

# Exam ILALP

## MORNING SESSION

Date: Wednesday, October 31, 2018

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

*Recognized by the Canadian Institute of Actuaries.*

Tournez le cahier d'examen pour la version française.



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

1. (7 points) SWX Life, a Canadian company, considers introducing a standalone Critical Illness (CI) product for its financial advisor distribution system. You are given:
- The product covers the following three conditions as defined below:
    - **Cancer** means a tumor characterized by the uncontrolled growth and spread of malignant cells and the invasion of tissue.
    - **Heart attack** means the death of a portion of the heart muscle as a result of inadequate blood supply to the relevant area as evidenced by new electrocardiogram (ECG) changes indicative of myocardial infarction.
    - **Stroke** means a cerebrovascular event caused by hemorrhage, thrombosis or embolism, resulting in a measurable neurological deficit that persists for 45 consecutive days.
  - The definitions of eligible conditions are guaranteed.
  - The exclusion period on cancer is 30 days and may be increased due to future medical advancements.
  - Level premiums are guaranteed to attained age 75 and non-guaranteed thereafter.
  - Full face amount is paid as a lump sum for each condition and is level to attained age 100.
  - A doctor's report stating the diagnosis is required as proof of incidence.
  - A survival period of 30 days after diagnosis except in the case of accidental death is required.
  - There is an 18 month contestability period.
  - Return of premium on survival option is available at policy duration 20.
- (a) (5 points) Critique the product design of the above product.
- (b) (2 points)
- (i) State the feasibility of using a UK experience study to establish incidence rate assumptions for this new CI product.
  - (ii) List all steps necessary to set the incidence rate assumptions.

2. (10 points) TXT Life primarily sells term and whole life insurance products in Canada. In January 2019, TXT is planning to introduce a level cost of insurance universal life (LCOI UL) product with a 7-year surrender charge schedule sold through home service agents. The new product will target middle income buyers with a minimum specified amount of 250,000.

- (a) (2 points) Evaluate the appropriateness of the proposed distribution method.
- (b) (3 points) You are given the proposed lapse rate assumption for the LCOI UL product:

<b>LCOI UL Lapse Rates (Nonsmoker/Smoker Composite)</b>		
<b>Duration</b>	<b>Male</b>	<b>Female</b>
1-5	9.0%	15.0%
6-10	4.0%	4.0%
11-15	2.5%	2.5%
16+	2.0%	2.0%
100% of lapses in December		

Recommend changes to the proposed lapse rate assumption and justify your recommendations.

## 2. Continued

- (c) (5 points) TXT Life would like to enhance their sales process for this product by adding an ‘optimizer’ to their 2019 new business illustration software. The optimizer would solve for the maximum premium level for a given face amount that would ensure the life insurance status of a policy is maintained. The proposed design is as follows:
- On the policy issue date and every policy anniversary thereafter, the software ensures the policy’s accumulating fund does not exceed the accumulating fund of a 20-pay policy ending at age 85.
  - At each policy anniversary, the policy’s accumulating fund is calculated as the policy account value less the surrender charge.
  - Face amount increases of up to 10% each year are automatically built into each scenario to preserve the exempt status of the policy.
  - Late dump-in premiums are permitted if the resulting accumulating fund remains below the maximum tax actuarial reserve (MTAR) of the exempt test policy
- (i) (4 points) Critique the proposal from an exempt test policy rules perspective.
- (ii) (1 point) Assess the feasibility of adding single pay and 20-pay level COI options for this product.

**3.** (8 points)

(a) (2 points) You are working on pricing the following variable annuity riders:

- Guaranteed Lifetime Withdrawal Benefit (GLWB)
- Guaranteed Minimum Accumulation Benefit (GMAB)
- Guaranteed Minimum Maturity Benefit (GMMB)

Describe the risks of each rider.

You are developing a new 2-year Guaranteed Minimum Accumulation Benefit (GMAB) feature using stochastic modeling.

(b) (1 point) Compare and contrast the following risk measures:

- (i) Conditional tail expectation (CTE)
- (ii) Value at Risk (VaR)

### 3. Continued

(c) (3 points) You are given:

- Initial single premium is 1,000.
- Risk free rate is 6% compounded continuously.
- GMAB payoff is 2% per annum from initial premium, in excess of the fund value.
- GMAB liability is floored at zero.
- Assume no other cashflows or decrements.
- 100 scenarios are used in the simulations and the worst 10 results are shown below:

Fund value at the end of year 2
400
600
790
950
1000
1210
1267
1285
1300
1301

- (i) Calculate the GMAB liability using CTE(95).
- (ii) Calculate the GMAB liability using VaR(92).

Show all work.

- (d) (2 points) Describe considerations in modeling a voluntary reset feature on a 2-year GMAB rider.

