



100  
1911-2011  
ANOS

---

ISEG. 100 ANOS A PENSAR NO FUTURO

Master in Actuarial Science

Loss Reserving

30-06-2011

Time allowed: 2 hours

Instructions:

1. This paper contains 7 questions and comprises 3 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 7 questions.
6. Begin your answer to each of the 7 questions 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 received the following data showing the number of reported claims on 31.12.2005.

Accident year	Reporting delay				
	0	1	2	3	4
2001	126	69	7	4	1
2002	87	58	8	3	
2003	77	45	8		
2004	79	41			
2005	84				

The exposure is shown in the next table.

Accident year	Exposure
2001	5 630
2002	5 124
2003	4 719
2004	3 898
2005	3 575

You may assume that no claims will be reported with a delay of more than four years.

1. Bornhuetter-Ferguson method

- Estimate the delay-specific claim frequencies. [10 marks]
- Estimate the overall claim frequency per accident year. [10 marks]
- Estimate the reporting pattern. [10 marks]
- Estimate the outstanding number of claims for each accident year. [10 marks]
- Fill the missing cells in the run-off triangle with predictions. [10 marks]

2. Chain ladder method

- Estimate the development factors. [10 marks]
- Estimate the reporting pattern. [10 marks]
- Estimate the overall claim frequency per accident year. [10 marks]
- Estimate the outstanding number of claims for each accident year. [10 marks]
- Fill the missing cells in the run-off triangle with predictions. [10 marks]

3. Benktander's method

With claim frequency and reporting pattern from question 1, apply Benktander's method to estimate the outstanding number of claims for each accident year. [20 marks]

4. Explain how you can evaluate the uncertainty of predictions by bootstrapping. [20 marks]

5. Exposure measures

- a. Discuss possible exposure measures in different lines of insurance: motor vehicle insurance, workers' compensation insurance, liability insurance. [10 marks]
- b. Explain why premium not always is a good measure of exposure. [10 marks]

6. Propose methods for smoothing and/or extending the reporting tail beyond delay 4. [10 marks]

7. Outstanding claim categories.

- a. Explain the meaning of the abbreviations RBNS, IBNR and CBNI. [10 marks]
- b. Why are IBNR claims more similar to CBNI claims than to RBNS claims? [10 marks]
- c. Determine the category of each of the following claims on 31.12.2005: [10 marks]
  - Claim A: Accident occurred 31.08.05, claim reported 05.01.06.
  - Claim B: Accident occurred 05.08.05, claim reported 10.08.05.
  - Claim C: Accident occurred 01.02.06, claim reported 15.02.06.