

INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

22nd September 2017

Subject ST8 – General Insurance: Pricing

Time allowed: Three Hours (14.45* – 18.00 Hours)

Total Marks: 100

INSTRUCTIONS TO THE CANDIDATES

- 1. Please read the instructions inside the cover 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 a new set of Question paper from the Invigilator.*

AT THE END OF THE EXAMINATION

Please return your answer booklet and this question paper to the supervisor separately. You are not allowed to carry the question paper in any form with you.

- Q. 1) i)** State the main feature of the following ways of pricing:
- Tariff
 - Qualitative
 - Cost Plus
- (3)
- ii)** State the reasons why using written premium may not always be appropriate as a measure of exposure.
- (3)
[6]

Q. 2) The pricing actuary of a company is estimating the expected claim frequency of private car insurance product using generalized linear model. The following assumptions are made:

- The expected claims frequency of the risk varies by geography and vehicle segment
- Link function is Log link
- Error structure follows Poisson distribution
- β_0 is the intercept
- β_1 is the effect of vehicle segment if it is “high-end”
- β_2 is the effect of geographic region if it is “Region A”
- Assume equal weights for all the four combinations of segment and geography

The following table gives the frequency for the combination of vehicle segment and geographical region.

Segment/Geography	Region A	Region B
High-end	0.25	0.35
Others	0.20	0.30

You are also given the following parameters values:

$$\text{Exp}(\beta_0) = 0.2955$$

$$\text{Exp}(\beta_1) = 1.2$$

$$\text{Exp}(\beta_2) = 0.6923$$

Prove that the above values for β_0 , β_1 , β_2 maximize the log likelihood for the given data under the given model specifications.

[7]

Q. 3) XYZ is a non-life insurance company selling only motor insurance. The company while writing rollover (renewal from other insurer) takes a declaration from the customer regarding the number of claims made in the immediately expiring policy to decide whether to offer No Claim Bonus (NCB) or not. If there was no claim in the immediately expiring policy, the NCB offered would depend on the NCB on the expiring policy.

The company accepts the declaration made by the customer but independently checks the claims status from the previous insurer as well. To do this, it costs the company in terms of staff cost. In most cases, the company does not get any response from the previous insurer. The cases where the company gets response from other insurer is in the form of clear yes or no.

At the time of claims, in most cases, the insurer gets to know whether there was any repair work done in the past. If there was a repair in the period coinciding with the duration of the previously expired policy and the customer claimed with the previous insurer but did not declare it, the insurer can identify that the customer made a wrong declaration.

Owing to poor response rate from previous insurers and the cost involved, the company wants to approach the previous insurer only in certain cases and not all cases. It has been suggested to build a model to calculate the probability of policyholder making wrong declaration and to confirm the details from previous insurer only when the modelled output is above a threshold limit.

- i) Outline the input data to be collected and the design of the output dataset required to build this model. (5)
- ii) Comment on why it is important to continuously monitor, and recalibrate if required, the model after it is implemented. (2)

[7]

Q. 4 i) Write down the various ways in which an expense analysis can be conducted. (1)

- ii) A large insurer has an established and stable commercial property portfolio. The head of the property underwriting department thinks that the expense loading for arriving at the final premium should be much lower than the expense loading for the rest of the lines of business combined. They also think that their expense loading for Commercial property should be lower compared to the competition as well.

Outline the possible reasons behind the intuition of the Commercial Property Underwriting team. (6)

[7]

Q. 5 i) a) Write down the primary reason why discovery period clause is applied to an insurance policy. (1)

b) Outline the main circumstances under which the basis of claims made cover is more suitable in an insurance policy. (2)

- ii) Outline the claims characteristics of employers' liability policy and professional indemnity policy for medical practitioners. (4)

- iii) Describe the ways the risk profile of an insurance company would go for a change when it starts issuing its employer's liability policy with the basis of cover changing from claims made basis to losses occurring basis. (2)

[9]

Q. 6 You work as an actuary in a non-life insurance company which is in operation for the last 10 years. The company writes almost all lines of business, with most of the business coming from motor and commercial lines. The company's annual premium growth rate is more than 20% for the last two to three years.

The management of the company is concerned about the quality of the business being underwritten and the likely impact on the company's profitability.

The company has state-of-the-art data systems wherein data relating to all rating factors is captured.

- i) State the three primary problems that an insurance company might face with rapid growth in premium income. (3)

- ii) State the various aspects, along with the reason, of the business being written by the company that the insurer might be interested in monitoring to address the management's concerns. (6)
[9]

Q. 7) i) In Casualty (Liability) business, write down the unique characteristic of this business which leads to the use of a family of curves called Riebesell curves. (1)

- ii) Riebesell curves are not based on underlying data but are based on an assumption regarding the original loss cost. Write down this assumption.

Also write down why it is often not appropriate to use Riebesell curves to adjust for original deductibles. (2)

- iii) A reinsurer trying to model the loss size of the long tailed liability line of business (Professional Indemnity) for its Excess of Loss reinsurance pricing.

