SOCIETY OF ACTUARIES
Life Pricing

Exam ILALP

MORNING SESSION

Date: Wednesday, April 30, 2014
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 ILALP.

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

Tournez le cahier d'examen pour la version française.

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Exam ILALP-Front Cover

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

1. (*11 points*) EDC Company is developing a new Term product and wants to select an appropriate pricing mortality assumption.

(a) (*1 point*) List the criteria for a good credibility method.

(b) (*1 point*) Explain why the Greatest Accuracy Credibility Theory (GACT) is not commonly used in practice.

(c) (*6 points*) Under the Limited Fluctuation Credibility Theory (LFCT), the criterion for full credibility is $\Pr\{|X - m| \leq -r\lambda\} \geq p$, where r is the error margin and p is the confidence level.

(i) (*1 point*) Identify when the expected aggregate amount of claims (X_E) is a good estimate of future expected mortality.

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

Mortality Experience Data			
	Male	**Female**	**Total**
Industry Data			
A/E Mortality Ratios	74.0%	75.0%	74.5%
Company Data			
A/E Mortality Ratios	67.7%	61.9%	65.4%
Actual Number of Claims	158	93	251
Expected Number of Claims (assuming 100% industry mortality)	233	149	382

The number of deaths required for full credibility is 3,007.

Calculate the expected number of claims for females using the normalized method and an appropriate level of credibility.

(iii) (*1 point*) Describe a shortcoming of the LFCT method.

1. Continued

(d) (*3 points*) The table below summarizes the mortality experience of the preferred versus non-preferred mortality cohorts.

Ratio of Preferred to Non-Preferred Mortality				
	Males		Females	
Years After Underwriting	Issue Ages 31 - 50	Issue Ages 51 - 70	Issue Ages 31 - 50	Issue Ages 51 - 70
1 - 5	52%	68%	43%	57%
6 - 10	50%	79%	47%	65%
11 - 15	55%	95%	42%	77%
16 - 20	57%	101%	48%	91%

(i) (*2 points*) Interpret the mortality trends observed from this table.

(ii) (*1 point*) Recommend modifications to the aggregate mortality assumption based on this information.

2. (*8 points*) You are re-pricing a Term 20 life insurance product.

Product Features	Term 20
Premiums	Level for 20 years
Risk Classes	Gender: Male and Female Lifestyle: Preferred Non-Smoker, Standard Non-Smoker, and Smoker
Renewability	Policy is renewable every 20 years until the policy anniversary following the insured's 50^{th} birthday
Guaranteed Renewal Premium	For each 20-year renewal period
Guaranteed Death Benefit (DB)	No change in the DB for the term of the policy
Additional Benefits – Waiver of Premium	Total premiums are waived if totally disabled prior to age 60

(a) (*3 points*)

(i) Describe the factors affecting the lapse rates for the above term product.

(ii) A recent lapse study carried out on the whole in-force block of policies produced the following results:

Policy Year	Lapse rate (%)
1	20
2	10
3	5
4	4
5+	3

Recommend the expected lapse assumption to be used for the re-pricing of this term product.

2. Continued

(b) (*5 points*) For the mortality assumption, the following statistics were obtained from the experience study:

	Value
Number of term policies issued in policy year 1	1000
Number of deaths in policy year 1	5
Best estimate mortality rate for policy years 1-20 for the term policy	0.005
Best estimate mortality rate for all policy years for a permanent policy underwritten at issue	0.007
Best estimate mortality rate for all policy years for a permanent policy converted from the term policy	0.009
Annuity factor (based on mortality, lapse, interest and expenses of the permanent products)	10

(i) (*1 point*) Evaluate, and recommend ways to improve if applicable, the credibility of best estimate mortality rate of 0.005/year for the term policy based on a 95% confidence level.

(ii) (*2 points*) You are given:

- Normal lapse rate: 3% for all years
- Total lapse rate: 9% for all years
- Newly underwritten mortality rate for a permanent policy: 0.007 for all years
- Normal permanent mortality rate: 0.009 for all years
- 3 out of 4 policies lapsed are from healthy policyholders

Recommend changes, if any, to the best estimate mortality rate of 0.007 per year for a permanent policy.

(iii) (*2 points*) Calculate the charge to be included in the pricing of the term product to account for the conversion feature, assuming converted policies are not included in the mortality experience studies, and the Net Amount at Risk is equal to the Face Amount in all years.

3. (*13 points*) ECC Life is introducing a new Variable Annuity (VA) product to complement its existing portfolio. This new product will be advertised as "Vampire" and will require no underwriting.

Vampire's product features will be as follows:

- Single Premium
- Guarantee minimum death benefit (GMDB)
- Guarantee minimum withdrawal benefit (GMWB)
- Policyholder can choose between 200 different foreign and domestic investment funds
- During the accumulation phase, if the account value exceeds the guarantee value by 5%, the policyholders are allowed to reset their guarantee value (top up to the account value). This feature can be utilized once a year at any time.

(a) (*3 points*) Describe risks of the new VA product. Recommend strategies to manage those risks.

(b) (*7 points*)

(i) (*3 points*) Describe modeling techniques for all policyholder behavior assumptions relevant to Vampire.

(ii) (*1 point*) Explain limitations surrounding the modeling techniques.

