

INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

26th November, 2012

Subject SA3 – General Insurance

Time allowed: Three hours (9.45* - 13.00 Hours)

Total Marks: 100

INSTRUCTIONS TO THE CANDIDATES

1. *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*
2. ** 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.*
3. *You must not start writing your answers in the answer sheet until instructed to do so by the supervisor*
4. *The answers are expected to be India Specific application for the syllabus and corresponding core reading. However, substantially the core reading material is still taken from material supplied by Actuarial Education Company which are meant for UK Fellowship examination. The core reading also contains some material which is India Specific, mostly the IRDA regulation. In view of this, it should be noted that focal point of answers is expected to be India Specific application. However if application specific to any other country is quoted in the answer the same should answer the question with reference to Indian environment.*
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 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.

Q.1) You are an actuarial analyst with insurance company 'India Inc'. 'India Inc' has been underwriting home insurance business for almost six years. The home insurance portfolio was priced using one way analysis and you have now been asked to develop the pricing framework for this portfolio using Generalised Linear Modelling (GLM).

- [i] Your colleague has suggested that you could fit the GLM model to historical loss ratios rather than distinguishing between claim frequencies and claim sizes. He also suggested that the GLM model may be fitted to averaged claims data rather than individual claims. Outline the limitations in your colleagues' suggestions (4)

You have performed a GLM modelling analysis of claims frequency and the output of this analysis is given below (fitting a Poisson distribution to claims frequency with log link):

| | Estimate | Wald statistic 5% | Wald statistic 95% |
|---|----------|-------------------|--------------------|
| Area A | 0 | 0 | 0 |
| Area B | 0.37 | 0.15 | 0.59 |
| Area C | 0.84 | 0.30 | 1.38 |
| Area D | 1.26 | 0.56 | 1.99 |
| Area E | 1.83 | 1.31 | 2.30 |
| Area F | 2.15 | 1.29 | 3.69 |
| Distributed over the internet | 0.2 | -0.21 | 0.61 |
| Distributed over the phone | 0 | 0 | 0 |
| Distributed by broker X | -0.27 | -0.63 | 0.05 |
| Distributed by broker Y | -0.5 | -1.16 | 0.11 |
| Distributed by bank J | -0.6 | -1.01 | -0.18 |
| Distributed by bank K | -0.1 | -0.51 | 0.34 |
| Interaction of Area F and distributed by bank K | 0.6 | -0.03 | 1.30 |
| Constant | -4.65 | -4.65 | -4.65 |

Based on the results of your analysis, you have concluded that home insurance premiums should be changed to the following:

INR 4000 per policy multiplied by the estimate of claim frequency from the GLM output above

The existing premiums are INR 100 per policy with a 50% loading for area E, 100% loading for area F and 50% discount for areas A and B. Brokers are allowed to vary from these book rates by +/- 20% and banks allowed to offer a 10% discount on new business.

- [ii] Under the proposed basis, what would be the highest and lowest premiums and which policies would they apply to? What is the premium under the existing basis for these policies? (3)
- [iii] Explain what further analysis is required before changing the pricing basis (7)

- [iv] The claims frequency and severity for Bank K has historically been the lowest compared to all other distribution channels. In light of this, Bank K has approached you to raise its commission rate from 5% to 10%. What information and analysis would you need to assess Bank K's proposal?
How would the output from the GLM analysis (above table) impact your response to Bank K's proposal?

(8)
[22]

- Q.2)** The Fire insurance portfolio of company XYZ has performed well in recent years and the underwriting manager has been asked to prepare financial projections presenting a case for expanding this portfolio. Results of the Fire insurance portfolio over the last three years are shown below.

Based on historical experience and 'best estimate' projections of portfolio growth (the underwriting manager expects to achieve a 20% increase in market share per annum), the underwriting manager has prepared a 3 year business plan for the Fire insurance portfolio as follows:

(All figures except loss ratio and GWP growth are in INR '000s)

| | Actual performance | | | Plan performance | | |
|-----------------------------|--------------------|------|------|------------------|------|------|
| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
| Gross written premium | 180 | 182 | 184 | 221 | 265 | 318 |
| Gross earned premium | 179 | 181 | 183 | 202 | 243 | 291 |
| Reinsurance premiums earned | 4 | 4 | 4 | 4 | 4 | 4 |
| Net earned premiums | 175 | 177 | 179 | 198 | 239 | 287 |
| Gross incurred claims | 143 | 148 | 143 | 162 | 194 | 233 |
| Reinsurance recoveries | 2 | 3 | 3 | 3 | 3 | 4 |
| Net claims incurred | 141 | 145 | 140 | 159 | 191 | 229 |
| Underwriting expenses | 35 | 36 | 36 | 36 | 36 | 37 |
| Underwriting result | -1 | -4 | 3 | 3 | 12 | 21 |
| GWP growth | | 1% | 1% | 20% | 20% | 20% |
| Net loss ratio | 81% | 82% | 78% | 80% | 80% | 80% |

- [i] You are the chief actuary for company XYZ and the CEO has asked you to review the business plans prepared by the underwriting manager. Prepare a detailed memo to the CEO on your opinion of the projections.

(11)

Company XYZ has decided to go ahead and expand its Fire insurance portfolio for commercial properties and to target high market share in Gujarat, owing to its rapid industrialization in recent years. Further, company XYZ has entered into an exclusive distribution arrangement with Broker MIS which is the dominant broker in Gujarat. Company XYZ hasn't distributed its products through brokers previously.

