# INSTITUTE AND FACULTY OF ACTUARIES

# EXAMINATION

21 April 2015 (am)

## Subject ST7 – General Insurance: Reserving and Capital Modelling Specialist Technical

*Time allowed: Three hours*

***INSTRUCTIONS TO THE CANDIDATE***

1. *Enter all the candidate and examination details as requested on the front of your answer booklet.*

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 booklet until instructed to do so by the supervisor.*

4. *Mark allocations are shown in brackets.*

5. *Attempt all seven questions, beginning your answer to each question on a new page.*

6. *Candidates should show calculations where this is appropriate.*

*AT THE END OF THE EXAMINATION*

*Hand in BOTH your answer booklet, with any additional sheets firmly attached, and this question paper.*

*In addition to this paper you should have available the 2002 edition of the Formulae and Tables and your own electronic calculator from the approved list.*

**1** (i) Define aggregate excess of loss reinsurance. [1]

(ii) Define "rate on line" in the context of an excess of loss reinsurance treaty. [1]
[Total 2]

**2** A general insurance company is considering building a computer model to determine its capital requirements.

Outline the advantages of building and using a deterministic rather than a stochastic model. [8]

**3** An actuary has calculated the expected ultimate claims on a book of general insurance business using the chain ladder method on both a paid and incurred basis. He notes that the amounts which he projects on a paid basis are significantly higher than those he has projected on an incurred basis. Further inspection shows that this effect is common across all accident years and is not due to a single unusual early payment; the actuary has had the calculations and data fully checked.

(i) Suggest two main reasons why this phenomenon might have arisen. [2]

(ii) Suggest appropriate tests that the actuary might undertake to determine the reason. [9]
[Total 11]

**4** Summary financial statements have been provided for two general insurance companies (A and B). The companies are based in the same country.

**Balance Sheets as at 31/12/2014 (£ millions)**

| | *Company A* | *Company B* |
|---|---|---|
| Outstanding claims and IBNR* | 500 | 700 |
| UPR* | 400 | 200 |
| Current Liabilities | 30 | 20 |
| Free Reserves | 450 | 250 |
| **Total Liabilities** | **1,380** | **1,170** |
| | | |
| Broker balances | 5 | 20 |
| DAC* | 40 | 40 |
| Cash | 300 | 350 |
| Gilts | 880 | 760 |
| Equities | 155 | 0 |
| **Total Assets** | **1,380** | **1,170** |

*IBNR – incurred but not reported
*UPR – unearned premium reserve
*DAC – deferred acquisition costs

**Profit and Loss Account for the year ending 31/12/2014 (£ millions)**

| | *Company A* | *Company B* |
|---|---|---|
| Gross premium earned | 800 | 400 |
| Net premium earned | 760 | 300 |
| Commission | 80 | 80 |
| Gross claims incurred | 500 | 300 |
| Net claims incurred | 475 | 270 |
| Other expenses | 100 | 40 |
| Investment income | 40 | 20 |

(i) Calculate the following ratios for Companies A and B, stating any assumptions made:

(a) solvency ratio
(b) gross claim ratio
(c) return on capital employed

[5]

(ii) Compare the performance and financial condition of the two companies, including possible reasons for the differences. [9]

[Total 14]

**5** A general insurance company has produced the following summary showing the amount of economic capital allocated to each major business unit as at 31 December 2014.

| *Class of business* | *Capital allocation (£m)* | *2015 expected premium (£m)* | *Number of years of business written* |
|---|---|---|---|
| Property catastrophe reinsurance | 60 | 70 | 3 |
| Pet insurance | 10 | 40 | 7 |
| Professional indemnity | 45 | 30 | 4 |
| General liability | 35 | 60 | 1 |
| Direct motor | 60 | 100 | 6 |

(i) Comment on the company's capital allocation, making reference to types of risk as appropriate. [10]

The underwriting director's view is that capital allocations are generally too high, as when one class performs badly, others tend to perform well, meaning that the overall result is neutral.

