

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINATION

26 September 2011 (pm)

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 nine 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 (i) State the reasons why a general insurance company would use reinsurance. [4]

A general insurance company underwrites an individual commercial property risk with an EML of £21.6m. The risk is reinsured under a surplus treaty with a retention of £3m. The company has recently settled a claim for £24.5m.

- (ii) Calculate the amount that can be recovered under the surplus reinsurance treaty in respect of this claim. [2]

[Total 6]

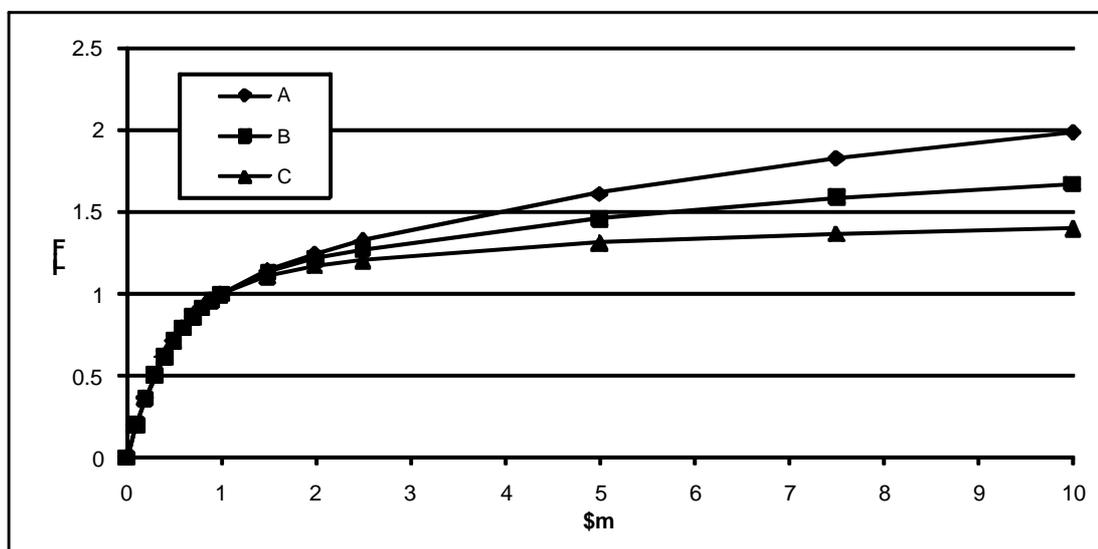
- 2 A general insurance company is reviewing the ILF curves used in its public liability insurance book. A computer model is used to fit the ILF curves to historical claims. The user of the model must input ground up claim records, each of which has the following data:

- Date of loss
- Ground up claim expense, after inflation to current values
- Ground up indemnity amount, after inflation to current values

As part of tort reform, legislation has recently been passed to limit indemnity payments to \$1m.

- (i) Describe how the original claims data should be adjusted before they can be used in the ILF computer model. [2]

Consider the three ILF curves shown below. Curve B arises from the claims before tort reform.



- (ii) Explain which of A and C would be more appropriate after the reform. [2]

[Total 4]

3 A large general insurance company writes product liability business.

The pricing manager would like to know what the true rate change has been between the 2009 and 2010 renewals for a particular product liability policy. The policy has been subject to some significant changes over the year and the pricing manager has asked an underwriter for his view on the rate change.

- (i) State the advantages and disadvantages of relying on this method of determining the rate change. [3]

The pricing manager has asked for a calculation of the rate change for the policy using the premium and cover details given below.

<i>Policy Year</i>	<i>Policy Excess (£)</i>	<i>Policy Limit (£)</i>	<i>Turnover (£)</i>	<i>Line</i>	<i>Coinsurance Share of Premium (£)</i>
2009	100,000	900,000	1,000,000	20%	4,900
2010	500,000	1,000,000	1,500,000	23%	2,700

The policy limit restricts the maximum claim amount to £900,000 in 2009 and £1,000,000 in 2010. There have been no other changes to the risk or cover of the policy from 2009 to 2010 and there are no size-related or experience-related discounts in the price.

The following table of increased limit factors has been provided for use with this policy.

