is closed to new business.

Assume the following for the inforce mod-co reinsurance transaction:

- Quota share arrangement of 90%
- NAAR stays constant
- Taxes, investment income and maintenance expenses are ignored
- CM Re pays JZ Life an allowance of 10% of ceded premiums
- JZ Life pays CM Re a risk charge of 5% of the capital relief based on 200% of required capital
- This block will be recaptured at the end of year 3.

Projected cash flows (before reinsurance) are as follows (in millions):

Base Scenario

	Total Premiums	Total Claims	100% Required Capital
2017	200	140	50
2018	210	147	52
2019	200	140	50

2. Continued

Catastrophe Scenario

	Total Premiums	Total Claims	100% Required Capital
2017	200	200	52
2018	180	230	56
2019	160	280	60

Calculate the following for each year:

- (i) Gain or loss to JZ Life each year under the base scenario.
- (ii) Gain or loss to CM Re each year under the catastrophe scenario.

Show all work.

- (d) (2 points) The catastrophe scenario in part (c) excludes the following:
 - 40% of the policies of this block are eligible for non-forfeiture options.
 - Policyholders are eligible to take policy loans, and the utilization has been volatile over the years.
- (i) Assess how these exclusions affect the mortality risk to CM Re.
- (ii) Describe how these exclusions would be handled in a reinsurance transaction.

3. (9 points)

- (a) (3 points) Assess the accuracy of each of the following statements with regard to tentative decisions made by the IASB during its re-deliberations on the IFRS for insurance contracts. Include any necessary recommendations to correct the statements.
- A. *Changes in the discount rate are presented in other comprehensive income (OCI).*
 - B. *Investment components are excluded from revenue.*
 - C. *Premiums written are presented in the income statement.*
 - D. *The day one locked-in discount rates are used to accrete interest on the contractual service margin (CSM) and calculate the subsequent adjustments that unlock the CSM.*
- (b) (6 points) The IASB continues to discuss a number of matters surrounding the treatment of participating insurance contracts under IFRS.
- (i) Describe the five key areas under discussion.
 - (ii) Describe any concerns an insurance company may have with the IASB's proposals regarding these five key areas.

4. (10 points) DLF Life issued variable annuity policies with only equity investment options and the following benefits:

- Guaranteed minimum death benefit (GMDB): Return of premium upon death, no explicit additional charge.
- Guaranteed minimum accumulation benefit (GMAB): Return of premium at the end of 5 years, annual rider charge of 0.50% of account value.
- Guaranteed minimum income benefit (GMIB): Annuitization base benefit with an annual roll-up of 5% which can be exercised just after the 7th anniversary, annual rider charge of 0.90% of account value.
- Guaranteed minimum withdrawal benefit (GMWB): Withdrawal benefit with annual ratchet, up to 5% of the withdrawal base can be withdrawn annually without reducing withdrawal base, annual rider charge of 0.90% of account value. The withdrawals are guaranteed to continue until the total withdrawals received equal the final withdrawal base amount, even if the account value gets to zero before that time.

(a) (2 points) Describe the reserve calculation methodologies used to produce the GAAP reserve for each benefit listed above.

(b) (8 points) For each of the following independent future events:

- (i) Decrease in the risk-free rate
- (ii) Constant 6% equity returns over the next 10 years
- (iii) A decrease in overall mortality improvement
- (iv) No equity growth combined with low prevailing interest rates

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

5. (11 points)

The features of a variable annuity (VA) product are as follows:

- Guaranteed minimum death benefit (GMDB) and guaranteed minimum income benefit (GMIB) combination product
- Two options are available:
 - GMDB and GMIB roll-up by 6% annually
 - Annual ratchet to the GMIB and GMDB
- GMIB annuitization begins after a 3-year waiting period
- 100% allocation to the Stock Fund
- The only expense is a mortality & expense ratio (MER) of 2% of fund value per annum

- (a) (2 points) List four possible modifications to the guarantees that could minimize the impact on statutory reserves and capital requirements.
- (b) (2 points) Describe the conditions in which the statutory reserves for the ratchet design would be higher than the statutory reserves for the roll-up design. Justify your answer.
- (c) (4 points) You currently have a C-3 Phase II model.
- (i) Describe the key changes that would be required to update the model to calculate the AG43 stochastic component.
- (ii) Describe the key changes that would be required to update the model to calculate the AG43 standard scenario reserve.
- (d) (3 points) You are given the following information for a single scenario under AG43:

Time	0	1	2	3
Working reserves	95,000	90,000	81,000	0
Projected assets	35,000	24,000	10,000	10,000
Discount rate		5%	3%	4%

- (i) Calculate the greatest present value of accumulated deficiencies (GPVAD) under this single scenario. Show your work.
- (ii) Calculate the AG43 reserves, assuming the CTE(70) is 2.5 million and the standard scenario reserve is 2.7 million. Show your work.

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- 6.** (10 points) You have been asked to review the margins for uncertainty built into a principle-based valuation model for a variable deferred annuity product. The product is relatively new with only a few years of experience. The margins were developed by a consultant.

Here are some details that were given to the consultant prior to developing the margins:

- The product has features that make it materially different from all other products in the market.
- The methodology used to determine the margins should be transparent and easy to communicate to managers, and it should not be heavily reliant on historical data which is scarce for the product.
- The product's first lapse study was recently completed and includes all experience since the inception of the product.
- The product's first mortality study will not be completed until next year. Until then, best estimate mortality rates should be based upon the experience of similar products in the market.
- The product contains equity guarantees which can be out-of-the-money for long periods of time. During these periods, the product will be very profitable.

Taking the above information into consideration, the consultant built the following margins into the model:

- Valuation mortality rates are 95% of best estimate mortality rates.
- Best estimate lapse rates are based upon the experience study and equal 10% per year. Lapse margins are set to 60% of the standard deviation of industry lapse rates, resulting in a valuation lapse rate (including margin) of 5% per year.
- A shock lapse rate of 50% is reflected in the year the surrender charges go to zero.
- Equity risk and interest rate risk are modeled stochastically.
- Interest rates are reduced by an extra 1% due to higher volatility in the equity markets.

6. Continued

- (a) (2 points)
- (i) List the advantages and disadvantages of the top-down and bottom-up approaches to setting margins.
 - (ii) Identify the approach being used for setting the mortality margin and lapse margin.
- (b) (8 points) Critique the level of margin and the appropriateness of the method used to determine the margin for each of the following:
- (i) Mortality margin
 - (ii) Lapse margin
 - (iii) Interest margin

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

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