

ACSC/STAT 4703, Actuarial Models II

Fall 2018

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Homework Sheet 5

Due: Friday 9th November: 11:30 PM

Basic Questions

1. An insurance company sets the book pure premium for its workers' compensation insurance at \$732. The expected process variance is 54,906 and the variance of hypothetical means is 36,040. If a company has aggregate claims of \$232,700 on policies covering a total of 84 employees, 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 fire insurance policy for a company.

Year	1	2	3	4	5
Exposure	34	42	58	49	54
Aggregate claims	\$34,320	\$29,140	\$47,030	\$42,200	\$43,830

The book premium is \$760 per unit of exposure. The variance of hypothetical means per unit of exposure is 409,000. The expected process variance per unit of exposure is 8,048,600. Using a Bühlmann-Straub model, calculate the credibility premium for Year 6 if the company has 57 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	412.83	1199.65	0.00	22.66	194.77	365.982	244580.86
2	0.00	1416.52	2239.52	0.00	96.68	750.544	1053686.07
3	0.00	0.00	167.69	0.00	563.23	146.184	59624.79
4	0.00	275.90	670.79	0.00	0.00	189.338	86708.91

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

4. Over a five-year period, an insurance company observes the following numbers of claims:

No. of claims	0	1	2	3	4	5	6	7	8	9	10
Frequency	3163	3103	1896	1019	479	206	78	36	13	6	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 3 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 gamma distribution with $\theta = 400$. The first 5 years of experience on this policy are:

Policyholder	Year 1	Year 2	Year 3	Year 4	Year 5	Mean	Variance
1	839	427	36	38	466	361.2	113,454.7
2	256	1,276	496	903	564	699.0	157,557.0
3	146	112	682	557	1,022	503.8	146,161.2
4	524	1,856	2,783	1,438	652	1,450.6	859,036.8

- (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:

Policyholder	Year 1		Year 2		Year 3	
	Exp	claims	Exp	claims	Exp	claims
1	382	1	334	2	376	0
2	670	0	676	3	504	0
3	715	2	665	1	476	2
4	792	0	813	1	619	3

In Year 4, policyholder 1 has 401 units of exposure. Calculate the credibility estimate for claim frequency for policyholder 1.