

INSTITUTE OF ACTUARIES OF INDIA
EXAMINATIONS

31st May 2012

Subject ST8 - General Insurance: Pricing

Time allowed: Three hours (14.45* – 18.00 Hrs)

Total Marks: 100

INSTRUCTIONS TO THE CANDIDATES

1. *Please read the instructions on the front page of answer booklet and instructions to examinees sent along with hall ticket carefully and follow without exception*
2. ** You have 15 minutes at the start of the examination in which to read the questions. You are strongly encouraged to use this time for reading only, but notes may be made. You then have three hours to complete the paper.*
3. *You must not start writing your answers in the answer sheet until instructed to do so by the supervisor*
4. *The answers are not expected to be any country or jurisdiction specific. However, if Examples/illustrations are required for any answer, the country or jurisdiction from which they are drawn should be mentioned.*
5. *Attempt all questions, beginning your answer to each question on a separate sheet.*
6. *Mark allocations are shown in brackets.*
7. *Please check if you have received complete Question Paper and no page is missing. If so, kindly get new set of Question Paper from the Invigilator.*

AT THE END OF THE EXAMINATION

Please return your answer book and this question paper to the supervisor separately.

- Q. 1)** An insurance company is planning to sell rainfall index-based insurance for agriculture. The policies will compensate farmers for likely losses to crops due to natural volatilities in amount of rain from expected amounts. Each insurance contract will be defined in terms of a particular location and a given period of time in months. Policies will also be customised for given combinations of trigger and exit levels of rainfall and for the amount of compensation per mm per day of rainfall, on the basis of likely loss due to the shortfall in rain. The trigger level will be the level of daily rainfall below which compensation will payable to a farmer for each mm of shortfall in rainfall up to the exit level. The exit level is the level at which the farmer would receive the maximum payout as it is assumed his crop would have failed or would have been permanently damaged. The total payout during the period of cover is fixed while issuing the policy.
- a) List possible exclusions that can be stated in the policy wordings for such insurance cover. (2)
 - b) Outline risk factors for this cover. (3)
 - c) Outline possible rating factors for this cover. (3)
- [8]
- Q. 2)** List the different approaches to rating of general insurance products. In respect of each approach to rating, state the circumstances when they will be used. (6)
- [6]
- Q. 3)** You work as an actuary in a recently set-up non-life insurance company. The company writes almost all lines of business, with a majority of business coming from motor and health lines. You have been asked to carry out a regular loss-ratio monitoring exercise so the emerging experience can be used as useful inputs to the underwriters to write the business profitably. The company is yet to fully set up information systems to capture information relating to policies and claims. You have been asked to prepare a report highlighting the current situation and the need for adequate data capturing on systems so that the loss-ratio exercise becomes more meaningful.
- a) Outline the issues likely to be faced by the company when there is inadequate data capturing on information systems. (4)
 - b) Outline the benefits of capturing information on systems at policy issuance and claims stages. (6)
- [10]
- Q. 4)** While pricing, outline the items in which controls can be imposed by regulator or statutory bodies. (6)
- [6]

- Q. 5)** A company writes only motor insurance. In the country in which the company writes business, the current scenario is very competitive.
- a)** Discuss the issues the company currently faces while pricing. (3)
 - b)** Discuss the issues the company is likely to face when the industry moves to more profitable rates due to exit of loss-making companies. (2)
- [5]
- Q. 6)** An insurer is considering the reinsurers to consider for a new product it plans to sell.
- a)** Outline the factors the insurer should consider before finalising a reinsurer. (3)
 - b)** State the stages of a product life where a reinsurer is likely to be involved. (2)
- [5]
- Q. 7)** Discuss factors to consider while determining the extent of loading for catastrophic risk while pricing an insurance contract. (6)
- [6]
- Q. 8)** The yield curve for risk-free bonds is upward sloping so that the yields on long term bonds is greater than that for short term bonds. With respect to a portfolio of personal accident policies, to what extent can an insurer take advantage of this feature in yield curve while pricing
- if the insurer is small to medium sized, has a slowing growth pattern and just satisfies the statutory solvency requirement
 - if the insurer is large sized with a high solvency ratio
- [4]
- Q. 9)** An actuary is developing an insurance product that indemnifies homeowners for damages caused due to water seepage only. The rating factors considered are geographical location, age of the building and sum insured. The actuary makes the observation that the one-way relativity for a given location X was significantly higher than the GLM-indicated relativity.
- a)** What does a one-way relativity of a factor signify? (1)
 - b)** Which of the following scenarios results in this observation, on the assumption that the model is correct? Also explain why the scenario is correct and why the others are not.

