INSTITUTE AND FACULTY OF ACTUARIES

EXAMINATION

28 September 2021 (am)

Subject SP8 – General Insurance Pricing

Specialist Principles

Time allowed: Three hours and twenty minutes

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

If you encounter any issues during the examination please contact the Assessment Team on T. 0044 (0) 1865 268 873.

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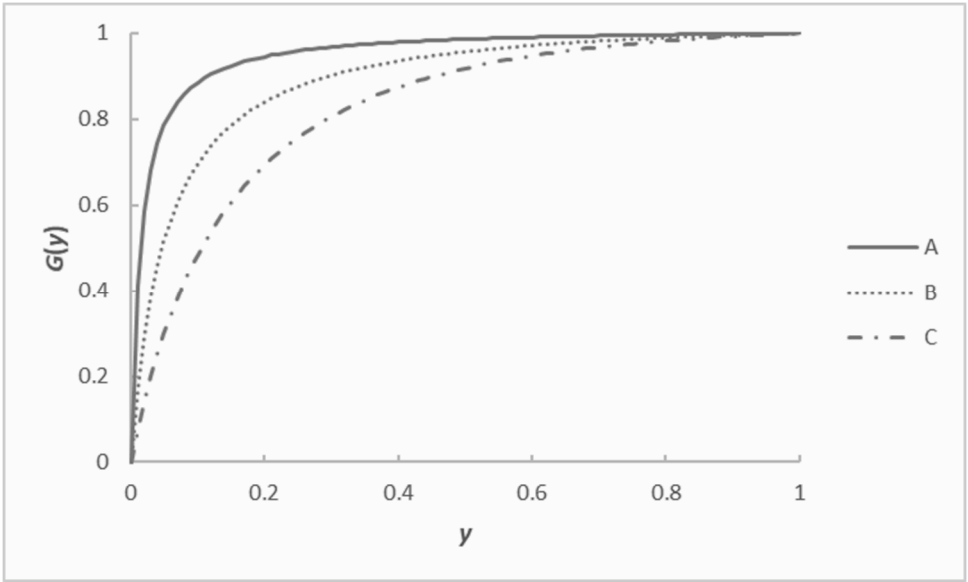
1 (i) Define ‘rate on line’. [1]

An excess of loss reinsurance layer with zero reinstatements is quoted at 5% rate on line.

(ii) Explain how the rate on line would change if one reinstatement is allowed at 100% additional premium. [4]

[Total 5]

2 The following graph shows three market exposure curves that an Actuary has obtained from a Broker**:**



where:

- y is a random variable representing the size of the loss as a proportion of the sum insured.
- $G(y)$ represents the expected losses capped at y as a proportion of total uncapped losses.

(i) Comment on the underlying losses represented by the exposure curves in the graph. [3]

(ii) Discuss how the Actuary may determine the appropriateness of these curves for a pricing exercise. [6]

[Total 9]

3 An insurance company writes a number of lines of business. Some lines cover losses arising from weather-related perils including natural catastrophes, and others do not.

(i) Outline different approaches the Pricing Actuary could take to set the risk premium for the natural catastrophe cover. [3]

The Underwriting Director is concerned about climate change on the lines of business that cover weather-related perils. They have asked the Pricing Actuary to make a risk premium adjustment for these lines of business.

(ii) Outline the factors the Pricing Actuary should take into account in determining an appropriate adjustment. [4]

The Sales Director has stated that climate change should have no impact on the premiums in respect of insurance products that do not cover weather-related perils.

(iii) Suggest why the Sales Director's statement may be incorrect. [3]

[Total 10]

4 A general insurance company is concerned about falling renewal rates in its portfolio of motor insurance policies. The Marketing Manager has proposed introducing discounts for loyal customers with the following structure:

New policy	*Base price*
1st renewal	2% discount to base price
2nd renewal	5% discount to base price
3rd renewal onwards	10% discount to base price

Discuss the Marketing Manager's proposal. [10]

5 (i) Describe how insurance-linked securities work. [3]

A large insurance company is planning to issue catastrophe bonds to manage its exposure to US hurricanes.

(ii) Discuss the factors that should be considered before the company issues any catastrophe bonds. [7]

[Total 10]

6 A large insurance company is concerned about recent media coverage on the rise in harassment cases in the workplace. The Head of Underwriting has indicated that there could be a rise in claim numbers and claim costs.

(i) Describe the insurance products that could be impacted. [7]

(ii) Suggest measures the insurer may take to mitigate the risks to its business. [4]

[Total 11]

7 An insurance company is reviewing the profitability of its construction class of business. The following table shows the ultimate loss ratios for the past 6 underwriting years. The expense ratio has been 30% on average over the same period.