The reinsurer is writing the Excess of Loss layer 20 Cr XS 20 Cr.

But the reinsurer has only the following ILF table available. It is also known to the reinsurer that the expected loss cost at the basic limit of Rs. 1 Cr is Rs. 2000.

Limit (in INR Crores)	ILF
1	1
2	1.50
5	2.00
10	2.50
20	2.80

The reinsurer decides to use the Riebesell curve with factor (alpha) at 0.1 appropriate to the type of liability business (Professional Indemnity).

Calculate the loss cost pertaining to the Excess layer (20 Crore XS 20 Crore) using the Riebesell curve with justification of using the assumption of Riebesell curve and also outline how further testing of the assumption could be made. (7)
[10]

Q. 8) Insure India is a stable non-life insurance company specializing in Auto insurance. In Auto insurance, the penetration of two wheelers insurance in the country is very low. The customers buy insurance for two wheelers for the first year only as this is compulsory in nature and a very few policyholders renew the insurance policy in subsequent years.

To take care of this issue of uninsured vehicles, the regulator has allowed the insurance companies to file multi-year insurance products for two wheeler extending up to 5 years.

The Company wants to take the first mover advantage of this by filing the required product. The company has reliable and credible data for annual two wheeler policies.

You are the pricing Actuary of the company and are now devising the method to calculate premium rates for the proposed long term product.

- i) State the challenges that you expect to encounter while pricing this product (4)

- ii) State how you would address the challenges stated above (4)
- iii) In the country, the following NCB model is applicable for annual policies:

No. of consecutive claim free years	Applicable NCB %
0	0%
1	20%
2	25%
3	35%
4	45%
>=5	50%

The average claim frequency of the two wheelers in the country is 5%. At the start of 3rd year, what is the probability that a new policyholder (with NCB=0%) will be at following slabs of NCB:

- a) 0%
b) 20%
c) 25%

(2)
[10]

- Q. 9) i) Write down the primary difference between the Occurrence Exceedance Probability (OEP) and Aggregate Exceedance Probability (AEP) curves in the catastrophe model output. (1)

- ii) A multinational direct property insurer has recently run its property book exposure through a Catastrophe Model for Earthquake cover. It has run its Indian exposure and Japanese exposure separately.

State the possible reasons why there is almost no difference between the AEP and OEP limits across all return periods in the model output for the Indian exposure

Also State the possible reasons why there is substantial difference between the AEP and OEP limits at the lower return periods in the model output for the Japanese exposure against a negligible difference between these limits at the higher return periods. (4)

- iii) Despite no major earthquake in the country over the last decade, the loss values on the OEP and AEP curves for the property line of business have gone up across almost all return period levels when compared with the recent years. The marketing head of the insurer is so interested in knowing the reason behind this. The total amount risk exposure for line of business has remained stable over the years and also there no construction cost inflation over the years.

As a property pricing actuary of the insurer, outline the possible reasons for such increase to the marketing head. (6)
[11]

- Q. 10) Insure India is a relatively new insurance company which writes predominantly motor class of business.

The company's persistency rates are much below the industry benchmarks.

i) Explain why it is good for the company to maintain a good persistency rate and the risks that the company is exposed to by continuing with the current condition of low persistency (6)

ii) To increase the renewal rate, the company has taken many initiatives. Under one of the initiatives, the company has built a model to predict the probability of renewal of each policyholder.

To attract the customers having low renewal probability to renew the policy, the marketing department has proposed to offer discount of 0%, 5% or 10% to these policyholders on case to case basis. The discount will be offered only if they renew their policy at least one month prior to the expiry of the previous policy by paying the premium due in full. Being a new insurer, the company has no data of such an offer.

Outline the factors you would take into consideration while arriving at the level of discount to be offered by the company by still achieving a minimum level of profitability. (5)

[11]

Q. 11) i) Define a stop loss treaty. (1)

ii) Write down the two primary differences between the Adverse Development Cover and the Loss Portfolio Transfer arrangement. (1)

iii) Outline the key factors which influence the amount of premium to be charged by a reinsurer under an Adverse Development Cover (3)

iv) EL NINO is a weather event which reduces the probability of a normal monsoon in the Indian sub-continent during the monsoon season. Most of the Indian agricultural crops under kharif season are heavily dependent on the monsoon rains for a good yield. Under an EL NINO condition, describe the usefulness of the following reinsurance treaties to a reinsurer with due consideration to possible inadequate pricing by the insurers.

a) Quota Share Treaty

b) Stop Loss Treaty (5)

v) A large direct insurer decides to write crop insurance business accounting for about 20% of its overall premium. Crop insurance is a short tailed but entails high uncertainty due to large dependence on natural weather parameters.

The insurer decides to take the reinsurance cover through a combination of Stop Loss and a Quota Share treaty arrangements. Outline how such an arrangement can be structured with an illustrative example. (3)

[13]
