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

Exam ILALFVU

MORNING SESSION

Date: Thursday, November 2, 2017
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 4 questions numbered 7 through 10.

   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.

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Exam ILALFVU Front Cover

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

1. (*9 points*) You are given the following for a 2-year non-renewable term life policy accounted for under IFRS 4 Phase II rules:

Scenario	Probability	PV(CF)
Policyholder dies during policy year 1	0.2%	25,000
Policyholder dies during policy year 2	0.3%	20,000
Policyholder lapses during policy year 1	6.5%	-20
Policyholder lapses during policy year 2 or survives to end of year and does not convert	53%	-50
Policyholder converts at end of policy year 2	40%	-243

Assume:

- PV(CF) = present value at issue of cash outflows minus cash inflows
- The policy can only be converted at the end of policy year 2
- Risk adjustment at issue: 11

(a) (*5 points*)

(i) (*3 points*) Calculate the Contractual Service Margin (CSM) at issue. Show all work.

(ii) (*2 points*) You are given the following at the end of policy year 1:

- Best estimate liability: -7.92
- Risk adjustment: 5.48

Calculate the CSM at the end of policy year 1, assuming no changes in assumptions. Show all work.

1. Continued

(b) (*4 points*) You are given four possible events:

A. At the end of policy year 1, the probability of converting at the end of year 2 is increased.

B. At the end of policy year 1, the discount rate is increased.

C. The policyholder does not die during the first policy year.

D. The policyholder does not lapse during the first policy year.

Determine the direction of each event's impact, if any, on the following policy year 1 financial results:

(i) the underwriting result on the income statement

(ii) the investment result on the income statement

(iii) other comprehensive income

Justify your responses.

2. (*10 points*) On a closed block of business, ABC Life has an existing 60% quota share reinsurance treaty with reinsurer DEF. DEF retrocedes to reinsurer GHI on an excess of loss basis of 500,000 per risk.

The following applies to the reinsured closed block of business:

Company	Invested Assets at Beginning of Year t	Annual Operating Expenses
ABC	1,750,000	100,000
DEF	3,000,000	50,000
GHI	500,000	25,000

Cohort	Total Face Amount per Policy	Reserve per Policy at Beginning of Year t	Reserve per Policy at End of Year t	Annual Premium per Policy	Number of Lives at Beginning of Year t	Expected Claims in Year t
1	1,500,000	3,500	3,750	9,000	200	1,500,000
2	800,000	4,300	4,450	5,400	400	2,400,000

Assume:

- All lives in each cohort are identical
- Premium rates are the same for each company
- Premiums are paid at beginning of year
- Death benefits are incurred at end of year
- Operating expenses are incurred at end of year
- No premium taxes
- No reinsurance allowances
- Investment income = 3.5%

(a) (*3 points*) Explain the advantages and disadvantages of coinsurance to reinsure an inforce block of business.

(b) (*6 points*) Calculate the gain from operations for each company in year t. Show all work.

(c) (*1 point*) Recommend whether company ABC Life should recapture the business. Justify your answer.

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3. (*9 points*)

(a) (*5 points*) You are given the following information for WXY:

- Risk free rate of return is 6%
- Risk premium is 7%
- Cost of debt is 14% based on WXY's credit rating
- Tax rate is 35%
- WXY is financed with 50% debt and 50% common stock
- WXY allocates its equity over three profit centers

Five Year Financial Plan (in millions)			
Profit center	**Five-Year ROE**	**Beginning Equity**	**Ending Equity**
Traditional Insurance	17%	50	70
Non-Traditional Insurance	8%	230	450
Non-Insurance	12%	120	340

Assess the equity allocation in the five-year financial plan based on cost of capital. Show all work.

3. Continued

(b) (*4 points*) WXY is introducing a 1-year term insurance product with the following results (in thousands):

PV of Premiums and Fees	650
PV of Investment Income	25
PV of Expenses	120
PV of Benefits	525
Initial Required Capital	250
Tax Rate	35%

(i) Calculate the return on capital assuming the cost of capital is 10%. Show all work.

(ii) WXY's capital policy requires them to hold the economic capital at a level that will withstand a 1-in-200 year credit loss event over a 12-month horizon.

You are given the following information:

Percentile of annual credit loss	50	95	99	99.5	99.9
Amount of loss (in thousands)	80	500	600	625	8,000

Assume WXY internally allocates economic capital.

Recommend whether WXY should launch the term product given the economic capital requirement on a risk adjusted basis.

Show all work.

4. (*14 points*) RHM, a U.S. life insurance company, has a large block of inforce universal life secondary guarantee (ULSG) products.

