

INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

11th November 2014

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 you are required 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)** A model is tested on the validation sample data set of 10 data points. Predicted score and observed value for those 10 data points is provided in the following table:

Data Point No.	1	2	3	4	5	6	7	8	9	10
Predicted Score	0.9	0.8	0.7	0.6	0.5	0.5	0.4	0.3	0.2	0.1
Observed Value	1	1	0	1	0	1	0	0	1	0

Draw a rough sketch of the Gains Curves to show the cumulative values from the model and the cumulative observed values from the data.

[4]

- Q. 2)** In a pricing exercise for a general insurance product, a multivariate model has been built and theoretically concluded as sufficiently accurate and relevant. The market for this insurance product is fairly competitive. Describe briefly the steps involved in ascertaining the impact these rates would have in the market.

[5]

- Q. 3)** You are a pricing actuary for a small company which has noticed total losses of Rs 360 Cr in 2012 and Rs 250 Cr in 2013. The numbers of policies sold were 5 in 2012 and 22 in 2013.

You believe that the distribution of your average losses in year k is

$$X_k | \theta \sim \text{Gamma}\left(V_k, \frac{V_k}{\theta}\right), \text{ where } \theta \sim U(4, 40)$$

Calculate the Bühlmann-Straub risk premium for the total losses in year 2014, assuming that the company sells 11 policies in year 2014.

[5]

- Q. 4)**
- i) In the context of the output of a catastrophe model, what does ‘Aggregate Exceedance Probabilities’ mean? (1)
 - ii) The catastrophe model output provided contains the loss thresholds at exceedance probability of 1% for two unrelated perils, Peril A and Peril B, separately denoted by $LTEP1\%_A$ and $LTEP1\%_B$. Explain, with an example, as to why $LTEP1\%_{(A \text{ and } B)}$ may not be equal to $(LTEP1\%_A + LTEP1\%_B)$ where $EP1\%_{(A \text{ and } B)}$ is the loss threshold at exceedance probability of 1% for the ‘combined effect of the perils A and B’. (3)
 - iii) If only the set of amounts simulated 10,000 times for each of these two perils are available, how would you arrive at $LTEP1\%_{(A \text{ and } B)}$? (2)
 - iv) Would the loss threshold for the two perils combined be any different if the two perils have a positive correlation? (1)

[7]

- Q. 5)**
- i) Describe the run-off reinsurance solution and also specify the circumstances in which it may be sought. (3)
 - ii) Define the term “reinstatement” in the context of risk excess of loss reinsurance and briefly explain the reinsurance premium payment mechanism in case of a reinstatement. (4)

[7]

Q. 6) The motor insurance market in an emerging economy has witnessed a sharp rise in the popularity of web aggregators where customers can compare premiums charged by various insurers in the market. Discuss the benefits it could bring to various stakeholders in the market and also the challenges it could pose. [8]

Q. 7) In the hypothetical situation of an annual dice rolling event, a dice is rolled 3 times by each participant. If '6' turns up all the three times, the participant gets a cash prize of Rs 1,00,000. Around 10,000 participants are expected to turn up for the event. You are required to establish the price to be charged per participant.

The organizer has a surplus of 5,00,000 to cover for any losses and expenses in excess of the amounts charged. The expense per participant is fixed at 50.

i) Determine the price to be charged per participant so that the surplus is sufficient to pay for the cash prizes and the expenses with 99% probability. (5)

ii) Briefly explain the terms model uncertainty, parameter uncertainty and process uncertainty. Briefly explain the above uncertainties with respect to the proposed solution to the above problem. (4) [9]

Q. 8) i) You are a pricing actuary working for a reinsurance company. The company reinsures a particular type of property risk on a quota share basis. Following data is available for last six underwriting years 2008 to 2013 on the business that is subject to the quota share. All numbers are in INR Crores.

Underwriting Year	Estimated Ultimate Losses	Expenses	Premium Earned	Change in Premium Rate
2008	259	13	240	
2009	145	7.3	160	2%
2010	255	5.1	260	-10%
2011	260	10.4	300	8%
2012	230	11.5	300	5%
2013	284	11.4	280	-4%

Calculate the loss ratio that can be expected for the year 2014 for this class based on all of the historical experience and the rate change and inflation assumptions given above, stating any assumptions you make. Assume that the claims inflation has been running at 5% per annum over last six years. The premium rates in year 2014 are expected to increase by 6%. (6)

ii) Briefly explain various factors to be considered in arriving at premium trends that could be used to bring historical premiums to current rate levels. (5) [11]

Q. 9) i) List the two basic assumptions required for Increased Limit Factors (ILFs). (2)

ii) Increased limits factors are generally developed on a per-claim or per-occurrence basis. Discuss the reason why it is generally not developed on annual aggregate limit basis (3)

iii) Spot the inconsistency in the table and offer explanation:

LIMIT	100	250	500	1000	2000
ILF	1.00	1.50	1.63	1.90	2.00

(3)

iv) In a hypothetical scenario, for a certain type of liability claims, the award amounts as awarded by the courts are capped at 200 per claim. With 100 as the base amount, calculate “per-claim” ILF for limits of 150 and 200, with the following information:

- Probability of loss amount of 200 is 10%, and
- Between 0 and 200, losses are uniformly distributed

(4)

[12]

Q. 10) You are the general insurance actuary working for a medium sized general insurance company mainly writing fire business. The company is evaluating the proposal of taking over a competitor with similar business.

i) Outline the major actuarial investigations you would undertake on the company to be acquired to evaluate the proposal.

(9)

The company currently doesn't write motor business and it is evaluating an alternative proposal of entering into motor business.

You have been also asked to specify future data requirements for this new class of business so that a suitable management information system can be considered.

ii) List the data items for which you would ask in order to help you to develop sophisticated pricing for this business in the future.

(6)

[15]

Q. 11) The third party insurance cover is mandatory in a small developing country and the comprehensive cover is encouraged by the Government. The penetration of two wheeler motor insurance is however limited only to third party cover and only in the year in which the vehicle is sold. More than 95% policyholders do not renew the policy in second year as they consider that paying fine, if caught, is easier than paying insurance premium.

The insurance regulator together with all the insurance companies has tried various ways like increasing renewal commission, renewal collection calls and extra marketing spent to increase the penetration of comprehensive cover as well as increase in renewal collection. The above efforts have resulted in improving penetration of comprehensive cover, however due the fact that the case size is still very small, insurance companies are not able to improve the renewal premium collection and it is still around 5%-10% only.

You are the Appointed Actuary working for the largest general insurance company in that country. The insurance regulator has approached you and is seeking a solution to achieve the regulators objective.

The suggested solution is to provide long term cover in order to ensure that two wheelers are insured for a longer period than the year of purchase.

- i)** List down the various other modifications that one needs to consider in relation to the above mentioned solution to make it more effective. (2)
- ii)** Also state briefly how this solution is expected to be different from the current two wheeler cover and its benefits to the insurers, distributors and policyholders. (7)
- iii)** State how the differences outlined above can be dealt with in pricing, no claim benefit and reserving. (6)
- iv)** What are the changes you propose in the policy which would help in controlling the claims in the policy. (2)

[17]
