

# INSTITUTE AND FACULTY OF ACTUARIES

## EXAMINATION

26 April 2012 (pm)

### Subject ST8 – General Insurance: Pricing 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 before 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 eight questions, beginning your answer to each question on a separate sheet.*
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** A general insurance company is considering whether to transfer the liabilities from a particular class of business using some form of run-off reinsurance.

(i) Outline:

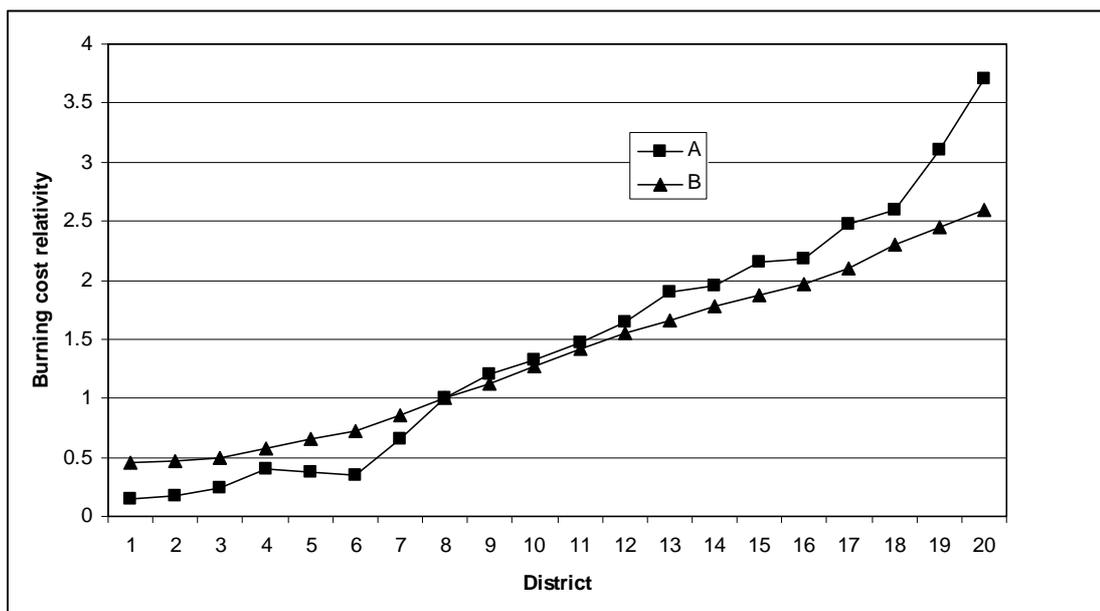
- (a) the aims of run-off reinsurance.
- (b) the circumstances in which it might be used.

[2]

(ii) Describe the two main types of run-off reinsurance that could be used. [6]  
[Total 8]

**2** A large general insurance company uses multivariate techniques to reallocate every UK postcode to one of 20 districts for its motor book. A postcode is allocated to a particular district based on its expected claims cost, where district 1 contains postcodes with the lowest risk and district 20 contains those with the highest risk.

There is a lot of uncertainty, especially around postcodes with little or no past exposure, and so the insurer has produced two alternative sets of district allocations, A and B. For each of A and B a GLM has been created, in which all factors other than district are identical. From these models a graph has been constructed showing the burning cost relativities for each district, for each of A and B:



Each of the districts contains the same amount of past exposure in each allocation.

Discuss the factors that the company would consider and the analysis that it would carry out when deciding which of the two district allocation models to implement into the pricing structure. [9]

- 3** A particular class of business has exactly  $n$  policies. It is assumed that the number of claims ( $N$ ) follows a binomial distribution and that the individual claim amounts ( $X_j$ ) are discrete random variables taking positive integer values.  $S$  represents the aggregate claim amount.

You are given Panjer's recursion formula:

$$g_0 = p_0$$

$$g_r = \sum_{j=1}^r (a + bj/r) f_j g_{r-j} \quad \text{for } r = 1, 2, 3, \dots,$$

where

$$g_k = P(S = k),$$

$$p_r = P(N = r)$$

and

$$f_k = P(X_i = k).$$

Show, using Panjer's recursion formula, that

$$g_0 = q^n$$

and

$$g_r = \sum_{x=1}^r \frac{p}{(1-p)} [(n+1)x-1] f_x g_{r-x} \quad \text{for } r = 1, 2, 3, \dots$$

[7]

- 4** A general insurance company is reviewing its pricing for a large book of personal lines business. It proposes to set its prices so that their average, over a representative basket of risks, is always within 5% of the average price of a specified competitor over the same basket. The competitor's prices are to be obtained in the open market.

