# INSTITUTE OF ACTUARIES OF INDIA

## EXAMINATIONS

## 12th May 2011

## Subject ST7 - General Insurance: Reserving & Capital Modelling

**Time allowed: Three hours (14.45* – 18.00 Hrs)**

**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 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.***

| AT THE END OF THE EXAMINATION |
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| Please return your answer book and this question paper to the supervisor separately. |

**Q. 1)** You are an actuary working in the investment department of a small general insurance company selling primarily motor insurance. The CFO of the company wants to maximize the dividends paid to all shareholders and suggests investing all monies in assets offering high returns such as equities.

Discuss your response to the CFO's suggestion. **[5]**

**Q. 2)** The following table shows figures as at 31st December 2010 for a Lloyd's syndicate, which writes mainly personal accident and kidnap and ransom insurance.

The underwriter's estimated loss ratios are from his report as at 31st March 2010 and are stated to be after taking into account the changes in policy terms and conditions, rate changes etc. The BF ultimate loss ratios use the chain ladder projected results and the underwriter's estimates using the Bornhuetter-Ferguson (BF) technique. The finance director has provided the budgeted loss ratios.

| Year of Account | Latest Paid Loss Ratio (1) | Chain Ladder Ultimate Loss Ratio (2) | Underwriter's Estimated Loss Ratio (3) | BF Ultimate Loss Ratio (4) | Budgeted Loss Ratio (5) |
|---|---|---|---|---|---|
| 2006 | 86 | 87 | 87 | 87.0 | 85 |
| 2007 | 90 | 98 | 103 | 98.7 | 92 |
| 2008 | 62 | 86 | 82 | 84.7 | 80 |
| 2009 | 43 | 83 | 77 | 80.4 | 82 |
| 2010 | 23 | 125 | 110 | 112.7 | 85 |

The finance director informs you that it has always been company practice to use the budgeted loss ratio in the BF calculations. He has seen your table of results and states that the BF method is not credible as it can give any results that you may want. He tells you that he intends to use the ultimate claims using the budgeted loss ratio in the BF calculations.

Discuss the finance director's comment on the credibility of the BF Method and his proposed course of action.

**[3]**

**Q. 3)** (i) Define a copula function and give the reason why it is used. (2)

(ii) Derive copula expressions for two variables X and Y when X and Y are not statistically independent. (3)

(iii) Write one copula expression used most commonly in insurance applications, giving its characteristics. (2)

**[7]**

**Q. 4)** You are the capital modeling actuary in a medium sized general insurance company writing both personal and commercial lines.

(a) State the risks you would consider in developing a capital model

(b) Suggest a basis for modeling each of the risks.

(c) Explain, with examples, how each risk may be correlated with the others.

**[7]**

**Q. 5)** (i) List the items that may need to be included in a reinsurance treaty document. (6)

(ii) Define the terms exposure measure, risk factor and rating factor (2)

**[8]**

**Q. 6)** ExW General Insurance Company Ltd writes Extended Warranty business that covers domestic electrical goods.

(i) State, with reasons, the reserves which would be required for this class of business (2)

(ii) Explain briefly the specific issues for this class of business in estimating UPR

The company writes an extended warranty contract for new televisions. The contract is written and premium collected when the television is purchased and takes over from the manufacturer's warranty after the product is 12 months old and extends the warranty until the product is 5 years old. The table below shows the premium written during underwriting years 2008 to 2010 and estimated figure for 2011 (3)

| **Underwriting Year** | **Written Premium (INR Crores)** |
|---|---|
| 2008 | 50 |
| 2009 | 100 |
| 2010 | 100 |
| Plan 2011 | 100 |

(iii) Calculate the earned premium in 2011 and UPR at the end of 2011, stating any assumptions made. (6)

**[11]**

**Q. 7)** The insurance regulator of a country, where the insurance industry is growing rapidly, has invited feedback from the actuarial profession on the suggestions they have received from the industry on modifications to solvency capital requirements.

State the possible reasons for each of the suggestions, and comment on their suitability:

(a) The minimum solvency margin should be proportional to technical reserves

(b) The minimum solvency margin should be proportional to the square root of premium income

(c) There should be a statutory basis for the calculation of technical reserves

(d) All technical reserves plus the minimum solvency margin should be invested in government securities

**[12]**

**Q. 8)** A country's insurance regulator has recently introduced proposals that will require, for the first time, that general insurance companies discount reserves for the purpose of assessing their tax liability and for solvency/financial accounts.

(i) Draft a note to the CFO of the general insurance company on the issues he has to consider when reserves are discounted (5)

The following procedures have been proposed by the regulator:

- Calculate the best estimates for the undiscounted claims reserves
- Estimate how these reserves will be paid over time
- Discount these payments using gross redemption yields available on government bonds of equivalent term
- Similar techniques are to be applied to the unexpired risk reserve

(ii) Describe the practical difficulties in implementing the above proposals. (6)

**[11]**

**Q. 9)** You have been provided with the following financial information for general insurance companies 1, 2 and 3 for the financial year 2010/11. All amounts shown are in Rs Crores.

| **Company** | **Company 1** | **Company 2** | **Company 3** |
|---|---|---|---|
| Gross Written Premium | 75 | 4000 | 625 |
| Additional Unexpired Risk Reserve c/f | 23 | 200 | 0 |
| Gross Outstanding Claims Reserve b/f | 30 | 1600 | 1875 |
| Gross Claims Paid | 53 | 1400 | 375 |
| Gross Outstanding Claims Reserve c/f | 45 | 1700 | 1750 |
| Non Acquisition Expenses | 8 | 500 | 75 |
| Investment Income | 5 | 200 | 40 |
| Current Assets at 31/03/2011 | 8 | 160 | 75 |
| Current Liabilities at 31/03/2011 | 17 | 200 | 100 |
| Investments at year end | 188 | 7000 | 2500 |
| Share capital at 31/03/2011 | 23 | 1000 | 313 |
| Acquisition Costs as a % of Gross written premium | 36% | 18% | 24% |

(i) Construct the balance sheet for each of the three companies as at 31st March 2011, stating any assumptions made. (5)

(ii) Derive underwriting, solvency and return on capital employed ratios for all three companies, stating any assumptions made. Taxation should be ignored. (3)

(iii) Comment on the results in part (ii). (4)

(iv) Discuss the limitations of using published accounts as a reflection of the true profitability of an insurer (2)

(v) Briefly outline an analysis which a general insurance company can adopt to report the true profitability of its business to its senior management (3)

**[17]**

**Q. 10)** You are the chief actuary for a general insurance company with total insurance reserves of Rs 100 Crores. You have recently completed the calculations of those reserves for the year-end accounts, which show a profit of Rs 1 Crore. Your chief executive has requested that the calculations of the reserves be reviewed with a view to showing a profit of Rs 2 Crores in the accounts.

i) Discuss the aspects of the reserving process that give rise to uncertainty, and how you might review your estimates in light of the chief executive's request. (6)

You have been asked by your CFO to provide ranges of estimates using each of:

a) Bootstrapping
b) Mack's method

ii) Describe each of these methods, giving its advantages and disadvantages. (13)

**[19]**

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