INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

November 2025

SP8 - General Insurance: Pricing

Time allowed: 3 Hours 15 Minutes

Total Marks: 100

Q.1) A large insurance company has recently introduced a product offering comprehensive risk coverage for spaceborne platforms tailored for satellite operators and aerospace clients. The product is being sold through brokers.

i) Describe the cover that could be provided under this product. (5)

The insurance company has decided to purchase an excess of loss (XoL) reinsurance program to cover the portfolio.

ii) Discuss how the reinsurance company would model the expected liabilities from this XoL program. (11)

iii) Suggest ways in which the reinsurer could manage these liabilities. (3)

[19]

Q.2) For a particular class of business, the following information is available:

- Claim counts follow a Poisson distribution.
- Claim sizes follow a lognormal distribution with a coefficient of variance equal to 3.5.
- Claim sizes and claim counts are independent.
- Claims are all independent of each other.
- The number of claims in the first year was 11,500.
- The aggregate loss in the first year was INR 10.25 million.
- The risk premium for the first year was INR 8 million.
- The exposure in the second year is identical to the exposure in the first year.
- The full credibility standard is to be within 5% of the expected aggregate loss 95% of the time.

Calculate the credibility premium for aggregate claims for the second year. **[4]**

Q.3) An insurance company writes a large portfolio of infrastructure engineering risks in India. The company has extracted the following cyclone-related adjusted losses over the past 10 years (2016–2025). The losses have been adjusted for inflation and exposure changes.

Loss Year	**Adjusted loss (INR crores)**
2018	0.4
2019	6.8
2021	0.1

A cyclone catastrophe model was applied to the company's 2025 portfolio, producing the following occurrence exceedance probabilities:

Probability	Loss (INR crores)
0.10%	12.00
0.20%	10.00
0.40%	8.00
0.50%	6.00
1.00%	4.50
2.00%	2.50
4.00%	1.50
10.00%	0.80
20.00%	0.20
Exp Loss	0.37

Comment on the suitability of the cat modelling results in light of the actual experience stating if any limitations of the data provided. **[8]**

Q.4) A company is in the process of filing for group cyber insurance coverage to protect against potential digital threats and cyber risks.

i) Outline the rating/risk factors that an insurance company would take into account in assessing the risk premium. (7)

ii) Outline the areas of uncertainty associated with deriving a risk premium for cyber insurance. (5)
[12]

Q.5)

i) You are modeling customer churn using a GLM. What type of distribution and link function would you use? (1)

ii) State the issues if the link function is mis specified in a GLM? (3)

iii) Explain why Generalized Additive Model is preferred over GLM? (4)
[8]

Q.6) An insurer has a quota share reinsurance treaty agreeing to pay the share in claims in Liability product with the following details:

- Gross Written Premium: Rs. 30 crores
- Gross Earned Premium: Rs. 27 crores
- Gross Claims Paid: Rs.14 crores
- Gross Outstanding Claims: Rs. 4 crores
- Reinsurer’s quota share: 30%
- Ceding commission: 12% of ceded premium
- IBNR= 10% of total incurred claims

- Profit commission is payable on the loss ratio if:
  - Loss ratio < 50% → 35%
  - 50% ≤ Loss ratio < 55% → 30%
  - 55% ≤ Loss ratio < 60% → 25%
  - 60% ≤ Loss ratio < 65% → 20%
  - 65% ≤ Loss ratio < 70% → 15%
  - 70% ≤ Loss ratio < 75% → 10%
  - 75% ≤ Loss ratio < 80% → 5%
  - >80% → 0%

Calculate the amount receivable/ payable to Reinsurer. **[5]**

Q.7) The management for a large insurance company is planning to use the following details from the company system in its annual budget process.

Line of Business	**Share of Total Premium (UW Year 2024)**	**Loss Ratio (UW Years 2020 – 2024)**	**Expense Ratio (Calendar Year 2024)**	**Combined Ratio**
Motor	30%	77%	35%	112%
Property	15%	40%	24%	64%
Personal Accident	10%	55%	15%	70%
Health	25%	68%	30%	98%
Crop	20%	85%	20%	105%
Total	**100%**	**69%**	**27%**	**96%**

i) Evaluate the suitability of the above statistics for planning budget including the premium volumes for the underwriting year 2025. (8)

ii) Recommend additional information the company should take into account when planning the budget for the next year including the premium volume targets. (5)

[13]

Q.8) A company selling retail health business wants to now enter in the Group Mediclaim Health insurance space. Compare and contrast the data requirements from the company's standpoint for Group Mediclaim health insurance pricing as compared to Retail health pricing? **[10]**

Q.9) You are a pricing analyst working on developing a Generalized Linear Model (GLM) for own damage claims for private car policies. Your manager has suggested reviewing the existing risk classification system for both vehicles and drivers, and to explore new rating factors to improve risk segmentation.

During a discussion with actuarial colleagues, one suggestion was to include the "number of hours a driver sleeps each night" as a potential rating variable in the model.

i) Discuss the potential advantages and disadvantages of including "number of hours of sleep per night" as a rating factor in the pricing model. (5)

ii) There is a recommendation to modify the exposure measure from vehicle years to hours driven. Compare the use of "hours drive" as the proposed exposure measure with the previous "vehicle years" measure. (3)

iii) The company has found significant theft cases in their loss ratio analysis. Which form of smoothening to be used for Pincode for theft cases? (2)

iv) How the level of smoothening could distort the pricing model? (2)

v) Suggest two scenarios in modelling where "offset" can be used. For each of these, outline how you would like to use "offset" in modelling. (2)

[14]

Q.10) A reinsurance company uses the burning cost approach to price the following risk excess of loss contract for tenure of 1 year as on 31st Mar 2025:

Inception date: 1st Apr 2025

Limit: INR 5 lakh

Deductible: 10 lakh

Reinstatements: None

The cedant has provided details of individual ground-up claims with incurred amounts greater than INR 5 lakh as follows:

Loss Year (1st April XX- 31st March XX+1)	Incurred claims
2020-21	7,50,000
2022-23	17,00,000
2023-24	8,00,000

Claims, on average, have been observed to inflate at 10% per annum.

The reinsurer wishes to maintain a profit loading of 25% to account for cost of capital and other expenses.

Calculate the rate on line the reinsurer should quote for this contract using the burning cost approach, stating any assumptions made. Decimal in working to 2plc. **[7]**

****