- [ii] Identify the key issues that will need to be raised within Company XYZ's FCR with regard to the planned expansion in Gujarat and the distribution arrangement with broker MIS

(6)

Company XYZ would like to reinsure the Fire insurance portfolio through an excess of loss treaty on a per risk basis (i.e. no events are covered) with different layers for different property types as detailed below:

| | |
|-----------------------------|--------------------------------|
| Residential properties | INR 1,000,000 XS INR 50,000 |
| Small medium enterprises | INR 1,500,000 XS INR 100,000 |
| Large commercial properties | INR 4,000,000 XS INR 1,500,000 |

- [iii] From the reinsurer's perspective, what factors would Company XYZ have considered before asking for these particular limits and excesses? Comment on how these factors apply to the limits and excesses that have been proposed for each property type. (5)

Company XYZ reinsures its Motor comprehensive, Fire and Home insurance portfolios under a single catastrophe XOL treaty. The treaty covers INR 250 crores xs INR 2 crores on any one event for the three classes combined. The premium for this cover is INR 200,000. This premium needs to be allocated to each of the above classes for profitability analysis.

- [iv] Briefly describe four different methods by which this premium may be allocated to each of the above classes. Which method of allocation would you recommend? Give reasons for your answer, stating advantages and disadvantages of each method (6)

[28]

Q.3) A new accounting system (NAS) is being introduced in the market and the CFO of the company has shared these rules with you and wants you to estimate the impact of the new rules on your estimate of the technical provisions of the company.

Following are the major changes to the accounting system that were highlighted by the CFO to you:

- 1 All liabilities will be discounted
- 2 The liabilities would include a margin for adverse deviation which would place the booked reserves at 75th percentile of the assumed loss distribution for the portfolio.
- 3 NAS allows you to consider the equity in the UPR i.e. the actuary can make assumptions regarding the loss ratio that the UPR will run-off at.
- 4 Allowance is to be made for reinsurance bad debt. The loss given default assumed under NAS is 60% as opposed to a full write-off under the current accounting rules.

- [a] The NAS requires you to consider not just the point in time estimate of the probability of default but to consider the probability of default over the next 5 years.

The following information is available at 2011 year end:

| Exposure Year | Paid Loss | Incurred Loss | Paid Development | Incurred Development | Earned Premium | Underwriting Year | Written Premium |
|---------------|-----------|---------------|------------------|----------------------|----------------|-------------------|-----------------|
| 2007 | 575 | 575 | 95% | 95% | 900 | 2007 | 1200 |
| 2008 | 550 | 582 | 85% | 90% | 1000 | 2008 | 1400 |
| 2009 | 450 | 554 | 65% | 80% | 950 | 2009 | 1100 |
| 2010 | 350 | 569 | 40% | 65% | 1100 | 2010 | 1300 |
| 2011 | 200 | 450 | 20% | 45% | 1200 | 2011 | 1400 |

Assume run-off in the 6th development year.

You are given the following spot rates on government bonds

| | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|
| Tenure | 1 year | 2 year | 3 year | 4 year | 5 year | 6 year |
| Yield | 7% | 7.25% | 7.50% | 7.75% | 8% | 8% |

Assume normal distribution for the unpaid losses. Coefficient of Variation (CV) of the undiscounted unpaid losses is given below:

| | | | | | |
|---------------|------|------|------|------|------|
| Exposure Year | 2007 | 2008 | 2009 | 2010 | 2011 |
| CV | 50% | 40% | 30% | 20% | 10% |

- [i] Determine the total earned liabilities under the existing accounting system and the NAS. Use the BF method for the latest exposure period and Chain Ladder method for the prior years. Justify your selection of the expected loss ratio for the BF method. (14)
- [ii] Determine the liability associated with the UPR as per the existing and the new accounting system rules (6)
- [iii] Your insurance company has had a 50% Quota share reinsurance arrangement in place on a Risk Attaching basis. The cessions are split equally between two reinsurance companies ABC Re and EFG Re. ABC Re is AA rated where as EFG Re is BBB rated. Following is the credit risk matrix provided to you by a rating agency.

| Rating | Probabilities of Default | | | | |
|--------|--------------------------|-------|-------|-------|-------|
| | 2012 | 2013 | 2014 | 2015 | 2016 |
| AAA | 0.75% | 0.80% | 0.72% | 0.70% | 0.65% |
| AA | 1.00% | 1.10% | 0.95% | 0.90% | 0.88% |
| A | 1.50% | 1.60% | 1.54% | 1.43% | 1.24% |
| BBB | 3.00% | 3.20% | 3.07% | 2.87% | 2.48% |
| BB | 4.00% | 4.27% | 4.10% | 3.82% | 3.31% |
| B | 5.00% | 5.33% | 5.12% | 4.78% | 4.14% |

Calculate the provisions for Reinsurance bad debt of the earned component under the new and the existing accounting rules. (10)
[30]

- Q.4)** [i] A five year comprehensive insurance policy for two wheelers is proposed by the consumer body to avoid the hassle of renewing the policy every year. It is proposed that the premium be paid in one go at the outset of the policy. List potential causes of adverse selection under the proposed product (5)
- [ii] Describe any mechanism to mitigate adverse selection. Provide advantages and disadvantages of the proposed mechanism. (6)
- [iii] Also list the adjustments that you would make to the final price of the five year policy to incorporate the proposed mechanism into the product. Assume that the standard pricing is based on historical data of the single year product. (4)
- [iv] What factors, in addition to the standard factors considered in pricing the one year policy, would you consider for pricing this 5 year policy? (5)
[20]
