Instituto Superior de Economia e Gestão

UNIVERSIDADE TÉCNICA DE LISBOA

DESDE 1911

Master in Actuarial Science

Loss Reserving

07-06-2013

Time allowed: 2 hours

Instructions:

1. This paper contains **6** questions and comprises **4** pages including the title page.
2. Enter all requested details on the cover sheet.
3. You must not start writing your answers until instructed to do so.
4. Number the pages of the paper where you are going to write your answers.
5. Attempt all questions.
6. Begin your answer to each question on a new page.
7. Marks are shown in brackets. Total marks: 200.
8. Show calculations where appropriate.
9. An approved calculator may be used.

You are the actuary of a general insurance company and have been asked to analyse the claim cost of a certain type of insurance. The company has been active in that line of insurance for five years only, and has systematically collected payment data only during the last three years.

This is the data you receive from the company:

Cumulative paid claims

	Valuation date		
Accident year	31.12.2010	31.12.2011	31.12.2012
2008	189	266	324
2009	113	235	293
2010	23	99	152
2011		78	186
2012			54

Accident year	Earned premium
2008	437
2009	463
2010	503
2011	587
2012	659

1. Preparation

   a. Organise the paid claims in an (incomplete) development triangle. [10 marks]

2. Chain ladder method

   a. Estimate the year-on-year development factors for development years 1 to 4. [10 marks]

   b. Assume that claims paid up to development year 4 make up 90% of ultimate claim cost. As a convenience, you may assume that the remaining 10% is paid in development year 5.

      Calculate the development factor for development year 5. [10 marks]

   c. Estimate the payment pattern expressed in percent of ultimate cost. [10 marks]

   d. Estimate the outstanding claim payments for each accident year. [10 marks]

   e. Calculate the estimated ultimate claim cost and the estimated ultimate loss ratio of each accident year. [10 marks]

3. Benktander method

You may use earned premium as a measure of risk exposure.

a. Calculate the average loss ratio using the "Cape Cod" method. [10 marks]

b. Estimate the outstanding claim payments using Benktander's method. Please organize your calculations in a table with the following contents. The columns "Theta" signify the estimated loss ratio for the tail, as estimated by chain ladder (CL), Cape Cod method (BF), and Benktander's weighted average. For each column, please show the formula.

Accident year	Earned premium	Paid claims	Paid proportion	Theta (CL)	Theta (BF)	Theta (Benkt.)	Outstanding payments (Benktander)	Ultimate claim cost (Benktander)	Loss ratio (Benktander)
2008									
2009									
2010									
2011									
2012									
Total									

[20 marks]

4. Projections and discounting

The valuation date is 31.12.12 and the discount rate is 5%.

a. Use the estimated outstanding payments of the Benktander method and the estimated payment pattern to complete the table of projected incremental claim payments. Please show the formula you used.

Incremental paid claims

	Payment year							
Accident year	2010	2011	2012	2013	2014	2015	2016	2017
2008	#N/A	77	58	?				
2009	#N/A	122	58	?	?			
2010	23	76	53	?	?	?		
2011		78	108	?	?	?	?	
2012			54	?	?	?	?	?
Total	#N/A	353	331	?	?	?	?	?

[10 marks]

b. Calculate the discounted value of outstanding claim payments. You may assume that all payments are made at the end of the payment year. [10 marks]

The valuation date is still 31.12.12. Assume that earned premium for 2013 will be 750 and that the expected loss ratio for 2013 is 70%.

c. Calculate the expected nominal value of claims incurring in accident year 2013. [5 marks]

d. Calculate the expected discounted value of claims incurring in accident year 2013. [10 marks]

5. Other information

a. Discuss what other information it could be reasonable to require from the company in order to assess the risk exposure. [10 marks]

b. Discuss what other information it could be reasonable to require from the company in order to assess the tail of payments beyond development year 4. [10 marks]

c. Explain what is meant by the policy attachment conditions "claims incurred" and "claims made". [15 marks]

d. With the data you have received (premiums and claim payments only), will information about the attachment condition of the policies be useful? Please answer yes or no and explain your answer briefly. [10 marks]

6. Generalised linear models

A generalized linear model (GLM) is fully specified by the following three choices: The link function, the covariate structure and the probability distribution.

a. Specify the link function that will provide multiplicative means. [10 marks]

b. Specify a covariate structure that will allow you to estimate a multiplicative model with accident year effects and development year effects. It is sufficient to write down the formula, no matrix is required. [10 marks]

c. Give an example of an probability distribution from the exponential family that could reasonably be used to model claim payments. [5 marks]

d. What probability distribution would you use if your aim was to model claim numbers? [5 marks]