(iii) (*3 points*) Profitability metrics have been produced using the modeling techniques from above and the following assumptions:

- A 10% annual return for the investment funds
- Mortality, expense and inflation pricing assumptions from ECC's 10-year term product with level premium:

i. Mortality tables
ii. Renewal expense
iii. Inflation rate

Critique these assumptions and recommend appropriate changes.

Justify your answer.

3. Continued

(c) (*3 points*) With respect to projecting underlying stock returns:

(i) (*1 point*) Evaluate the use of both lognormal and Wilkie models.

(ii) (*1 point*) Recommend a more appropriate model. Justify your recommendation.

(iii) (*1 point*) Describe other steps for implementing a stochastic modeling process.

4. (*10 points*) GJ Life is evaluating stochastic economic scenario generators and their applications to Equity Indexed Annuities (EIAs).

(a) (*2 points*) GJ is pricing an EIA with the following product features:

Index Period	3 Years
Index	S&P 500
Index Growth Method	Point to Point
Floor Return	0%
Guaranteed Minimum Account Value at the end of year *t*	90% of Single Premium x $(1.03)^t$
Ratchet	Annual
Participation Rate	90%
Margin	1%
Cap	8%

You are given the following stochastic scenario:

Time (in Years)	S&P 500 Level
0	1000
1	1075
2	1250
3	1200

Calculate the percentage growth in the Index Account Value at the end of three years.

4. Continued

(b) (*1 point*) Describe the criteria that must be met to use a book value valuation method on a block of EIA business in the U.S.

(c) (*2 points*) Describe the practical considerations an actuary should consider when using stochastic deflators.

(d) (*1 point*) For a certain scenario, you are given:

- A cash flow of 1,000,000 is expected to occur 10 years from today.
- Risk-neutral scenario probability: 25%
- Real-world scenario probability: 30%
- Risk-free interest rate: 3%
- 10-year risk-adjusted interest rate: 5%

Calculate the stochastic deflator for the given scenario.

(e) (*4 points*) Describe the key differences between risk-neutral and real-world scenarios, and recommend which should be used by GJ. Justify your recommendation.

5. (*7 points*)

(a) (*5 points*) Compare and contrast Guideline G6 Policy Illustrations in Canada and the NAIC Life Insurance Illustrations Model Regulation with respect to the content and structure of illustrations.

(b) (*2 points*) You are given the following information with respect to a potential policyholder:

Risk Class: Male Non-smoker
Age: 57
Issue Date: May 1, 2013
Death Benefit Specified Amount: 100,000
Planned Annual Premium: 1,000

The following policy illustration has been produced:

ABC Life Insurance Company
Insured Name: John Smith
FlexSelect, Form 101, a life insurance policy

Numeric Summary:

Policy Year	Age	Premium	Account Value	Death Benefit	Cash Surrender Value
0	57	1000	1,000	101,000	900
1	58	1000	1,520	101,520	1,368
2	59	1000	2,050	102,050	1,845
3	60	1000	2,591	102,591	2,332
4	61	1000	3,143	103,143	2,829
5	62	1000	3,706	103,706	3,335
6	63	1000	4,280	104,280	3,852
7	64	1000	4,866	104,866	4,379
8	65	1000	5,463	105,463	4,917
9	66	1000	6,072	106,072	5,465
10	67	1000	6,694	106,694	6,024

Criticize the illustration based on the general rules and format from the NAIC Life Insurance Illustrations Model Regulation.

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6. (*11 points*) SEM Insurance started selling mortgage insurance in the U.S. 10 years ago at the height of the subprime mortgage growth. SEM experienced high sales and profits with this product in the first few years. You are given the following information about SEM's mortgage insurance program:

Benefits	Pay the outstanding balance of the mortgage upon the death of the insured. For joint mortgages, benefits paid on first death.
Coverage Period	Not fixed. Projected to the end of the mortgage amortization period.
Distribution Channels	Mortgage brokers
Underwriting	Simplified. No medical tests.
Risk Classes	Male smoker, male non-smoker, female smoker, female non-smoker
Premium	Guaranteed level
Commission	50% of premiums in the first year, and 0% thereafter

(a) (*3 points*) SEM attributes the success of this product to the use of an effective distribution channel, simplified underwriting and special product design on premium and commission. Critique the validity of this statement.

(b) (*2 points*) List the drawbacks of using guaranteed level premiums and heaped first year commissions for this mortgage insurance product.

(c) (*3 points*) Since the subprime mortgage crisis in 2007, new sales have decreased substantially, lapse rates have increased and death claims have been much higher than expected. SEM is redesigning this product and is evaluating three proposed premium structures:

Premium Structure	Description
1. Limited Level Premiums	Policy is paid up at the end of payment period
2. Decreasing Premiums	Guaranteed issue age rates are applied to the current death benefit
3. Annually Increasing Premium Rates	Guaranteed attained age rates are applied to the current death benefit

Describe the advantages and disadvantages of each of the above proposed premium structures.

6. Continued

(d) (*3 points*) SEM is considering the use of the following distribution channels to increase sales of this product:

- Career agents
- Independent agents
- Direct response

(i) Compare the benefits and costs of each of these distribution channels.

(ii) Evaluate whether each distribution channel is appropriate for this product.

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

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