**4.** (11 points)

- (a) (2 points) Describe how implementing a predictive underwriting model would affect the following assumptions:
- (i) Mortality
  - (ii) Lapse
- (b) (4 points) You are introducing predictive analytics in developing experience studies. Critique the following statements:
- (i) *You should include the same key drivers from the previous studies that were used in the traditional approach to speed up the adoption of the new predictive modeling method.*
  - (ii) *You should remove all questionable values in your data set because data quality is crucial in predictive modeling.*
  - (iii) *You should partition the data set into the three categories: “train”, “test” and “validation”, so that multiple individuals can work on the data simultaneously.*
  - (iv) *You should use the more refined assumptions developed using the predictive analytic approach in pricing and valuation.*
- (c) (3 points) Compare a traditional fully underwritten approach to an automated underwriting system for the following:
- (i) Process
  - (ii) Benefits
  - (iii) Risks

#### 4. Continued

(d) (2 points) PKL Life is reviewing underwriting processes for a permanent life insurance portfolio. You are given:

- PKL Life receives 75,000 permanent life insurance applications each year and all go through full underwriting.
- PKL Life underwriting costs:

Underwriting Test	Cost
Blood test	35
Urine specimen	20
Oral fluids	25
Medical Exam	120
Medical Information Bureau (“MIB”)	10
Motor Vehicle Report (“MVR”)	10
Pharmaceutical Database (“Rx”)	10
Attending Physician Statement (“APS”)	100
Third-Party Data	1.25

Calculate the anticipated annual cost savings of switching from full underwriting to the following:

- Simplified underwriting
- Automated underwriting using predictive analytics

Show all work.

**5.** (12 points) XYZ Life is pricing a new fixed deferred annuity for sale in the U.S.

You are given:

- Single premium: 20,000
- Commission: 4% of premiums
- Annual charge: 150 (paid at beginning of each policy year)
- Guaranteed interest credited rate: 3.50% in first policy year, 3.00% thereafter
- 5 year Constant Maturity Treasury rate: 4.12%
- Projected profits: 0.60% return on assets

- (a) (4 points) Calculate the maximum surrender charge (as a percentage of the fund value) in the third policy year in accordance with Standard Nonforfeiture Law. Show all work.
- (b) (4 points) You have been asked to consider how the concepts discussed in the “Equities – Different points of view, a relative affair” section of the Unruh Report might be applied to the annuity market.
- (i) Identify three stakeholders and, for each, a provision in the NAIC Standard Nonforfeiture Law for Annuities that the stakeholder would view as equitable. Justify your answer.
- (ii) Identify three provisions in the NAIC Standard Nonforfeiture Law for Annuities that would be viewed as inequitable from a terminating policyholder’s perspective.
- (c) (4 points) XYZ has discovered that three competitors offer a deferred annuity with the same commission and have no annual charges. Their current interest credited rates are 3.75%, 3.50%, and 3.25%, respectively.
- (i) Propose changes to XYZ’s annuity that would be consistent with each of the five competitor-oriented pricing strategies.
- (ii) Rank the pricing strategies in the order of best fit for XYZ. Justify your answer.

6. (12 points) You have received the following memo with comments and recommendations for pricing and profitability measurement of a new annuity product under development at your company.

*To: Pricing Department*

*From: Peer Review Actuary*

*I have reviewed the recent pricing results for the new accumulation annuity product the company is developing and have the following recommendations for how we can improve the profitability:*

- A. Since the ROE is below the target, we should invest in higher yielding commercial mortgages instead of government bond assets. As we are just changing the asset allocation from one category to another this will not affect our total assets, and the only effect on the ROE calculation will come from the increased earnings generated by the commercial mortgages.*
- B. There must be an error in the pre-tax and after-tax ROI calculations as the numbers are almost identical. With projected tax reserves equal to solvency reserves, I would have expected the after-tax return to have been lower than the pre-tax rate in the same proportion as the tax rate.*
- C. Since our credited rate strategy is to keep a constant spread between earned interest rates and credited interest rates, I think we can stop performing the stochastic modeling that we are doing for the fixed annuity portion of this product. Assuming we maintain that spread, our net profit does not have much risk from interest rates.*
- D. I noticed that the earnings were negative for each of the first 3 years before turning positive in all later years. As there are multiple years of negative values, we cannot rely on the ROI calculation because it will result in multiple logical values.*
- E. The annuitization option which allows the client to get a variable income annuity uses an assumed interest rate (AIR) of 3%. Although it will hurt the profitability, I think if we increase the AIR to 5% our clients will be happier as they will get a higher initial benefit and higher growth rate.*
- F. Finally, it is too aggressive to use the rates earned on assets as the discount rate in the calculation of present value of distributable earnings. Given the riskiness of the product, we should use a higher discount rate, preferably the ROI.*

Critique each statement in the memo. Justify your answer.

**\*\*END OF EXAMINATION\*\***

**Morning Session**

**USE THIS PAGE FOR YOUR SCRATCH WORK**