

# EXAMINATION

17 April 2008 (pm)

## Subject ST3 — General Insurance 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 7 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** Describe the role of the broker in transacting insurance in the London Market. [5]
- 2** You are an actuary who works for a large general insurance company that has been writing personal lines business for many years and that has kept good marketing records. The marketing director has asked you to model the effect on policy sales of changing each of:
- the per policy profit loading and
  - the amount spent on advertising.
- (a) Describe the impact that these two items will have on the company's total profit and
- (b) Explain ways in which a model may be set up to estimate the future profit arising from changes in these two items. [6]
- 3** You are an actuary working on secondment overseas in a country that has no guidance in place for the actuarial profession. A member of your team has asked you about the importance of guidance in your home country.
- (i) State the advantages and disadvantages of having guidance in place. [5]
- You have been asked to draft a formal report on the year-end reserving exercise conducted by your team. The company's board will also review the report. The board consists of non-actuarial members only. You have been asked specifically to include a detailed section on "methodology and assumptions" used.
- (ii) Describe the sub-sections that you would include in the "methodology and assumptions" section. [5]
- (iii) List the other key sections that you would include in a formal reserving report. [2]
- [Total 12]
- 4** Describe how you would project the various components of the existing overall liability outgo for a motor portfolio in each future time period. [13]

- 5**
- (i) State the two definitions of burning cost premium and show how they are linked. [2]
- (ii) You have ten years of premium and individual paid claims development data, gross of reinsurance, for a particular product. Explain the steps you would take to analyse and adjust these data for the purpose of reviewing the risk premium for that product. [13]
- (iii) For a separate project you have claim data for claims reported between 30 September 2006 and 30 September 2007. The average reporting delay is nine months. You are setting the rates for annual policies sold between 1 January 2008 and 30 June 2008. Claims inflation was 3% in 2006, 4% in 2007 and is expected to be 5% in 2008 and 6% in 2009. Using a claim at the mid-point of the periods given, calculate the inflation adjustment needed for the 2008 rating series stating any assumptions made. [4]
- [Total 19]

- 6**
- (i) State the assumptions underlying the Empirical Bayes Credibility Theory (EBCT) Model 1 and Model 2. [4]

$X_1, X_2, \dots, X_n$  are the aggregate claims, or the number of claims, in successive periods for a risk. Let  $a_0, a_1, \dots, a_n$  be the values which minimise the expression:

$$E[(m(\theta) - a_0 - a_1 X_1 - a_2 X_2 - \dots - a_n X_n)^2]$$

where  $m(\theta) = E[X_j | \theta]$

You are given

- $s^2(\theta) = V[X_j | \theta]$
- $E[X_j m(\theta)] = V[m(\theta)] + (E[m(\theta)])^2$
- $E[X_j X_k] = V[m(\theta)] + (E[m(\theta)])^2$
- $E[X_j^2] = E[s^2(\theta)] + V[m(\theta)] + (E[m(\theta)])^2$

- (ii) For Model 1 show that the estimate of  $m(\theta)$  is given by:

$$(1 - Z) E[m(\theta)] + Z \bar{X}$$

where:

$$\bar{X} = \sum_{j=1}^n X_j / n$$

and:

$$Z = \frac{n}{n + E[s^2(\theta)] / V[m(\theta)]} \quad [5]$$

Company A's records show the claim amounts and number of policies from its household book of business over the last 5 years. You are given the corresponding claim amounts and number of policies from company B, as shown below:

<i>Year</i>	<i>Company A</i>		<i>Company B</i>	
	<i>£000's</i>	<i>Policies</i>	<i>£000's</i>	<i>Policies</i>
2003	300	100	300	110
2004	280	90	330	110
2005	310	70	260	90
2006	270	95	310	105
2007	240	78	300	105

- (iii) Using EBCT Model 2 calculate  $E[m(\theta)]$ ,  $V[m(\theta)]$  and  $E[s^2(\theta)]$  and hence the expected claim amount for company A, where  $m(\theta) = E[X_j | \theta]$  and  $s^2(\theta) = P_j V[X_j | \theta]$ . [9]
- (iv) Comment on your results given that using Model 1,  $E[m(\theta)] = 290$ ,  $V[m(\theta)] = 60$ ,  $E[s^2(\theta)] = 700$  and the expected claim amount for company A is £287,000. [1]  
[Total 19]

**7** You are a consulting actuary. You have been asked to review and comment on a client's reserving methodology, and to re-project some of the key classes of business, in order to form a view on the client's year-end reserve figures. The client is a large international company with a variety of classes of business being sold in the US and some countries in Latin America.

After reviewing their methodology you note the following:

- Incurred claims data are used for projections.
  - Projections are performed at a net of reinsurance level.
  - For the Bornhuetter-Ferguson (B-F) method, the expected loss ratio (ELR) is calculated as a rolling average of the ultimate loss ratios, using the chain ladder method, for the previous three accident years.
  - The incurred claims data from the Latin American countries is converted into \$US prior to projecting. Due to concerns of possible hyper-inflation in these countries, only the latest diagonal is adjusted. All previous diagonals are equal to the data in \$US from the previous year reserve calculations. This is done using the latest exchange rates and by converting the movements in paid and outstanding claims only.
- (i) Comment on the advantages and disadvantages of this approach and highlight any recommendations that you would make to the client. [12]

The company is writing some new books of business. For these classes the company has based the latest ELR on the underwriter's view.

- (ii) State the advantages and disadvantages of this approach, again providing any recommendations that you may have. [3]

You have decided to re-project the following data for a motor book of business. You have been told that the claims inflation has been steady at about 5% for each year. You have no information about premium rate increases, but you can approximate this using the increase each year in the average premium per policy.

<i>Year</i>	<i>Earned Premium \$000's</i>	<i>Earned Policy Years</i>	<i>Incurred Claims \$000's</i>	<i>Incurred Cumulative Development Factor</i>	<i>Selected Ultimate Loss Ratio</i>	<i>Selected Ultimate Loss</i>
2002	11,750	1,150	8,765	1.000	75%	8,765
2003	13,000	1,275	10,350	0.960	76%	9,936
2004	12,500	1,125	9,235	0.940	69%	8,681
2005	13,250	1,050	9,500	0.920	66%	8,740
2006	15,250	1,125	11,250	0.975	72%	10,969
2007	17,650	1,265	9,575	1.520		

- (iii) State the key assumption being made when the increase in the average premium per policy is used as the assumed premium rate increase. [1]
- (iv) Calculate the incurred B-F ultimate for the 2007 accident year with the ELR based on the weighted average (by premium) of the last five accident years. [5]

When looking at the summary list of reserves by country and class, you notice that there is a book of business called MisMass. You have not been provided with any data for this class; however from the summary list of reserves you can derive that the reserves have been estimated to be £142m and the discounted reserve figure for this book is £86m.

- (v) Determine the implied Discounted Mean Term (DMT) using a discount rate of 5% per annum and hence comment on what this book of business may contain. [2]

You have requested additional data from the company on MisMass to show how the reserve figures were derived.

- (vi) State what reserving methods would be applicable for projecting the claims data for this book of business, and comment on any limitations of these methods. [3]
- [Total 26]

**END OF PAPER**