ACSC/STAT 4703, Actuarial Models II
Fall 2020

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Homework Sheet 5

Due: Friday 27th March: 11:59 PM

Basic Questions

1. An insurance company sets the book pure premium for its fire insurance at \$488. The expected process variance is 92,063 and the variance of hypothetical means is 56,243. If a company has aggregate claims of \$23,400 on policies covering a total of 36 properties, calculate the credibility premium for this company's next year's insurance using the Bühlmann model.

2. An insurance company has the following data on a Workers' compensation insurance policy for a company.

Year	1	2	3	4	5
Exposure	356	402	550	526	572
Aggregate claims	\$250,201	\$293,114	\$477,136	\$482,150	\$499,300

The book premium is \$960 per unit of exposure. The variance of hypothetical means per unit of exposure is 589,000. The expected process variance per unit of exposure is 18,323,900. Using a Bühlmann-Straub model, calculate the credibility premium for Year 6 if the company has 611 units of exposure.

3. 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	0.00	0.00	2984.19	0.00	0.00	596.838	1781077.99122
2	1401.86	0.00	0.00	5422.18	3521.14	2069.036	5589781.11628
3	0.00	0.00	0.00	512.54	861.47	274.802	156811.77912
4	0.00	597.94	0.00	288.63	488.99	275.112	75379.41947

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

4. An insurance company observes the following numbers of claims from individuals over a seven-year period — that is, the following table gives the number of claims in the past seven years:

No. of claims	0	1	2	3	4	5	6	7	8	9	10
Frequency	1,933	1,788	891	660	491	58	43	46	23	0	1

Assuming the number of claims made by an individual in a year follows a Poisson distribution, calculate the credibility estimate for the expected claim frequency in the following year, of an individual who has made a total of 1 claim in the past 6 years. [Note that this is a different length of history from the individuals in the dataset.]

Standard Questions

5. Aggregate claims for a given individual policy are modelled as following a Pareto distribution with $\alpha = 6$. The first 5 years of experience on this policy are:

Policyholder	Year 1	Year 2	Year 3	Year 4	Year 5	Mean	Variance
1	0.2	17.5	0.4	14.6	1.0	6.74	8.56551
2	1480.6	14.5	970.7	30.9	1873.1	873.96	840.39769
3	700.9	79.9	1417.4	2702.4	1.6	980.44	1118.40544
4	24.7	165.0	0.0	28.0	210.9	85.72	95.33927

   (a) Estimate the EPV and VHM.

   (b) Calculate the credibility premium for policyholder 4 in the next year.

6. Claim frequency in a year for an individual follows a Poisson with parameter Λt where Λ is the individual's risk factor and t is the individual's exposure in that year. An insurance company collects the following data:

	Year 1		Year 2		Year 3	
Policyholder	Exp	claims	Exp	claims	Exp	claims
1	454	5	531	7	450	3
2	617	1	616	2	539	0
3	728	5	651	2	804	3
4	767	2	761	4	832	3

   In Year 4, policyholder 3 has 793 units of exposure. Calculate the credibility estimate for claim frequency for policyholder 3.