INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

7th December 2022

Subject SP8 – General Insurance: Pricing
Time allowed: 3 Hours 15 Minutes (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. ***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.***
3. ***Attempt all questions beginning your answer to each question on a separate sheet.***
4. ***Mark allocations are shown in brackets.***
5. ***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. You are not allowed to carry the question paper in any form with you.

Q. 1)

i) Explain in detail the basic structure of a catastrophe model. (6)

ii) Why are the traditional rating approach not suitable for catastrophe losses? (2)

[8]

Q. 2) Assume the aggregate claims for property line are following a Poisson process. The claim severity X~ Gamma (a,b) with a = 1.68 and b = 5. The standard for full credibility requires a 95% probability of being within ±5% of the true pure premium. Estimate the credibility to be assigned to 400 claims along with mentioning assumptions made in calculation. **[5]**

Q. 3) A tech-based and recently established general insurance company (the 'insurer') has been approached by a well-established private player ABC to insure their solar power plant operations, including distribution. The insurer has not written this Line of Business earlier, and is considering whether to start writing insurance for the solar power plant. There has been considerable growth and technological advancement in solar power technology in recent years, thus adding to the uncertainty. However, this could contribute to the insurer's ESG initiatives.

i) List the coverages and perils that the ABC might ask the insurer to cover. (6)

ii) Suggest sources of information that the insurer could use for Pricing. (2)

iii) Discuss the potential sources of uncertainty/inconsistency which could render the external data unfit for use. (5)

iv) Discuss the information that the company would seek from the solar power plant operator in order to price a policy effectively. (12)

[25]

Q. 4) The Government of a growing developing country is undertaking an ambitious road construction project connecting the mountain terrain with the river plains. As part of this project, there are 2 major engineering projects expected to be completed parallelly within next 5-years:

a) A 40-km long mountain tunnel.
b) A 2-km long suspension bridge at a height of more than 2,500ft.

The entire project has been outsourced to a large and well-reputed construction company on a Build-Operate-Transfer basis.

i) Describe the typical coverages provided by a liability insurance policy. (3)

ii) Suggest, with reasons, the types of liability insurance that the construction company should obtain. (10)

The construction company is about to commence the tunnel and bridge projects and is seeking a property cover for the project.

iii) Explain why the risk profile for the property cover might not be uniform throughout the lifetime of the policy and how this might be included in the rating process. (5)

iv) List the external factors that could add to the risk of pricing uncertainty in the above policy. (4)

v) List the reasons why the insurer might want to monitor the performance of this policy closely. (4)

[26]

Q. 5) Motor Own Damage (OD) business has average claim amount of INR 25,000 with 20% claim frequency. The total claims, by amount, from claims less than INR 5,000 are 10% of the total claims.

i) Estimate the revised risk premium if an excess of INR 5,000 is introduced for motor OD. (5)

ii) You want to estimate the reduction in risk premium due to introducing INR 5,000 excess. Assume, you can access any data available in company. Describe how you would investigate this. (7)

iii) Discuss the various practical aspects as to why the discount in final premium offered to policyholders would not be the same if they decide to opt the excess. (5)

[17]

Q. 6) A Reinsurance Actuary is pricing a particular type of commercial property risk on a quota share basis. The below data is provided for last seven underwriting years (UW Year) 2016 to 2022 on the business.

			(Amount in Crs.)
UW Year	Ultimate Losses	Earned Premium	Premium Rate Change
2016	90	85	
2017	80	75	5%
2018	75	80	10%
2019	95	100	-5%
2020	105	110	-5%
2021	100	90	10%
2022	110	105	5%

Estimate the expected loss ratio for UW Year 2023 using the above details if the claims inflation over the years has been 3% p.a. and the premium rates in 2023 are expected to increase by 10%. **[8]**

Q. 7) In GLM, the linear predictor for a set of observations may be written in matrix form as $\eta = \boldsymbol{X}\beta + \varepsilon$. An Actuary is fitting a model to cattle insurance claims data with three factors:

- Any surgical operation happened in past– Yes or No
- Weight of cattle – Light, medium or Heavy
- Age of Cattle – 1 to 15 years

Surgical operation information and weight of cattle will be fitted as categorical factors, whilst age of cattle will be fitted by a quadratic polynomial.

There are 4 of the observations as per below table:

Observation	Surgical Operation in past	Weight of Cattle	Age of Cattle
1	Yes	Heavy	15
2	Yes	Heavy	12
3	No	Light	7
4	No	Medium	9

i) Construct the matrix X for the four observations above, stating clearly what each of the columns in X represents. (6)

Two GLMs using the factors above have been fitted and has obtained the following results:

Model	Factor Fitted	Deviance (Unscaled)
1	Surgical Operation in past, age of cattle	44.3423
2	Surgical Operation in past, weight of cattle, age of cattle	41.0237

Scale parameter = 0.31

ii) Determine with chi-sqaure test, whether the factor weight of cattle is statistically significant at the 10% level of significance. (5)

[11]

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