<i>Limit (£)</i>	<i>ILF</i>
100,000	1.000
500,000	2.300
1,000,000	2.750
1,500,000	2.900
2,000,000	3.000

- (ii) Calculate the change in premium rate between 2009 and 2010, ignoring the effects of inflation. [5]
[Total 8]

4 A general insurance company is building an employers' liability pricing model.

Discuss the issues arising in choosing the number of years' past data to use. [8]

5 A Bermudan catastrophe reinsurer specialises in US household exposures.

- (i) List possible perils that could cause large losses to the reinsurer. [2]

The reinsurer wishes to price a hurricane-only policy. The cedant has provided a list of current exposures on the policy, which the reinsurer has put into a catastrophe model. An extract of the output is given below.

<i>Event ID</i> (1)	<i>Loss to policy</i> (2)	<i>Frequency</i> (3)	<i>Expected Loss</i> (4) = (2) × (3)
6531	62,500,607	0.001	62,501
6532	50,000,486	0.002	100,001
6533	12,000,117	0.001	12,000

The total expected annual loss to the policy is calculated by summing column (4).

- (ii) Give reasons, other than the underlying volatility of claims experience, why the total expected annual loss from the catastrophe model may differ from the actual long-term average. [7]

The cedant proposes to issue an Industry Loss Warranty (ILW) as an alternative reinsurance cover, and wishes to use the above catastrophe model output to calculate the expected claims to the proposed ILW.

- (iii) State the other items of data about each event that are required for this purpose. [1]

The proposed ILW has unlimited free reinstatements.

- (iv) Describe how you would model the expected claims to the ILW, with reference to the catastrophe model output in part (ii). [2]
[Total 12]

6 A general insurance company is pricing a professional indemnity annual policy that renews on 1 October 2011. The insured is an actuarial consultancy.

- (i) Give two examples of perils covered by this policy. [1]
- (ii) List possible rating factors for this policy. [2]

The policy is written on a claims-made basis.

- (iii) Compare the cover given on a claims-made basis with that of a losses-occurring basis for this type of policy. [2]

Historical claims and exposure data are to be used to estimate a premium for the 2011 policy.

- (iv) Suggest two exposure measures that do not need to be adjusted to allow for inflation. [1]

The table below shows the historical exposure on a losses-occurring basis by policy year, inflated to the midpoint of the 2011 policy year.

<i>Policy Year beginning 1 October</i>	<i>Inflated Turnover (£m)</i>
2007	82.4
2008	85.7
2009	86.9
2010	90.0
2011 (estimated)	95.0

In order to move to a claims-made basis, the delay table below is used. It implies that, of the claims made in any policy year, 25% of the ultimate claims amount comes from events occurring in that year, 50% from the year before and the remaining 25% from the year before that.

<i>Delay</i>	<i>% of Claims</i>
-2	25%
-1	50%
Current	25%

Exposure for rating on a claims-made basis is to be used.

- (v) Convert the exposure onto a claims-made basis for policy years 2009, 2010 and 2011. [3]

It is now proposed that for policy years 2009, 2010 and 2011, the policy will only cover claims occurring on or after 1 October 2009.

- (vi) Recalculate the claims-made exposure for each of these policy years, stating any assumptions that you make. [3]

[Total 12]

7 A reinsurer is pricing some 2011 quota share contracts.

(i) Describe the characteristics of quota share reinsurance. [3]

The experience of two contracts is as follows:

<i>Year of Account</i>	<i>Ultimate Loss Ratios</i>	
	<i>Insurer A</i>	<i>Insurer B</i>
2008	59%	51%
2009	51%	55%
2010	43%	40%

The loss ratios are ultimate losses / premium net of brokerage.

The following rate changes have been applied for Insurer A:

2008 to 2009	-2%
2009 to 2010	4%
2010 to 2011	5%

(ii) Amend Insurer A's loss ratios for a 2011 rating environment, ignoring the effects of claims inflation. [3]

The company is considering a further contract, for Insurer C. Historical ultimate loss ratios to the contract are shown below. The loss ratios have been adjusted onto 2011 pricing, brokerage and claims levels.

<i>Year of Account</i>	<i>Ultimate Loss Ratio</i>
2000	103%
2001	92%
2002	72%
2003	85%
2004	89%
2005	83%
2006	81%
2007	76%
2008	81%
2009	99%
2010	84%
<i>Mean</i>	86%
<i>Standard deviation</i>	9%

Insurer C wants to include a profit commission on the contract for the first time. Under the profit commission the reinsurer will pay 20% of the profit in the year of account to Insurer C, where the profit is defined by the formula

$$\text{profit} = \text{premium net of brokerage} - \text{expenses} - \text{ultimate losses}$$

Expenses are defined as 30% of premium.

