

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINATION

19 April 2022 (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.

- 1** An insurance company calculates the ratio of actual premium charged to theoretical premium.
- (i) Explain why the actual premium charged may differ from the theoretical premium. [3]
- (ii) Comment on the use of this ratio to assess the appropriateness of its premiums. [3]
- [Total 6]

- 2** A portfolio of independent risks is divided into Class A and Class B, each containing the same number of risks.
- For each risk in Class A, the number of claims per year follows a Poisson distribution with mean 7.
- For each risk in Class B, the number of claims per year follows a binomial distribution with $n = 5$ and $p = 0.65$.
- A randomly selected risk gave rise to four claims in Year 1, x claims in Year 2 and five claims in Year 3.
- The Bühlmann–Straub credibility estimate for the number of claims in Year 4 for this risk is 4.313182.
- Determine the value of x . [7]

- 3** A reinsurance company is planning to write a quota share treaty covering a small insurer that underwrites marine policies.
- Explain how the pricing may account for:
- (a) large losses.
- (b) investment returns.
- (c) change in cedant business mix.
- (d) profit commission. [8]

- 4** A motor insurance company sells mainly through price comparison websites. The company uses 15 rating factors in its rating model, based on a generalised linear model.

The Regulator has just announced that in 3 months' time, five of the factors in the rating model can no longer be used.

- (i) Discuss the actions the Pricing Actuary could take to make the pricing model compliant with the new regulation. [2]
 - (ii) Explain the implications this new regulation is likely to have on the motor insurance market. [6]
- [Total 8]

- 5** A reinsurance company has been writing only annual contracts, but has been asked to provide a quote for a multi-year reinsurance programme.

- (i) Suggest pricing issues that the reinsurance company's Actuary should consider when modelling the multi-year programme. [6]

The Actuary has modelled the multi-year program and calculated a technical rate.

- (ii) Outline reasons why the market rate for the multi-year feature may differ significantly from the technical rate. [4]
- [Total 10]

- 6 A reinsurer is asked to quote on four facultative excess of loss contracts, each covering one of the following commercial properties.

| <i>Property</i> | <i>Sum insured (\$)</i> |
|-----------------|-------------------------|
| A | 100,000 |
| B | 300,000 |
| C | 600,000 |
| D | 1,000,000 |

The pricing model estimates that the ground-up loss cost for such properties is 1% of the sum insured. The following exposure curve, which assumed unlimited reinstatements, is considered appropriate.

| <i>Limit as % of sum insured</i> | <i>Exposure curve (%)</i> |
|----------------------------------|---------------------------|
| 10 | 50 |
| 15 | 60 |
| 20 | 70 |
| 25 | 75 |
| 50 | 80 |
| 75 | 90 |
| 80 | 95 |
| 85 | 97 |
| 90 | 99 |

- (i) Calculate the expected loss cost for each facultative contract if each loss is subject to an excess of \$150,000 and limit of \$600,000. [8]
- (ii) Comment on how your answer to part (i) may differ if only one reinstatement was allowed. [2]
- [Total 10]

- 7 A personal lines insurance company, Company A, writes motor business. It captures policy and claims data about its customers.

- (i) List the main uses of the data captured by Company A. [4]

Company A has recently acquired the policies from another motor insurance company, Company B. Company A's Pricing Actuary wishes to combine both sets of data from Company A and Company B to build a new set of rating models.