- i) Location X is scantily populated with very few homes/buildings thus reducing total exposure to risk and this was taken into account by GLM
 - ii) Location X has many high rise buildings making them more vulnerable to seepage related damages.
 - iii) Location X is an urban location with predominantly older buildings compared to other locations making them more susceptible to damages under the cover (3)
- [4]**

- Q. 10) a)** What is a translated gamma distribution and why is it considered appropriate aggregate claim distribution model? (2)
- b)** State how would you express a translated gamma variable X with parameters α , β and λ that is equivalent in terms of (2)
- i. Gamma Variable
 - ii. Chi-square variable
 - iii. State the definitions of each of the parameters α , β and λ above.
- c)** You are a general insurance actuary reviewing the company's motor portfolio. You aim to estimate the probability that the incurred ratio in future time period does not exceed 80%. If the probability exceeds 5%, a price review is necessitated. Experience for the past one year was analyzed and it was observed from the total exposure of 2000 policies that every 10 policies gave rise to a claim. The incurred claim amounts after adjusting for inflation were modeled and a lognormal distribution with $\mu = 10$ and $\sigma = 1$ was arrived at as an appropriate fit. The aggregate claims distribution model given as $S = \sum_{i=1}^{i=N} X_i$ for the data was characterized by mode > median > mean. You are required to fit an appropriate distribution model to the aggregate claims with the above given information and justify if price review would be necessitated, given that the projected earned premiums for the future period under current levels of premium is INR 11 Million. Clearly state any assumptions made. (12)
- [16]**

- Q. 11) i)** Explain the following terms: (6)
- a) Excess of Loss reinsurance
 - b) Stop Loss
 - c) Probable Maximum Loss

- ii) A general insurance company is planning to review its reinsurance arrangements in its property line based on previous year's experience. The company had the following reinsurance arrangements in place at the beginning of previous year:

- Surplus lines treaty up to 10 lines with threshold of INR 20 MN
- Portfolio aggregate XL programme INR 30 MN XS INR 20 MN
- Cat XL of INR 100 MN XS INR 50 MN
- Stop Loss to share 85% of losses following between LR of 105% and 125% of appropriate measure of premiums

The following losses occurred during the year (*All amounts in INR*):

PML	Quantum of Loss	Remarks
40,000,000	19,000,000	
40,000,000	38,500,000	Catastrophe
60,000,000	57,500,000	Catastrophe
120,000,000	23,000,000	
20,000,000	8,000,000	
80,000,000	46,500,000	
100,000,000	1,500,000	
220,000,000	4,500,000	
30,000,000	26,500,000	Catastrophe
50,000,000	41,000,000	Catastrophe

The company's premiums in the property line over the last year were as given below:

GWP	281.20 MN
GEP	239.02 MN
NEP	119.51 MN
NWP	125.80 MN

As a first step of review you have been advised to calculate gross and net incurred claim ratios and the amount of claims retained by the cedant and the amount ceded under each of the arrangements, stating any assumptions you make.

(10)

[16]

- Q. 12)** a) Define credibility. Given the standard for full credibility for frequency how would you estimate the standard for full credibility for severity. (2)
- b) What is square root rule for partial credibility? By general reasoning or otherwise and clearly stating any assumptions you make, derive the square root rule for partial credibility. (6)

- c) An actuary establishes a full credibility standard such that the observed value is within $\pm 7.5\%$ of the true value 85% of the time with an a priori expectation that claim occurrence follows a Binomial distribution with probability of occurrence as 25%, all exposures being homogeneous, and no variation existing in the claim costs. The actuary has estimated pure premium as Rs. 5315/- having analyzed portfolio experience comprising 173 claims. The credibility complement pure premium is Rs. 6281/- based on alternate data.

Using the premises of classical credibility theory and stating any assumptions need to be made arrive at the credibility weighted pure premium.

(6)

[14]
