ACSC/STAT 4703, Actuarial Models II
Fall 2017

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Homework Sheet 4

Due: Friday 3rd November: 11:30 PM

Basic Questions

1. An insurance company sells car insurance. It estimates that the standard deviation of the aggregate annual claim is \$3,691 and the mean is \$725.

   (a) How many years history are needed for an individual or group to be assigned full credibility? (Use $r = 0.01$, $p = 0.95$.)

   The standard premium for this policy is \$725. An individual has claimed a total of \$3,300 in the last 10 years.

   (b) What is the Credibility premium for this individual, using limited fluctuation credibility?

2. A car insurance company classifies drivers as good or bad. Annual claims from good drivers follow a gamma distribution with $\alpha = 4$ and $\theta = 200$. Annual claims from bad drivers follow a Pareto distribution with shape $\alpha = 5$ and $\theta = 6000$. 75% of individuals are good drivers.

   (a) Calculate the expectation and variance of the aggregate annual claims from a randomly chosen driver.

   (b) Given that a driver's annual claims over the past 3 years are \$1,000, \$600 and \$800, what are the expectation and variance of the driver's claims next year?

3. The number of claims made by an individual in a year follows a Poisson distribution with mean Λ, where the value of Λ follows a Pareto distribution with $\alpha = 4.6$ and $\theta = 0.24$. Given that an individual has made three claims in the past 7 years, what is the expected number of claims made in the next year?

Standard Questions

4. For a certain insurance policy, the book premium is based on average claim frequency of 0.3 claims per year, and average claim severity of \$4,030. A particular group has made 130 claims from 987 policies in the last year. The average claim severity was \$7,414. Estimate the credibility premium for this group using limited fluctuation credibility if the standard for full credibility is:

(a) 203 claims for claim frequency, 740 claims for severity.

(b) 1406 policies for claim frequency, 740 claims for severity.

(c) 1721 policies for aggregate claims.

5. An insurance company has 3 years of past history on a driver, denoted X_1, X_2, X_3, X_4. It uses a formula $\hat{X}_5 = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4$ to calculate the credibility premium in the fourth year. It has the following information on the driver:

   - In year 1, the expected aggregate claim was \$2,000.
   - Expected aggregate claims increase by 5% per year.
   - The coefficient of variation of the aggregate claims is 0.7 in every year.
   - The correlation (recall $\text{Corr}(X,Y) = \frac{\text{Cov}(X,Y)}{\sqrt{\text{Var}(X)\,\text{Var}(Y)}}$) between aggregate claims in years i and j is $e^{-|i-j|}$.

   Find a set of equations which can determine the values of α_0, α_1, α_2, α_3 and α_4. [You do not need to solve these equations.]