INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

25th March 2021

Subject SP7 – General Insurance Reserving and Capital Modelling

Time allowed: 3 Hours 30 Minutes (14.30 – 18.00 Hours)

Total Marks: 100

INSTRUCTIONS TO THE CANDIDATES

1. *Please read the 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. *Mark allocations are shown in brackets.*

Q. 1) ABC is a large general insurance company writing Motor, Engineering, liability, and other general lines of business. A student actuary was asked to calculate UPR for following policies issued under Erection All risk (EAR) and Contractor's All risk (CAR) insurance cover. He performed his calculation using the 365th method.

Policy Start Date	Policy End Date	Gross Premium (INR)
02 Jul 2019	01 Jul 2021	50000
23 Nov 2019	22 Nov 2021	20000
01 Jul 2019	30 Jun 2022	75000
15 Aug 2019	14 Aug 2021	25000
01 Apr 2019	28 Feb 2020	30000

   i) Outline the issues with his approach. (3)

   ii) Using the above data, calculate the UPR as at 31 December 2020 using below methods:

- Uniform earning of premium over time.
- Linear earning of premium over time.

(3)

   iii) Describe the situations when the amount of unexpired risk reserve can be substantially different from UPR. (2)

The Company's liability portfolio is showing adverse claim ratio trend in the recent few years. The Company has decided to stop writing this business as it is small in size and decided to focus on other major lines. The Company is approached by a broker to purchase adverse development cover for reinsuring this portfolio. The price quoted by the broker is the best estimate loss cost plus 25% loading along with brokerage.

   iv) Explain the term adverse development cover. (2)

   v) Explain the risks to the ceding company of reinsuring this portfolio and how it can be mitigated. (4)

   vi) Explain the risks to the reinsurance company of writing this portfolio and how it can be mitigated. (4)

   vii) State with reasons whether you think that the company's decision to cease underwriting Liability insurance is appropriate in this situation. (2)

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Q. 2)

   i) An actuarial analyst has used a curve fitting method to estimate age to ultimate development pattern for carrying out reserving using Basic Chain ladder (BCL) method. Briefly describe the curve-fitting method. Discuss the uses and possible situations where a curve-fitting method could be ineffective. (7)

   ii) Define Cape Cod method of reserving. Comment on the key difference between the BF method and Cape Cop method and its key shortcomings. (3)

iii) The following claims information for a large insurer has been provided. You have been asked by the senior actuary to calculate the incurred B-F ultimate for the 2020 accident year with the ELR based on the weighted average (by premium) of the last five accident years. The claims inflation has been steady at about 5% for each year. The premium rate increase can be approximated using the increase each year in the average premium per policy. (8)

Year	Earned premium (in INR 000's)	Earned Policy Years	Incurred claims (in INR 000's)	Incurred cumulative development factor	Selected Ultimate Loss Ratio	Selected Ultimate Loss
2015	11,750	1,150	8765	1.000	75%	8,765
2016	13,000	1,275	10,350	0.960	76%	9,936
2017	12,500	1,125	9,235	0.940	69%	8,681
2018	13,250	1,050	9,500	0.920	66%	8,740
2019	15,250	1,125	11,250	0.975	72%	10,969
2020	17,650	1,265	9,575	1.520		

iv) Discuss the suitability of the following approaches for deriving an estimated loss ratio for use within the Incurred Bornhuetter-Ferguson method:

a) Using the underwriter's view of the priced loss ratio. (2)

b) Using market loss ratios derived from industry benchmark information. (2)

c) Using an average of the last five years selected ultimate loss ratios adjusted for premium rate increases and claims inflation. (2)

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Q. 3) Discuss the investment strategy (including suggestions of appropriate investment types) of a small general insurer having mainly property and liability portfolio who (although solvent) has recently stopped underwriting and entered run-off. **[9]**

Q. 4) Identify and discuss various claim characteristics for a Motor Insurance policy from a risk modelling perspective. **[10]**

Q. 5) **i)** Define Operational risk. List major categories of Operational risk that a Capital modelling actuary might want to model. Discuss each of these with examples. (10)

ii) How can an actuary model and parameterise Operational Risk in a stochastic model? What are the major challenges that an actuary might face while modelling Operational Risk? (10)

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Q. 6) **i)** Define the term copula. When is the use of copula more beneficial over more traditional methods and why? (4)

ii) You are given the following information:
The number of claims and claim amounts for a line of business in a given year has the following distribution

Claim No.	Probability
0	60%
1	20%
2	20%

Claim Amount	Probability
10,000	80%
100,000	20%

An insurer and a reinsurer have an annual aggregate excess of loss agreement with a limit of 50,000 for all claims arising from this line. What is the copula function for the joint distribution of the aggregate annual payout of the insurer and reinsurer? (7)

iii) Which copula would you use for the following and why?

    a) Cyber and Crop insurance premium for a multi-national insurer. (3)

    b) Commercial Property Damage and Business Interruption claims for a mid-sized insurer. (3)

Choose a likely correlation coefficient for each of the above and justify the same.

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