The above loss ratios have a long term average of 86%, which the reinsurer considers to be a reasonable estimate of the 2011 loss ratio before profit commission.

A colleague suggests basing the profit commission load for 2011 on the profit commissions that would be paid historically, based on the above formula and tabulated loss ratios.

(iii) Comment on this suggestion. [3]

Another colleague suggests using a probability distribution to estimate the ultimate 2011 loss ratio. She suggests fitting a Normal distribution, with mean 86% and standard deviation 9%, to the loss ratios given in part (iii).

(iv) Comment on these suggestions. [4]

(v) Calculate the probability of a profit commission being paid under the Normal distribution given in part (iv). [3]

The underwriter points out that the percentage ceded under the contract has doubled from 25% in 2000-2003 to 50% in later years.

(vi) Explain whether this will affect your analysis. [1]

[Total 17]

- 8** A large general insurance company needs to calculate the expected loss costs for a 2011 marine insurance policy, using a frequency-severity model. The insured is a large shipping company.

The following information is available:

- the company has 200 ships and this number has been constant for many years;
- the policy deductible is £100,000;
- the policy is on a losses-occurring basis.

The table below lists every claim reported to date against its policy year of occurrence. The amount of each claim is the current ground up (paid plus outstanding) claim amount.

<i>Policy Year</i>	<i>GU Claims (£)</i>					
2004	7,000	14,000	35,000	25,000	-	-
2005	71,000	90,000	34,000	-	-	-
2006	82,000	55,000	185,000	52,000	-	-
2007	103,000	24,000	4,000	148,000	222,000	-
2008	17,000	196,000	311,000	6,000	579,000	-
2009	408,000	100,000	61,000	41,000	689,000	390,000
2010	74,000	128,000	231,000	219,000	64,000	53,000

- (i) Calculate, for each policy year, the number of claims that exceed the deductible at 2011 price levels. Assume a claims inflation rate of 5% p.a. [3]

The development factors for the number of claims reported, in excess of the deductible, are given in the table below.

<i>Policy Year</i>	<i>Number of currently reported claims (in excess of the deductible) as a percentage of ultimate number</i>
2006 & prior	100%
2007	95%
2008	90%
2009	80%
2010	55%

- (ii) Calculate the ultimate number of claims that exceed the deductible for each policy year. [2]
- (iii) Estimate the expected ultimate number of claims for the 2011 policy year, explaining the rationale for your estimate. [2]

It transpires that the information given on the number of ships was incorrect. In fact, the number of ships has been increasing dramatically over the last 10 years.

- (iv) Outline, without doing any calculations, how this might change the analysis in parts (ii) and (iii) above. [2]

The development factors in part (ii) above were specifically developed for similar shipping companies.

- (v) Explain why the factors might not be appropriate. [2]

- (vi) Suggest two distributions that could be used to model the frequency. [1]

A severity distribution is to be fitted to the trended claims.

- (vii) State a further adjustment that should be made. [1]

The completed model will be used to price a policy with an aggregate limit of £10m. The underwriter then reveals that the insured has just acquired a company with 50 ships, which requires coverage as well. A colleague suggests that the price should be increased by 25%.

- (viii) Discuss the appropriateness of this approach. [6]

[Total 19]

9 A pricing analyst is building a generalised linear model (GLM) to predict the theft claim frequency for a book of household contents policies.

- (i) Write down the structure of a GLM, defining all the terms in the formula. [3]
- (ii) State what is meant by the terms “categorical factor” and “non-categorical factor” in the context of a GLM. [1]
- (iii) Explain how the scaled deviance and Akaike Information Criterion (AIC) statistics can be used to assist with model selection. [4]

The analyst fits an initial model, Model 0, that has a known scale factor and contains several possible rating factors. He then tries two further models, both of which are identical to Model 0 but with one rating factor removed.

Model 1A excludes an “occupied during the day” indicator, which is a two-level factor in Model 0. Model 1B instead excludes “property type”, which is a seven-level factor in Model 0.

The following results are obtained from the analysis.

<i>Model</i>	<i>Scaled Deviance</i>	<i>AIC</i>
0	7003.7	8236
1A	7004.8	8235
1B	7015.0	8241

- (iv) Compare the three models by
 - (a) analysing the significance, at the 5% level, of the rating factors used, and
 - (b) commenting on the results. [6]
- [Total 14]

END OF PAPER