(a) (*8 points*) You are given the following values for a ULSG policy with a shadow account design:

Values in Millions	End of Policy Year 3
XXX basic reserve	150
XXX deficiency reserve	100
Net level premium for secondary guarantee period	30
Net level premium for whole life	120
Shadow account value	60
Net single valuation premium	300
Single guarantee funding premium	120
Surrender charge	20

Calculate the final Actuarial Guideline 38 (AXXX) basic reserve and deficiency reserve at the end of policy year 3 assuming:

(i) the policy was issued in 2003.

(ii) the policy was issued in 2013.

Show all work.

4. Continued

(b) (*4 points*) RHM plans to cede all ULSG business issued in 2016 to an affiliate captive reinsurer, ORD Re, using a coinsurance arrangement.

You are given the following:

ORD Re	Value (millions)
Liabilities	
AXXX basic reserve	400
AXXX deficiency reserve	50
AG 48 stochastic reserve	250
AG 48 deterministic reserve	300
AG 48 net premium reserve	100
Assets	
Bonds (Securities Valuation Office (SVO) listed)	250
Commercial loans	100
Hedging derivatives	50
Letter of credit	100
Surplus	Value not known

Justify an opinion on whether ORD Re satisfies the requirements of Actuarial Guideline 48 (AG 48), and suggest remedies if ORD Re does not.

Show all work.

(c) (*2 points*) The appointed actuary of RHM has made the following comments regarding AG 48 compliance:

A. VM 20 and AG 48 allow for exclusions from calculating the stochastic reserve for universal life policies if certain conditions are met.

B. Analysis for AG 48 compliance must be conducted for each reinsurance treaty and not just in aggregate for the entire operating company.

C. We are allowed to apply a reduction percentage to reduce the net premium reserve calculated under prescribed mortality rates.

D. Unless we comply with the AG 48 framework by December 31 of the year the actuarial opinion is filed, we will lose some reserve credit.

Critique each statement.

5. (*8 points*) You are given the following initial best estimates for a variable annuity with a guaranteed minimum death benefit (GMDB) rider issued by company JKL:

Year	**1**	**2**	**3**
Gross assessments	1550	1420	1180
Maintenance expenses	30	25	22
Benefits in excess of policy account values	0	120	268

- Capitalized expenses at issue = 1600
- Discount Rate = 5%
- SOP 03-1 Benefit Ratio = 9%
- All non-issue related cash flows occur at end of policy years
- Assume the same benefits and assessments are used in the SOP 03-1 and Estimated Gross Profit (EGP) calculations

(a) (*6 points*) Calculate JKL's DAC balance for this product at the end of policy year 2. Show all work.

(b) (*2 points*) JKL's documentation for the product's best estimate mortality assumption states the following:

> *"As the company currently has no experience with variable annuity death benefits, the best estimate mortality assumption is set to be equal to the standard non-smoking mortality class used for the company's variable universal life product."*

Critique the mortality assumption with respect to ASOP 10.

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6. (*10 points*) You are given the following five events for SJG, a U.S. life insurance company:

Event A: During 2016, the statutory interest rate for a block of term policies issued in 2005 was changed from 3.5% to 4.0%. As a result, the statutory cap on tax reserves decreased, causing the tax reserves to decrease. Tax reserves before and after the change were as follows:

	Tax Reserves (millions)	
	Before Change (3.5% rate)	After Change (4.0% rate)
December 31, 2015	5.0	4.5
December 31, 2016	6.5	5.5

Event B: Tax reserves for a block of universal life policies issued in 2015 were not reported at December 31, 2015 due to a computer programming problem. The problem was fixed during 2016. Tax reserves were as follows:

	Tax Reserves (millions)
December 31, 2015	4.0
December 31, 2016	5.0

Event C: During 2016, the tax reserve factors for whole life policies issued before 2016 were updated to assume deaths occur continuously rather than at the end of the policy year. Tax reserves before and after the change were as follows:

	Tax Reserves (millions)	
	Before Change (EOY deaths)	After Change (Continuous deaths)
December 31, 2015	25.0	24.0
December 31, 2016	27.0	28.0

6. Continued

Event D: During 2016, it was discovered that tax reserves for single premium whole life policies issued in 2010 were being computed using the wrong interest rate. The problem was fixed during 2016. Tax reserves before and after the change were as follows:

	Tax Reserves (millions)	
	Before Change (Wrong Rate)	After Change (Correct Rate)
December 31, 2015	10.0	12.5
December 31, 2016	12.0	15.0

Event E: During 2016, deferred annuities were moved from a homegrown valuation system to a third party valuation system. The two systems are similar except for technical differences in the detailed calculations (rounding, timing of deaths and lapses, etc.) Tax reserves before and after the change were as follows:

	Tax Reserves (millions)	
	Before Change (Old System)	After Change (New System)
December 31, 2015	15.0	14.0
December 31, 2016	17.5	18.0

Calculate the impact on 2016 taxable income for each of the above events. Show all work.

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

USE THIS PAGE FOR YOUR SCRATCH WORK