INSTITUTE AND FACULTY OF ACTUARIES

EXAMINATION

30 September 2014 (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 11 questions, beginning your answer to each question on a new page.*

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.

© Institute and Faculty of Actuaries

1 (i) Define the general insurance term *captive*. [2]

(ii) Outline the circumstances under which lighter regulatory capital requirements may apply to a captive. [1]
[Total 3]

2 (i) Describe the cover offered by directors' and officers' liability insurance, giving two examples of the perils covered. [3]

(ii) Define the term *claims made policy*. [1]

(iii) Explain why directors' and officers' liability insurance would usually be written on a claims made basis. [2]
[Total 6]

3 (i) Outline the features of a good rating factor. [4]

(ii) Suggest rating factors that could be used for a travel insurance product. [3]
[Total 7]

4 A general insurance company is quoting for renewal of a large employers' liability policy. The coverage is due to change as follows:

	Excess per claim (€)	*Limit per claim (€)*
Previous underwriting years	10,000	10m
Forthcoming underwriting year	15,000	15m

The company wishes to develop losses from previous underwriting years to their ultimate level and use them in a frequency/severity model for the forthcoming underwriting year, where the new excesses and limits will apply.

Discuss the issues that the company should consider when developing the losses. [8]

5 A reinsurance company is quoting for a property catastrophe reinsurance contract.

When the contract exposures are run through a catastrophe model, the outputs in the table below are obtained. The mean annual loss of £850,000 is also an output from the model. The catastrophe model allows for all losses that can occur under the contract after all policy conditions have been applied.

Occurrence Exceedence Probability	Loss (£)	Aggregate Exceedence Probability	Loss (£)
0.001	6,720,568	0.001	9,079,743
0.002	5,699,379	0.002	8,169,830
0.004	5,209,773	0.004	7,377,621
0.005	5,019,663	0.005	6,906,690
0.01	4,542,104	0.01	5,632,374
0.02	3,850,841	0.02	4,596,968
0.04	3,041,600	0.04	3,979,562
0.1	2,227,807	0.1	2,646,802
0.2	1,100,136	0.2	1,327,115
0.5	129,434	0.5	165,377

The following definitions are used:

- "Gross premium" is the premium charged to the cedant.
- "Net premium" is gross premium net of brokerage.
- "Underwriting profit/loss" is net premium, less expenses and ultimate claims.

Brokerage is 10% of gross premium and other expenses are 15% of net premium.

As well as the cost of claims and expenses, the net premium includes:

- a volatility margin of 8% of the largest individual event loss in a year at the 1-in-100-years level, and

- a charge of 10% of the capital required to be held.

The capital requirement is 70% of the underwriting loss (i.e., the negative profit) that would result from aggregate losses over a year at the 1-in-200-years level.

Derive the gross premium to be quoted for the contract, showing all workings.   [7]

6 A general insurance company specialises in insuring properties in areas that are exposed to hurricanes. It uses catastrophe models that include an event set that is designed to represent 10,000 years' worth of hurricanes.

    (i)   Outline how it is possible to generate such an event set. [3]

Some recent hurricanes have produced large losses to the company, so the company wants to investigate the accuracy of the vulnerability module. It has already investigated the other modules and is satisfied that they are performing adequately.

    (ii)   Define the term *vulnerability module*. [1]

    (iii)   Describe the investigations that would be conducted. [6]
                                                   [Total 10]

7 An insurance industry association classifies private motor cars into one of 50 groups for the purpose of insurance pricing, based on similarity of vehicle characteristics.

    (i)   Suggest factors that may be appropriate for defining this classification. [4]

    (ii)   Discuss the advantages and disadvantages to a motor insurer of using its own vehicle classification, rather than that of the industry association, for pricing motor insurance. [6]
                                                 [Total 10]

8   A pricing analyst is carrying out a burning cost calculation for a property insurance policy.

The following data are available on exposure and claims:

Underwriting year	Sum insured ($m)	Excess per claim ($)	Paid claims ($)	Claims development factor
1	0.5	500	255	1.00
2	0.7	500	170,877	1.00
3	1.0	1,000	-	1.01
4	1.3	1,000	9,001	1.05
5	4.0	4,000	2,553	1.20
6	8.0	4,000	-	1.80
7	6.0	3,000	18,088	2.10

The analyst determines the burning cost as follows:

Underwriting year	Ultimate claims ($)	Ultimate claims per $m sum insured ($)
1	255	510
2	170,877	244,110
3	0	0
4	9,451	7,270
5	3,064	766
6	0	0
7	37,985	6,331
Average		36,998

It is intended that the overall average rate of $36,998 be used as one of the inputs to determine the price for the forthcoming renewal in year 8, when the sum insured and excess are expected to be the same as for year 7.

Discuss the sources of inaccuracy in the analyst's method, suggesting how these could be reduced.   [11]

9 (i) State the advantages and disadvantages of purchasing excess of loss reinsurance. [2]

(ii) Outline the features of aggregate excess of loss reinsurance. [3]

A Lloyd's syndicate insures large industrial plants across the world against fire, storm and flood. The syndicate is due to renew its existing outwards reinsurance contract, which gives catastrophe excess of loss cover for claims arising in the underwriting year. The syndicate has provided the information shown in the table below to its reinsurance broker. The information relates to losses experienced on the contract.

Underwriting year	Event ID	Loss ($m)
2008	ST1-08	10
2008	FL1-08	30
2009	ST1-09	5
2011	FL1-11	20
2011	FL2-11	35
2012	FI1-12	5
2012	ST1-12	2
2012	FI2-12	3

(iii) Set out the further information that is required to price this reinsurance contract. [7]

[Total 12]

10 A linear regression model of pet insurance claim frequencies comprises two independent variables, namely type of pet and age of pet. The model is used to predict annual claim frequencies for cats and dogs. The table below summarises the frequency of claims from a recent dataset.

Claim Frequency

Young cat	34%
Young dog	63%
Old cat	15%
Old dog	70%

The model can be written in matrix form as:

$$\mathbf{Y} = \mathbf{X}\boldsymbol{\beta}$$

where the responses Y_i are independent and Normally distributed with common variance σ^2, $\mathbf{X}$ is the design matrix, and $\boldsymbol{\beta}$ is the vector of parameters.

(i) Specify for the model, assuming a base level of "old cat":

    (a)   the vector of parameters
    (b)   the design matrix, including a row for each of the observations
    (c)   definitions for the columns of the design matrix

                    [4]

(ii) Calculate the predicted values for E[**Y**] by minimising the sum of squared errors, showing all workings. [8]

                           [Total 12]

11 A general insurance company writing mainly motor and household insurance uses generalised linear models to predict the number and cost of claims on policies. The insurer builds separate models for each peril. Each month the pricing department submits a report to the management team showing how actual claims experience in the previous month compares with that predicted by the models.

(i) Explain why such a report should be produced. [4]

(ii) Explain the most likely causes of the differences between actual and predicted experience. [10]

                           [Total 14]

END OF PAPER