ACSC/STAT 4703, Actuarial Models II

FALL 2023
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Homework Sheet 6

Due: Thursday 8th November: 14:30

Basic Questions

1. An insurance company has the following previous data on aggregate claims:

Policyholder	Year 1	Year 2	Year 3	Year 4	Year 5	Mean	Variance
1	76.04	5.33	872.93	0.00	0.00	190.860	146419.894
2	5.55	64.77	1421.35	542.52	2140.48	834.934	853717.609
3	33.12	10.10	108.50	0.00	173.90	65.124	5501.682
4	12.78	494.70	1578.16	87.65	32.21	441.100	442838.590
5	1728.19	0.00	2898.65	1570.46	24.30	1244.320	1528521.572

Calculate the Bühlmann credibility premium for each policyholder in Year 6.

2. The file `HW6_data.txt` contains aggregate claim data from 100 policyholders over the past 10 years. Use this data to estimate the book premium and the credibility of 10 years' experience.

3. An insurance company collects the following numbers of claims from five policyholders over a 5-year period.

Policyholder	Year 1	Year 2	Year 3	Year 4	Year 5
1	6	5	4	5	5
2	7	4	5	2	8
3	4	2	3	2	0
4	6	4	5	5	7
5	3	0	2	1	2

The company assumes that the number of claims for each policyholder follows a Poisson distribution. Use Bühlmann credibility to estimate the average number of claims for Policyholder 4 in Year 6.

Standard Questions

4. The file `HW6_data2.txt` contains aggregate claim data from 100 policyholders over the past 10 years. Some policyholders did not purchase insurance in all years. Use this data to estimate the book premium and the credibility of 10 years' experience.

5. Aggregate claims for a given individual policy are modelled as following a Gamma distribution with $\alpha = 4m_i$ and $\theta = R_i$, where R_i is a risk factor for that policyholder that varies between individuals and m_i is the exposure of the individual.

From a dataset of 100 policyholders with different exposures, they find that the total aggregate claim is \$98,236 from a total of 722 units of exposure. They also calculate:

$$\sum m_i^2 = 11,604$$
$$\sum m_i X_i^2 = 16,850,495.1375$$

where X_i is the aggregate claims per unit of exposure for Policyholder i (so $\sum m_i X_i = 98236$). Estimate the EPV and VHM from this data.