Underwriting year	*Ultimate loss ratio (%)*
2015	85
2016	53
2017	65
2018	46
2019	40
2020	32

(i) Comment on the performance of this class of business. [7]

(ii) Outline how surplus reinsurance may help the insurance company improve its return on capital. [6]

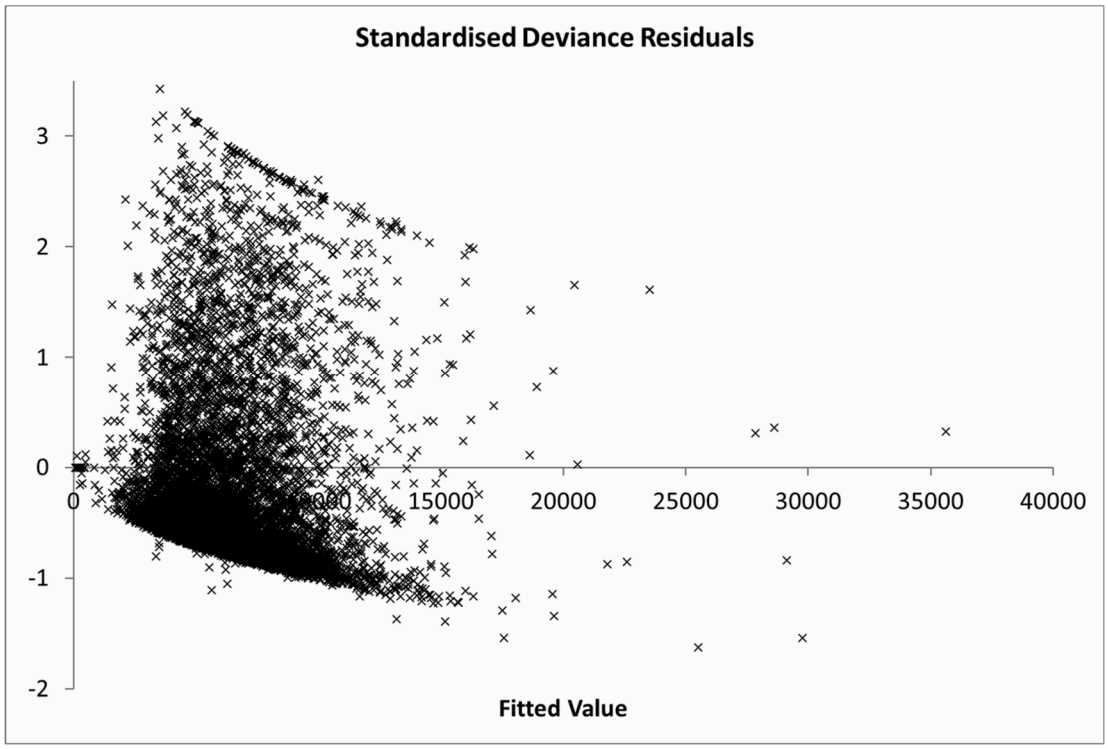
[Total 13]

8 A Pricing Actuary has fitted a Generalised Linear Model (GLM) to the observed burning cost for a portfolio of motorcycle business.

(i) Suggest why the Pricing Actuary may fit a burning cost model. [2]

(ii) Explain why a gamma error structure would not be appropriate for the GLM. [2]

The Actuary has used the fitted model to calculate the residuals for the data on which the model was built. The residual for each observation has been plotted against the fitted value as shown below.



(iii) Comment on the residual plot. [3]

(iv) Describe other uses of residuals in modelling and model assessment. [2]

The GLM has been built using information the insurer has captured from each customer at point of quote. The Underwriting Director has suggested that externally sourced data may prove predictive in the model.

(v) Outline the typical sources of external data and how each could be predictive of motorcycle claims experience. [7]

[Total 16]

9 (i) Outline how a change in policy deductible can affect both frequency and severity of claims. [2]

(ii) Compare the approaches to developing individual loss amounts for use in the frequency-severity method. [4]

(iii) Describe what needs to be taken into account in selecting development factors to be used in the frequency-severity method. [4]

A Student Actuary has the following random sample of five observations from a population:

0.6 0.8 1.0 1.2 1.4

They use the Kolmogorov–Smirnov test for testing the null hypothesis, H_0, that the cumulative density function for the population is:

$$F(x) = 1 - \frac{1}{(1+x)^4}$$

The test statistic is defined as:

$$\max_n \; |F_n(x) - F(x)|$$

where $F_n(x)$ is the empirical distribution function of the sample, size n.

Critical values for the test are:

Level of significance	10%	5%	2.5%	1%
Critical value	$\frac{1.22}{\sqrt{n}}$	$\frac{1.36}{\sqrt{n}}$	$\frac{1.48}{\sqrt{n}}$	$\frac{1.63}{\sqrt{n}}$

(iv) Determine the result of the Kolmogorov–Smirnov test. [6]

[Total 16]

END OF PAPER