ACSC/STAT 4703, Actuarial Models II

FALL 2023

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Homework Sheet 7

Due: Thursday 23rd November: 14:30

Basic Questions

1. The following table shows the paid losses (in thousands) on claims from one line of business of an insurance company over the past 5 years.

Accident year	Earned premiums	Development year 0	1	2	3	4
2018	6914	1771	1730	1244	493	592
2019	10659	2658	2651	1818	861	
2020	10698	2502	2897	1917		
2021	16863	3818	4073			
2022	18971	4488				

   Assume that all payments on claims arising from accidents in 2018 have now been settled. Estimate the future payments arising each year from open claims arising from accidents in each calendar year using

   (a) The chain-ladder method

   (b) The Bornhuetter-Ferguson method with expected loss ratio 0.78.

   (c) The Bühlmann-Straub estimate.

2. The file `HW7_data.txt` contains a run-off triangle. An actuary is planning to use the chain-ladder method to estimate future reserves. Test whether losses in different years are correlated, and whether there are any calendar year effects.

3. For the run-off table in Question 1, use Mack's model to estimate the MSE of the estimated outstanding losses.

4. The files `HW7Q4_reported.txt`, `HW7Q4_settled.txt` and `HW7Q4_aggregate.txt` give numbers of claims reported and settled, and aggregate claim amounts for each accident year and development year. By using the chain-ladder method to project number of settled claims, propotions of settled claims and average aggregate losses per claim, estimate the reserves needed.

Standard Questions

5. An actuary is using a Poisson model to analyse the run-off triangle from Question 1.

   (a) Show that the following aggregate losses are within a 0.05 likelihood interval under the Poisson model. (That is, show that the likelihood for these parameter values is at least 0.05 times the maximum likelihood for the data.)

i	μ_i
2018	5830
2019	9026
2020	9119
2021	13540
2022	15885

   (b) For the values in the above table, what is the probability that outstanding claims exceed \$20,000,000?