ACSC/STAT 4703, Actuarial Models II
Fall 2016

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Homework Sheet 6

Due: Friday 18th November: 10:30 PM

Basic Questions

1. An insurance company sells home insurance. It estimates that the standard deviation of the aggregate annual claim is \$6,321 and the mean is \$1,025.

   (a) How many years history are needed for an individual or group to be assigned full credibility? (Use $r = 0.05$, $p = 0.95$.)

   The standard premium for this policy is \$1,025. An individual has claimed a total of \$62,300 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 Pareto distribution with $\alpha = 6$ and $\theta = 4000$. Annual claims from bad drivers follow a Pareto distribution with shape $\alpha = 4$ and $\theta = 5000$. 80% 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 \$8,000, \$3,500 and \$500, 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 Gamma distribution with $\alpha = 4.2$ and $\theta = 0.05$. Given that an individual has made no claims in the past 10 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 0.6 claims per year, and average claim severity of \$2,030. A particular group has made 350 claims from 987 policies in the last year. The average claim severity is \$3,414. Estimate the credibility premium for this group using limited fluctuation credibility if the standard for full credibility is:

(a) 603 claims for claim frequency, 940 claims for severity.

(b) 1106 policies for claim frequency, 940 claims for severity.

(c) 1523 policies for aggregate claims.

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

   - In a given year, the expected aggregate claim is \$800 plus 5% of the value of the car.
   - In a given year, the variance of the aggregate claim is \$800,000 plus 12 times the value of the car.
   - The value of the car is \$19,500 in the first year.
   - The value of the car decreases by 15% 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 $e^{-5\sqrt{|i-j|}}$.

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