- (i) Discuss the merits of this proposal. [8]
- (ii) Suggest the questions that could be raised in order to refine the proposal. [3]

[Total 11]

- 5** (i) State the factors to consider when selecting an increased limit factor (ILF) curve for a pricing exercise. [5]

A general insurance company needs to price a professional indemnity policy for an accountancy firm. It has two ILF curves, appropriate for accountants. The numerical values of the curves are given in the table below.

<i>\$m</i>	<i>A</i>	<i>B</i>
0.00	0.00	0.00
0.25	0.50	0.40
0.50	0.75	0.70
1.00	1.00	1.00
2.00	1.35	1.50
5.00	2.00	2.50
10.00	2.50	3.50

- (ii) State how the claims distributions underlying curves A and B differ. [1]
- (iii) Suggest reasons why the claims distributions may vary by accountancy firm. [3]

An initial claims analysis of the layer \$0.5m excess of \$1m gives an expected loss cost of \$250,000. The company wishes to obtain the loss cost of a higher layer using the ILFs.

- (iv) Derive, using each curve separately, the expected loss for a \$2m excess of \$6m layer, using linear interpolation where necessary. [3]
- [Total 12]

- 6** (i) Describe the characteristics of Lloyd's syndicates. [4]

A binding authority contract allows a third party (the coverholder) to write a number of risks on behalf of an insurer.

A Lloyd's syndicate writes an annual insurance contract through a binding authority. The contract is due for renewal on 1 June 2012. The following data have been provided:

<i>Year of Account</i>	<i>Premium net of commission</i>	<i>Commission</i>	<i>Incurred Claims</i>
2007	4,230	15%	3,620
2008	4,200	15%	380
2009	5,500	20%	1,020
2010	5,430	20%	1,600
2011	4,640	20%	1,960

Values are in \$000 and are as at 31 March 2012. Premium income is received evenly throughout the year.

The following assumptions have been provided:

<i>Year of Account</i>	<i>Incurred % of Ultimate as at 31 March 2012</i>	<i>Rate Change on Previous Year</i>
2007	87%	
2008	75%	-10%
2009	62%	-5%
2010	45%	0%
2011	25%	5%

where rate change is the change in gross premium, i.e. before the deduction of commission.

- Rate change from 2011 to 2012 is to be zero.
  - The effects of claims inflation can be ignored.
  - The 2012 commission rate will remain at 20%.
- (ii) Derive ultimate loss ratios for each year of account, net of commission and at a 2012 rating level. Use a Bornheutter-Ferguson method for the 2011 year of account with a prior loss ratio (net of commission) of 55%. [10]
- (iii) Estimate the underlying contract ultimate loss ratio, net of commission and at a 2012 rating level. [1]  
[Total 15]

**7** A general insurance company writes pet insurance. This insurance covers the cost of vets' fees for household pets in the event of an accident or illness.

- (i) List the data fields that you would expect to be included within an information system used solely for pricing pet insurance. [5]

The company has recently taken over a book of pet insurance from another insurer and wants to transfer the new rating and administrative data onto its own systems.

- (ii) Describe the problems it might encounter with integrating the data, and the possible consequences. [12]  
[Total 17]

- 8 (i) Describe the features of catastrophe excess of loss reinsurance. [4]
- (ii) State why an insurer might buy this type of reinsurance. [3]

A reinsurance company writes catastrophe excess of loss reinsurance. The relative merits of two different contracts for the same cedant need to be investigated. The cedant has given an output from its catastrophe models. The output shows stochastically generated events, losses to the cedant and the year in which they arise. An extract is given below:

<i>Year</i>	<i>Event No.</i>	<i>Cedant Loss (£m)</i>
.....		
467	954443	20.3
467	954444	3.5
467	954445	0.3
467	954446	13.1
468	954447	15.0
468	954448	50.7
468	954449	32.4
468	954450	2.9
469	954451	11.3
.....		

- (iii) Suggest questions to ask the cedant about this output. [5]

The two alternative proposed layers are:

Layer 1: £5m excess of £10m at a rate on line of 0.2

Layer 2: £20m excess of £10m at a rate on line of 0.12

Both layers have one free reinstatement.

- (iv) Derive the contributions to losses to each layer from each of the years 467, 468 and 469. [4]

Carrying out the exercise on the full event set produces average annual losses as follows:

Layer 1: £0.5m

Layer 2: £0.8m

- (v) Derive:
- (a) the loss ratio of each layer.
- (b) the implied loss ratio of the layer £15m excess of £15m, assuming that pricing is consistent with layers 1 and 2. [2]

Suppose the reinstatement premiums are changed to be paid at 50% of the original premium.

- (vi) Describe how to derive the revised rate on line for layer 1 to maintain the same expected loss ratio.

[3]

[Total 21]

**END OF PAPER**