(ii) Discuss this statement. [5]

[Total 15]

**6** An actuarial department in a general insurance company has been asked to produce a reserve range for its professional indemnity business. The latest results and assumptions for the best estimate reserving exercise as at 31 December 2014 are as follows:

*All figures in £m*

| *Underwriting Year* | *Ultimate Premiums* | *Ultimate Claims* | *Incurred Claims* | *Paid Claims* | *Method Used* | *ELR* |
|---|---|---|---|---|---|---|
| 2010 | 25 | 20 | 16 | 10 | ICL | 75% |
| 2011 | 26.5 | 21 | 14 | 7.3 | PBF | 80% |
| 2012 | 25 | 22 | 13.9 | 5 | IBF | 80% |
| 2013 | 25 | 19 | 8.2 | 1 | IBF | 75% |
| 2014 | 24 | 18 | 3 | 0 | ELR | 75% |

ICL = incurred chain ladder
PBF = paid Bornhuetter Ferguson (B-F)
IBF = incurred Bornhuetter Ferguson (B-F)
ELR = expected loss ratio

Paid and incurred incremental development profiles are as follows:

| *Annual period* | *1–2* | *2–3* | *3–4* | *4–5* | *5–6* | *6–7* | *7–ultimate* |
|---|---|---|---|---|---|---|---|
| Incurred link ratio | 1.759 | 1.400 | 1.225 | 1.100 | 1.082 | 1.035 | 1.116 |
| Paid link ratio | 2.240 | 1.995 | 1.600 | 1.450 | 1.300 | 1.200 | 1.250 |

The reserving actuary estimates that a suitable range is obtained by increasing and decreasing the ELRs by 10% (absolute) and by lagging and accelerating the development profile by six months. The same methods should be selected as were used to calculate the best estimate reserves.

(i) Calculate the high and low points for the claim reserve range, stating any assumptions made. [5]

The actuarial department has been asked to consider further methods of deriving reserve ranges.

(ii) (a) Describe the Bayesian and Mack methods for estimating reserve ranges.

(b) Compare these two methods.

[8]

A suggestion has been to model the range around the best estimate ultimate claims using the lognormal distribution. The suggested parameterisation is a standard deviation of £15m and the high and low points of the range are defined as the $90^{th}$ and $10^{th}$ percentile respectively.

(iii) Determine the high and low points for the claim reserve range based upon the lognormal distribution. [4]

[Total 17]

**7** (i) Describe the following features of household insurance:

(a) the main types of coverage offered
(b) how the business is sold

[6]

(ii) Describe how the total exposure of a general insurer to a major flood loss could be assessed, considering both coastal and river flooding. [6]

(iii) (a) List the additional information, by adapting the proposal form or from elsewhere, that would be needed to improve future estimates of the exposure in part (ii).

(b) Discuss the problems that would arise in obtaining this additional information.

[5]

As insurance companies have obtained more information, there has been a movement towards reflecting the risk of flood damage in premiums charged. Formerly, high-risk households paid less than the fully risk-reflective price for their home insurance. More recently, homes with increased risk of flooding have had to pay substantially higher prices and the concern is that eventually some high risk homes may not be insurable. The government is considering how to overcome this problem and who might bear the cost of flooding when it occurs.

(iv) Suggest alternatives for those who should bear the cost of flooding. [3]

The government has suggested four main options for consideration regarding how best to secure the availability and affordability of flood insurance:

Option 1: Focus on flood risk reduction by the insurance industry, covering such options as brokers using local flood risk information, reinsurance (possibly by combining insurers), group purchasing and other innovations.

Option 2: Subsidised reinsurance pool for high flood risk households. An industry-run, not-for-profit, scheme would be set up to reinsure policies for households at a high risk of flooding with the reinsurer, funded by a levy on insurance companies. The scheme would not include the most expensive 1% of properties, new homes built after a certain date and genuinely uninsurable properties.

Option 3: Direct subsidy of insurance premiums. A levy on household insurers would be used to reduce the insurance premiums paid by those at the highest risk of flooding.

Option 4: A flood insurance obligation. All household insurance companies would be legally required to insure a certain proportion of households at high risk of flooding.

(v) Discuss the possible advantages and disadvantages of each of these options.

[13]

[Total 33]

**END OF PAPER**