

INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

23rd May 2011

Subject ST8 - General Insurance: Pricing

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

Total Marks: 100

INSTRUCTIONS TO THE CANDIDATES

- (i) *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*
- (ii) ** 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.*
- (iii) *You must not start writing your answers in the answer sheet until instructed to do so by the supervisor*
- (iv) *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.*
- (v) *Attempt all questions, beginning your answer to each question on a separate sheet.*
- (vi) *Mark allocations are shown in brackets.*

AT THE END OF THE EXAMINATION

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

Q. 1) Define Original Loss curves and Increased Limit Factors and demonstrate, with simple examples, how they are used for pricing.

[4]

Q. 2) An actuary wants to use GLM analysis for pricing a book of business. Discuss the initial analyses which should be done on the data before moving on to a GLM analysis for pricing with multiple rating factors.

[6]

Q. 3) A general insurance company is using a generalized linear model to set pure risk premium rates for personal car damage insurance. The rating factors used for the analysis are as follows:

Rating factor	Levels
Insured Age	Below 30, 30-60, Above 60
Gender	Male, Female
Car value	Low, High

An actuarial student modelled frequency and severity separately using Poisson and Gamma distributions respectively for the error structures. She used a Log link function for both models and produced the following parameter estimates:

Frequency model**Severity model**

Parameters	Model estimates	Parameters	Model estimates
Intercept	-1.71	Intercept	9.90
Age_Below30	0.41	Age_Below30	0.10
Age_Above60	-0.29	Age_Above60	0.05
Gender_Female	-0.22	Gender_Male	0.22
CarValue_High	0.92	CarValue_Low	-0.51

(i) From the above table, calculate the base estimates and relativities for each of the rating factor levels for both frequency and severity. (5)

(ii) Calculate the pure risk premium for a low value car for an insured who is a 35 year old male. (2)

The pure risk premium is loaded for expenses, commission, reinsurance cost, profit margin etc to arrive at the office premium. However there are other considerations related to the market and the business which will mean that the final premium level is different from the theoretically correct premium level.

(iii) Briefly explain the business or market related issues relating to private car damage insurance which will need to be considered before the final premium level is set. (6)

[13]

Q. 4) You are the pricing actuary of a general insurance company writing all classes of general insurance business.

(i) List the desirable qualities for a complement of credibility. (3)

(ii) Describe the factors to consider when choosing a credibility complement. (6)

Aggregate claims for a class of business in your company are assumed to follow a Poisson process, with claim severity $X \sim \text{Gamma}(a, b)$ with $a = 1.75$ and $b = 6$. Your standard for full credibility requires a 95% probability of being within $\pm 5\%$ of the true pure premium.

(iii) Calculate the credibility to be assigned to 450 claims. State any assumptions you make. (6)

[15]

Q. 5) A reinsurance pricing actuary is working on a workers' compensation risk excess of loss treaty for a cedant with 14 years' worth of past data. The layers to be priced are

Layer	Excess (Rs)	Limit (Rs)	Number of claims hitting the layer in the past 5 years
1	10,000,000	40,000,000	321
2	50,000,000	50,000,000	55
3	100,000,000	150,000,000	5
4	250,000,000	250,000,000	1

(i) Explain briefly the methods available for risk excess of loss pricing and the layers for which each method may be suitable. (8)

(ii) For a working layer (where there is sufficient number of claims to use experience based pricing methods), explain the advantages and disadvantages of using a frequency-severity method for pricing, compared to the burning cost approach. (4)

(iii) Explain the issues to consider relating to trending the historical frequencies and severities when using the frequency-severity method for pricing. (6)

(iv) Briefly explain methods the actuary could use for developing individual losses to ultimate amounts. (3)

The broker requested a change in the terms for the first layer. He wanted an Annual Aggregate Deductible (AAD) of Rs 20,000,000. He requested an estimate of the percentage reduction in reinsurance premium after introduction of the AAD. The actuary decided to use the stochastic simulation method to estimate the risk premium under the new terms to enable him to estimate the percentage reduction in risk premium.

(v) Outline the major steps the actuary would need to perform to apply this method for the above analysis. (4)

Out of the 20,000 simulations done by the actuary, one particular run gave the following 10 gross loss amounts:

Loss Number	Gross Loss Amount (Crore Rupees)	Loss Number	Loss Amount (Crore Rupees)
1	1.10	6	1.25
2	1.25	7	2.25
3	1.50	8	3.00
4	2.00	9	1.50
5	1.20	10	2.00

(vi) Calculate the net amount to be paid by the reinsurer in layer 1 for each of the losses. (4)

[29]

Q. 6) You are the pricing actuary of a general insurance company which has been writing household business for a number of years in addition to writing other general insurance business. The policies cover any or all of buildings, contents, public liability and accidental damage to household appliances, as specified by the policyholder.

The company has operated a comprehensive data analysis system for many years. The household account has recently experienced a considerable underwriting loss. It has been suggested that the main cause of the loss was an inadequate rating structure for the contents section of the policy, particularly for small sums insured.

The present basic premium rate for contents cover is Rs 5 per Rs1000 sum insured. Each household policy is subject to a minimum premium of Rs 100.

(i) Describe in detail the investigations you would make to verify, or otherwise, the suggested cause of loss that has been suggested. (12)

It has been decided to increase the basic premium rate for contents.

(ii) Outline what information you would need to calculate the new basic premium rate and comment on where you might obtain this information. (9)

A Marketing Director of the company has suggested that the rate per Rs 1000 sum insured should decrease as the sum insured increases instead of the current level increase in basic premium rate.

(iii) Discuss the possible reasons for the suggestion. (7)

An underwriter has suggested that a better alternative for reducing the claim cost on small policies would be to increase the size of the policy excess.

(iv) Comment on this suggestion. (5)

[33]