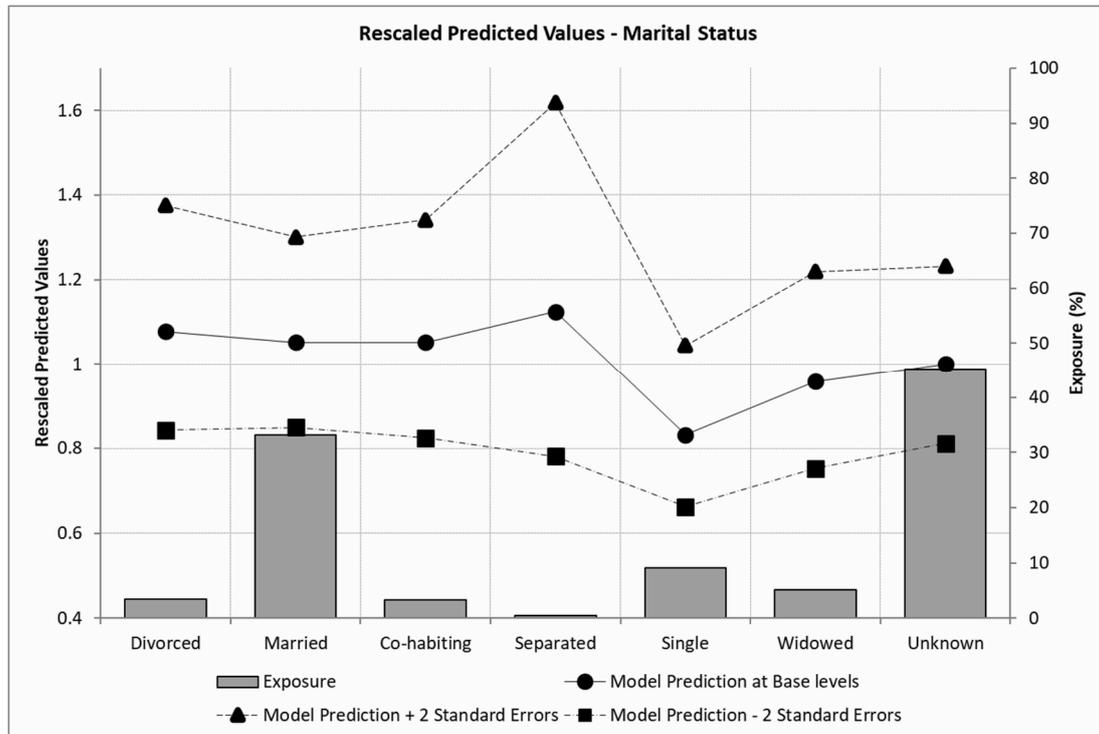
- (ii) (a) Outline the practical difficulties associated with integrating the data for this exercise.
- (b) Propose, with reasons, adjustments that the Actuary may make to address the difficulties identified in part (a).

[8]
[Total 12]

8 An Actuary has fitted a generalised linear model to the accidental damage claim frequency for a book of personal lines motor policies.

- (i) State the error distribution and the link function that would normally be used. [1]
- (ii) Explain why the Actuary is modelling each peril separately. [3]

The Actuary has fitted the factor ‘marital status’, split into seven categories, shown below:



The following information is also available:

| | <i>Model with marital status</i> | <i>Model without marital status</i> |
|-----------------|----------------------------------|-------------------------------------|
| Scaled deviance | 94,093.94 | 94,115.03 |
| AIC | 101,259.30 | 101,275.40 |

- (iii) Determine whether the factor marital status improves the model. [3]

The Actuary uses the model, with marital status fitted, to derive customer premiums.

- (iv) Comment on the appropriateness of marital status, as shown in the chart above, as a rating factor. [5]
- [Total 12]

- 9** ‘Physical climate change risk’ is defined as the risk arising from changing frequency and severity of weather-related events, such as floods and storms. It includes the direct and indirect impacts of such events.

A general insurance company, Company G, writes a variety of products. It is considering the relevance and materiality of physical climate change risk over different timeframes.

- (i) List business decisions that may be affected by physical climate change risk. [5]

‘Transition risk’ is defined as the financial risk arising from the transition of an economy to a state where it is taking action to reduce or eliminate activities that contribute to climate change.

- (ii) Suggest how transition risk may affect Company G’s balance sheet. [8]
[Total 13]

- 10** An insurance company has been approached by the owner of a collection of paper mills to quote for a policy covering property damage to the mills. The insurance company’s underwriter has run the data through the pricing model and has applied a 40% discount to the premium suggested by the model.

- (i) Explain why the underwriter might have applied such a discount. [6]
- (ii) Describe how the insurance company may assess the rate change on this policy. [4]

As well as property damage to the paper mills, the owner has also been considering motor insurance, credit insurance and legal expenses cover.

- (iii) Outline other insurance products, in addition to those listed above, that may be appropriate. [4]
[Total 14]

END OF PAPER