Obligatorisk. Innlevering innen 1. mai, 2006

Merk: Dette skal innleveres i en rapportform der tekniske beregninger legges fram til slutt, for eksempel som appendix. Hoveddelen av rapporten skal inneholde hovedkonklusjoner og hovedantakelser i en form mest mulig lesbar for andre (til og med for selskapets jurister!). Det kan være flere måter å gå fram på metodisk. Du skal bare velge en som er fornuftig. Er det behov for det må valget begrunnes.

I Differentiated pricing

This exercise deals with an automobile portfolio and is, essentially, a real one[1]. The statistical record is of $n = 183999$ rows and is stored as **automobile.txt** which can be downloaded from the web. Each row consists of the following 15 columns

- Column 1: Age
  coding: 0 for 'below 26', 1 =for '26 or above'

- Column 2 Sex
  coding: 0 for ' male', 1 for 'female'

- Columns 3-7: Traffic density
  coding: 00000 for 'highest traffic density'
  10000 for 'next highest'
  01000 for 'third highest
  00100 for 'fourth highest
  00010 for 'next lowest
  00001 for 'lowest'

- Columns 8-12: Driving limit
  coding: 00000 for 'less than 8000km'
  10000 for 'less than 12000 km'
  01000 for 'less than 16000 km'
  00100 for 'less than 20000 km'
  00010 for 'less 25-30000 km'
  00001 for 'unlimited'

- Column 13: Number of claims

- Column 14: Exposure time

- Column 15: Claim size (in NOK)

a) Use Poisson regression to understand the importance of the explanatory variables for claim intensity.

b) The same problem for claim size

c) Suggest a model for differentiated pricing. Outline carefully the interpretation of the regression coefficients.

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[1]Some steps have been taken to change the data slightly from the real example on which this exercise is patterned.

d) Carry out differentiated pricing and report the pure premium for the groups you find relevant to define (if there are many such groups due to cross-classifications, write a program; at least give som examples of differences in prices)

II Capital requirements and reinsurance

A company may cede some of its risk to reinsurer to obtain a suitable spread. Another motive is reduction of the required solvency capital. It is the second aspect that will be analysed here. On average the cedent loses money by reinsuring, but its shareholdes may obtain another advantage: Suppose the company goes up in value over a few years. If its original equity capital is smaller, then the gain per share could be much higher. For a well-run firm this might for the owners more than compensate for the loss from the reinsurance treaties. The question then is how much capital could be saved. Here are two examples.

Part 1

Suppose there are $J = 1000$ policies. Annual claim frequency is 1% for each of them. After the deductibe has been subtracted the size Z of the claims is Gamma distributed with shape parameter $\alpha = 1.5$ and scale parameter $\beta = 1$ million euro. The parameters and the other assumptions are known from experience, and we do not question their validity. There is an upper limit on all the contracts. For a single event no more than 10 million euro is covered. We are assuming that overhead costs are 15% of the pure premium. The premium charged the customers has a 25% loading over the pure one whereas the loading for the reinsurance premium is 20%.

We are considering reinsurance treaties of the layer bxa type where $b = 10$ million euro and the lower limit a is to be varied. Possible values are $a = 1$, $a = 2$, $a = 3$, $a = 5$ and $a = 10$. You are in all cases required to find the pure premium and the solvency capital needed at the 1% level demanded by the Norwegian financial authorities. Also determine the average loss by the ceding company of entering the reinsurance contract. Report on the amount of capital saved by the reinsurance. We are assuming that the company receives premium from each client at the start of the year and likewise pays the insurance premium at that time. These payments are added and subtracted the solvency capital.

Part 2

The firm is thinking ahead and expect to expand its business at the rate of 10% annually over the coming ten years. There is then an inflation rate of 3% on the size of the claims and of the insurance limits too. The company expects to gain 4% interest annually on its cash. Again it wants to examine how much capital it needs to raise in the beginning. The idea is to be certain to avoid asking for *new* capital from investors. The probability for that event is put as low as 1%.

Find out how much capital it needs when you vary the reinsurance coverage as specified above. Also report on its average loss due to the reinsurance.