ACSC/STAT 4703, Actuarial Models II
Fall 2017

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Homework Sheet 5

Due: Friday 17th November: 11:30 PM

Basic Questions

1. An insurance company sets the book pure premium for its tennants insurance at \$332. The expected process variance is 8,209 and the variance of hypothetical means is 21,455. 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 marine insurance policy for a shipping company.

Year	1	2	3	4	5
Exposure	455	490	476	532	565
Aggregate claims	\$1,202,000	\$2,760,000	\$5,056,000	\$2,410,000	\$3,280,000

The book premium is \$9,800 per unit of exposure. The variance of hypothetical means per unit of exposure is 1,435,000. The expected process variance per unit of exposure is 42,348,300. Using a Bühlmann-Straub model, calculate the credibility premium for Year 6 if the company has 592 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	6466.54	0.00	0.00	1430.52	1579.41	7847453.93
2	568.29	743.32	600.67	537.46	619.98	613.94	6221.22
3	0.00	590.62	0.00	0.00	0.00	118.12	69766.40
4	260.98	0.00	0.00	530.55	612.01	280.71	82541.30

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

4. Over a three-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	12
Frequency	3401	3146	1787	956	444	174	54	29	4	2	2	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.

Standard Questions

5. Aggregate claims for a given individual policy are modelled as following an exponential distribution. The first 5 years of experience on this policy are:

Policyholder	Year 1	Year 2	Year 3	Year 4	Year 5	Mean	Variance
1	446	208	533	40	25	250.4	53748.3
2	1090	1896	1309	62	361	943.6	544664.3
3	856	74	455	192	521	419.6	93305.3
4	76	203	560	1170	124	426.6	208730.8

   (a) Estimate the EPV and VHM.

   (b) Calculate the credibility premium for policyholder 2 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	432	2	403	2	448	3
2	214	4	270	3	302	6
3	303	0	323	1	317	1
4	515	3	487	2	502	4

   In Year 5, policyholder 2 has 264 units of exposure. Calculate the credibility estimate for claim frequency for policyholder 2.