

ACSC/STAT 4703, Actuarial Models II

Fall 2018

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Homework Sheet 4

Due: Friday 2nd November: 11:30 PM

Basic Questions

1. An insurance company sells marine insurance. It estimates that the standard deviation of the aggregate annual claim is \$7,603 and the mean is \$1,324.

(a) How many years history are needed for an individual or group to be assigned full credibility? (Use $r = 0.02$, $p = 0.95$.)

The standard premium for this policy is \$1,324. A company has claimed a total of \$48,300 in the last 8 years.

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

2. A workers' compensation insurance company classifies employees as high, medium or low risk. Annual claims from high risk employees follow a Pareto distribution with $\alpha = 4$ and $\theta = 9000$. Annual claims from medium risk employees follow a Gamma distribution with $\alpha = 4$ and $\theta = 500$. Annual claims from low risk employees follow a normal distribution with mean \$1,300 and standard deviation \$900. 25% of employees are high risk, 60% are medium risk and 15% are low risk.

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

(b) Given that an employee's annual claims over the past 4 years are \$6,000, \$50 and \$1,400, what are the expectation and variance of the employee's claims next year?

Standard Questions

3. For a certain insurance policy, the book premium is based on average claim frequency of 2.6 claims per year, and average claim severity of \$7,200. The standard for full credibility is 40 policy years for claim frequency and 110 claims for severity. The insurance company wants to change the standard for full credibility to 45 policy years for aggregate claims. A particular group has 100 claims in 32 policy years of history. For what values of total claims would the change in standards result in an increased premium for this group?

4. Aggregate claims for an individual are believed to follow a gamma distribution with $\alpha = 4$ and θ varying between individuals. For a randomly chosen individual, θ follows an inverse gamma distribution with $\alpha = 3$ and $\theta = 500$. The insurance company uses limited fluctuation credibility with $r = 0.05$ and $p = 0.95$ to determine an individual's premium. If an individual has 8 years of past history, for what value of total claims during these 8 years would the limited fluctuation credibility premium equal the fair premium (using the Bayesian method)?
5. An insurance company has 4 years of past history on a Tennants insurance policy, 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 fifth year. It has the following information on the policy:
- In year 1, the expected aggregate claim was \$300.
 - Expected aggregate claims increase by 3% 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 $\frac{5-|i-j|}{25}$ for all $i \neq j$.

Find a set of equations which can determine the values of $\alpha_0, \alpha_1, \alpha_2, \alpha_3$ and α_4 . [You do not need to solve these equations.]