INSTITUTE AND FACULTY OF ACTUARIES

EXAMINATION

16 April 2013 (am)

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 10 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.

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1   A general insurance company uses exposure curves to estimate losses on commercial property risks.

Suppose Y is a random variable representing the size of loss as a proportion of the total sum insured (M). The exposure curve is defined as:

$G(x) = LEV(x) / E[Y]$, for $x > 0$, where $LEV(x)$ is the limited expected value function:

$$LEV(x) = \int_0^x (1 - F(y))dy,$$

where $F(y)$ is the cumulative density function of Y.

The following table gives values from an exposure curve that is used to price a commercial property risk with a total value of $1m.

Y	G(y)
2.5%	7.0%
5.0%	14.0%
7.5%	20.0%
10.0%	27.0%
25.0%	56.0%
50.0%	84.0%
75.0%	97.0%

Using this curve, the expected loss to a policy covering the layer $475k in excess of $25k has already been calculated as $10,000.

Calculate the expected loss to the layer $700k in excess of $50k. [3]

2   A general insurance company is considering the introduction of an "early bird" offer for renewals on its existing book of personal lines policies. Renewal is not automatic and the policy will lapse if no instruction to renew is given. Customers who give instruction to renew at least a month before the renewal date would receive a discount from the standard renewal price. The company has no experience of running such an offer.

The company wishes to determine the level of discount to be offered in order to increase the profitability of the book by a target amount over the period of the offer.

Outline the process that the company should follow. [7]

3 The total claim amount payable, S, during a specified period in respect of a block of policies may be expressed as

$$S = X_1 + X_2 \ldots + X_N,$$

where X_i is the claim amount payable during the period in respect of the i-th claim and N is the (random) number of claims during the period.

A general insurance company believes that the number of claims has a Poisson distribution with mean μ and that the individual claim amounts follow a gamma distribution with parameters α and λ.

(i) Derive expressions for the mean and variance of S in terms of μ, α and λ. [2]

The insurer decides to use stochastic simulation to approximate the aggregate claims distribution for S.

(ii) Outline:

   (a) the benefits of simulation, and
   (b) how the simulation would be carried out

[4]
[Total 6]

4 A general insurance company is considering the type of pricing model to build for the following insurance propositions:

(a) A professional indemnity policy for a very recently established firm of architects. The insurer has other large, well-established books of similar business, for which five years of detailed data on past claims experience and exposure are readily available.

(b) A large fleet of chauffeur-driven limousines, for which exposures and claim amounts are aggregated and reported to the insurer in summary form each calendar month.

(c) An inwards reinsurance treaty covering a book of employers' liability policies that has risk-level and aggregate-level deductibles and limits, and a profit commission element.

Discuss, for each of the propositions, whether a frequency/severity or burning cost method would be more appropriate for the purpose of pricing. [8]

5 The pricing team of a general insurance company is about to conduct an exercise to investigate the profitability of recently underwritten motor business. As the claims experience will not yet be mature, it has decided to make use of the reported claim amount recorded on its claims system to give an initial estimate of profitability. The reported claim amount consists of paid claims and case reserves.

(i) Suggest ways in which the company may have determined the level of case reserves to record on its claims system, other than in relation to reopened claims. [4]

During the exercise, it transpires that movements for reopened claims are missing from the data extract, the effect of which is that the latest available claim amount is the amount as at the point of closure.

(ii) Suggest the reasons that a claim may need to be reopened. [2]

(iii) Discuss the impact of using the incomplete dataset for pricing. [4]
[Total 10]

6 A general insurance company writes property business in three divisions:

- household
- small commercial
- large commercial

The company has just purchased outwards catastrophe reinsurance coverage with an excess of £20m. It gives coverage for all three divisions.

(i) Suggest the perils that the catastrophe reinsurance is most likely to cover. [3]

The company wishes to allocate the costs of this layer to each of the three divisions for the purpose of pricing. The underwriter for large commercial properties states that his division should not be allocated any catastrophe reinsurance costs because his maximum limit per claim is £5m, which is well below the £20m excess.

(ii) Comment on the underwriter's opinion. [2]

(iii) Describe how the catastrophe reinsurance cost could be allocated between the three divisions. [4]
[Total 9]

7   A general insurance company is comparing the Classical and Bayesian credibility models for a rating exercise for a particular class of business.

The basic formula for calculating credibility weighted estimates is:

$$Z \times (\textit{Statistic from Observed Data}) + (1 - Z) \times (\textit{Ancillary Statistic}),$$

where $0 \le Z \le 1$.

The Bayesian credibility factor under consideration is:

$$Z_B = \frac{n}{n+k}$$

where n is the number of claims in the class of business in question, and $k > 0$.

Suppose that n_F is the number of claims required for full credibility under the Classical model.

(i)   Show that $k = n_F (n / n_F)^{\frac{1}{2}} [1 - (n / n_F)^{\frac{1}{2}}]$ when the two different credibility curves cross.   [3]

(ii)   Hence, derive a relationship between n_F and k that allows the two credibility curves to cross in the middle of the possible range of credibility.   [3]

The company is considering the ancillary statistic that will receive the complement of credibility, i.e. $(1 - Z)$, for the rating exercise.

(iii)   Discuss the issues that the company should consider when selecting the ancillary statistic.   [6]
[Total 12]

8   (i)   Describe the cover provided by liability insurance.   [3]

A large construction company is reviewing its liability insurance requirements.

(ii)   Suggest, with reasons, the types of liability insurance that the construction company should obtain.   [8]

The construction company is about to commence a project to build a new hotel and is seeking property cover for the duration of the project.

(iii)   Explain:

(a)   why the risk profile for the property cover might not be uniform throughout the lifetime of the policy, and

(b)   how this might be included in the rating process.   [4]
[Total 15]

9 A general insurance company writes professional indemnity insurance for solicitors on a losses-occurring basis.

The company insures a large law firm whose policy is due for renewal soon.

The following data has been provided:

Policy Year	Notified Claims (£000)	Policy Excess (£000)	Limit per Claim (£000)
2008	764	50	150
2009	638	50	150
2010	318	25	100
2011	402	25	100
2012	140	25	100
2013	See below	50	100

Calendar Year	Average Number of Solicitors in Year
2008	210
2009	208
2010	215
2011	214
2012	210
2013	213

The following information has been supplied for the data above:

- All policy years run from 1 July to 30 June.
- There is no aggregate limit on the total amount of claims in a policy year.
- Notified claims are as at 31 March 2013.

The following assumptions apply:

- Claims severity inflation is +5% per year.
- Claims frequency inflation is +2% per year.
- Claims development factors are as in the following table:

Policy Year	Claims Notified as % of Ultimate (as at 31 March 2013)
2008	90%
2009	80%
2010	65%
2011	45%
2012	15%

- The following increased limit factors are applicable to all policy years without the need for adjustments for severity trends:

Limit (£000)	ILF
-	-
25	0.50
50	0.70
100	1.00
125	1.15
150	1.25
200	1.40

Estimate the loss cost for the 2013 policy, showing all workings and justifying any further assumptions that you make. [13]

10 A motorist, who has recently passed her driving test and purchased her first car, has obtained quotes for motor insurance that range from about £600 to over £9,000. She is puzzled about how it can be possible for insurers to provide such different quotes for exactly the same level of cover.

Explain, with examples, the most likely reasons for the wide range of quoted amounts. Your answer should cover the following aspects:

- fundamental uncertainty in the rating basis
- data
- modelling techniques
- adjustments to historic data in the rating basis
- market considerations

[17]

END OF PAPER