

ACSC/STAT 4703, Actuarial Models II

Fall 2015

Toby Kenney

Homework Sheet 7

Due: Friday 4th December: 10:30 PM

Basic Questions

1. An insurance company sets the book pure premium for its car insurance premium at \$836. The expected process variance is 342,017 and the variance of hypothetical means is 86,202. If an individual has no claims over the last 6 years, calculate the credibility premium for this individual's next year's insurance using the Bühlmann model.

2. An insurance company has the following data on a group life insurance policy:

Year	1	2	3	4	5	6
No. insured	1,204	1,320	972	1,504	1,670	1,583
No. of deaths	8	3	7	9	11	10

The average mortality rate for the population is 1 death per 100 policies per year. The variance of hypothetical means of deaths per policy is 0.0014. Using a Bühlmann-Straub model, calculate the credibility premium for this group insurance for Year 7.

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

Policyholder	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Mean	Variance
1	0	445	0	0	877	1,198	420	268791.6
2	916	1,533	777	0	0	1,487	785.5	460396.3
3	709	0	0	1,275	924	0	484.6667	314534.3
4	1,910	2,004	3,723	714	1,410	422	1697.167	1383715
5	0	927	0	0	0	0	153.5	143221.5

Calculate the Bühlmann credibility premium for each policyholder in Year 7.

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

No. of claims	Frequency
0	3,935
1	4,108
2	1,420
3	637
4	211
5	94
6	40
7	15
8	4
9	0
10	1

Some customers only had a two-year claim history. Claim frequencies for these customers were:

No. of claims	Frequency
0	670
1	482
2	289
3	104
4	38
5	9
6	2
7	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 4 claims in the past 2 years.

Standard Questions

5. Aggregate claims for a given insurance policy are modelled as following a log-normal, and experience indicates that $\sigma = 1$ is the correct value. The first 4 years of experience on this policy are:

Policyholder	Year 1	Year 2	Year 3	Year 4
1	970	221	703	366
2	282	392	2934	1372
3	213	631	339	551
4	54	2383	252	647

- (a) Estimate the EPV and VHM based on the MLE estimates for each μ . [For a log-normal the MLE is $\hat{\mu} = \frac{\sum_{i=1}^n \log(X_i)}{n}$.]
- (b) Calculate the credibility premium for policyholder 3 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		Year 4	
	Exp	claims	Exp	claims	Exp	claims	Exp	claims
1	45	12	10	6	45	14	14	2
2	27	0	12	0	74	0	27	0
3	10	9	293	149	14	6	13	5
4	10	0	14	3	17	2	6	2

In year 5, policyholder 3 has 64 units of exposure. Calculate the credibility estimate for claim frequency for policyholder 3.