

INSTITUTE AND FACULTY OF ACTUARIES



EXAMINATION

01 May 2020 (am)

Subject SP8 – General Insurance: Pricing Specialist Principles

Time allowed: Three hours and fifteen minutes

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 (A) that writes personal lines business has been given the opportunity to acquire a small book of household business from another insurer (B), which is seeking to exit the market.

Describe the potential issues with the data available from insurer B from a pricing perspective. [4]

- 2** (i) Describe aliasing in the context of generalised linear models. [4]

Offsetting can be used as part of the process to remove aliasing from the data.

- (ii) Outline other uses of offsetting in model fitting and assessment. [3]

[Total 7]

- 3** (i) Explain how rating factors help to improve profitability. [2]

- (ii) List six desirable characteristics for a good rating factor. [3]

- (iii) State the key statistical tests used in selecting rating factors for a class of business. [3]

[Total 8]

- 4** The management for a large insurance company is planning to use the following details from the company system in its annual budget process.

<i>Line of business</i>	<i>Proportion of total premium (underwriting year 2020)</i>	<i>Loss ratio (underwriting years 2016–2020)</i>	<i>Expense ratio (calendar year 2020)</i>	<i>Combined ratio</i>
Property	20%	65%	25%	90%
Marine	25%	75%	24%	99%
Casualty	10%	45%	35%	80%
Energy	15%	40%	38%	78%
Motor	30%	80%	20%	100%
Total	100%	66%	26%	92%

- (i) Discuss the suitability of the above statistics for planning premium volumes for underwriting year 2021. [4]

- (ii) Suggest other information the company should consider in planning premium volumes. [4]

[Total 8]

- 5** Compare the data requirements for personal lines motor and motor fleet business. [9]

- 6 (i) Outline the trending used in the frequency-severity method. [3]

A large multinational company has been made aware of a fraud. An employee in their accounts department was contacted by telephone by someone fraudulently claiming to be the Chief Executive. The fraudster advised the employee that he needed to process an urgent and secret payment instruction. The fraudster provided the employee with bank account details and once the employee processed the payment, the fraudster quickly moved the money out of the bank account before it could be stopped or traced.

- (ii) Describe briefly the controls the company can put in place to avoid these types of fraud. [5]

A student actuary has been reading about the increase of ‘deep fakes’, which are artificial intelligence systems capable of generating realistic audio and video communications.

- (iii) Suggest how the risk premium calculated using the frequency-severity method could be affected by ‘deep fakes’. [2]

[Total 10]

- 7 An insurance company insures a portfolio of construction projects. The following table shows the distribution of risks in their portfolio. The largest risk that the company has written has an Estimated Maximum Loss (EML) of \$90 million.

<i>EML range (\$ million)</i>	<i>Number of risks</i>
<5	210
5 to 10	240
10 to 25	140
25 to 50	70
>50	10

The risk officer has expressed concern regarding the high risk in some of the projects. She wants the company to consider a reinsurance arrangement that limits their maximum exposure to \$25 million per risk.

- (i) Determine a suitable structure that would achieve the risk officer's objective using each of the following reinsurance products:

- (a) Quota Share Treaty.
- (b) Surplus Treaty.
- (c) Risk Excess of Loss Treaty.

[3]

- (ii) Explain which of the above products is likely to have the lowest ceded premium.

[2]

A student actuary has made the following comment:

‘A situation where claims regularly exceed the EML on a surplus reinsurance treaty should not matter to the reinsurer because it gets an agreed proportion of the premiums to cover the same proportion of claims. In fact, the reinsurer should be pleased because if the insurer made a higher estimate of the EML, this would have resulted in the reinsurer having to pay an even larger proportion of the claim’.

- (iii) Discuss the student's statement.

[6]

[Total 11]

8 (i) Describe the following pricing models:

- (a) Tariff
- (b) Qualitative
- (c) Cost plus.

[3]

A general insurance company that writes private motor insurance has seen its market share drop over the past 12 months.

(ii) Outline the investigations the insurance company may undertake to understand the reasons for the drop. [4]

A Generalised Linear Model (GLM) may be expressed in matrix form as

$$\mathbf{Y} = g^{-1}(\mathbf{X}\boldsymbol{\beta} + \boldsymbol{\xi}) + \boldsymbol{\varepsilon}$$

(iii) Write down an expression for the linear predictor. [1]

The pricing actuary has built a GLM for the likelihood of premium quotations converting to new business.

(iv) Write down the error distribution and link function that is most appropriate for this GLM. [1]

The actuary has fitted a simple GLM with three factors. The modelling software has produced the following output in respect of the linear predictor estimates:

Base	−4.5966
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<i>Sales channel</i>	
Internet	0.2432
Call centre	0.4112
Broker	0.0000
Other	−0.0650

<i>Age of customer</i>	
<25	−0.0276
25–35	0.0000
35–45	0.3716
45–65	0.5040
>65	1.1585

<i>Age of car</i>	
<2	0.2563
2–5	0.1442
>5	0.0000

(v) Determine the probability of an Internet premium quotation converting to new business for a 20-year-old with a 6-year-old car. [2]

The actuary wants to refine the model with more explanatory factors.

(vi) Suggest six further factors the actuary should consider in their GLM. [3]
[Total 14]

9 A broker arranges financial loss insurance for small businesses.

(i) List four different categories of financial loss insurance. [2]

(ii) Describe the cover provided by each category identified in part (i). [8]

The broker has noticed that the rates have hardened for these covers.

(iii) Suggest possible reasons for the hardening of the rates. [4]

[Total 14]

10 A reinsurance company writes a small portfolio of facultative commercial property risks. The following are the losses from the portfolio over the previous 5 years.

<i>Loss amount (£ million)</i>	<i>Sum insured (£ million)</i>
1.50	8.0
0.45	10.0
5.00	6.0
3.60	6.2
3.51	5.5
1.32	7.7
2.09	6.0
3.13	14.6
1.25	4.2
2.99	6.6

(i) Calculate an empirical exposure curve for the reinsurance company based on these data, using increments of 20% of sum insured. [9]

A property risk underwritten by the reinsurance company is due for renewal with the following expiring conditions:

Sum insured (SI)	£10 million
Expiring quoted premium	2.5% of SI
Expiring deductible	0
Expiring limit	£8 million

The cedant has requested a change in the deductible and limit, as below:

Proposed deductible	£2 million
Proposed limit	£6 million

(ii) Calculate the premium for the proposed structure, assuming other characteristics for the risk are the same. [3]

(iii) Comment on the suitability of the exposure curve for the calculation in (ii). [3]

[Total 15]

END OF PAPER