

ACSC/STAT 4703, Actuarial Models II

Fall 2017

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Homework Sheet 1

Due: Friday 29th September: 11:30 PM

Basic Questions

1. Aggregate payments have a compound distribution. The frequency distribution is negative binomial with $r = 2$ and $\beta = 2.5$. The severity distribution is an inverse gamma distribution with $\alpha = 2.5$ and $\theta = 15000$. Use a Pareto approximation to aggregate payments to estimate the probability that aggregate payments are more than \$150,000.
2. Loss amounts follow a gamma distribution with $\alpha = 5$ and $\theta = 5,000$. The distribution of the number of losses is given in the following table:

Number of Losses	Probability
0	0.08
1	0.31
2	0.39
3	0.22

Assume all losses are independent and independent of the number of losses. The insurance company buys excess-of-loss reinsurance on the part of the loss above \$100,000. Calculate the expected payment for this excess-of-loss reinsurance.

3. An insurance company models loss frequency as binomial with $n = 84$, $p = 0.14$, and loss severity as inverse exponential with $\theta = 20,000$. Calculate the expected aggregate payments if there is a policy limit of \$50,000 and a deductible of \$10,000 applied to each claim.
4. Claim frequency follows a negative binomial distribution with $r = 2$ and $\beta = 8.5$. Claim severity (in thousands) has the following distribution:

Severity	Probability
1	0.2
2	0.5
3	0.18
4	0.07
5 or more	0.05

Use the recursive method to calculate the exact probability that aggregate claims are at least 5.

5. Use an arithmetic distribution ($h = 1$) to approximate a Pareto distribution with $\alpha = 3$ and $\theta = 40$.

- (a) Using the method of rounding, calculate the mean of the arithmetic approximation.
- (b) Using the method of local moment matching, matching 1 moment on each interval, estimate the probability that the value is larger than 20.5.

Standard Questions

- 6. The number of claims an insurance company receives follows a negative binomial distribution with $r = 160$ and $\beta = 14$. Claim severity follows a negative binomial distribution with $r = 5$ and $\beta = 1.2$. Calculate the probability that aggregate losses exceed \$17,000.
 - (a) Starting the recurrence 6 standard deviations below the mean [You need to calculate the recurrence up to $f_s(20,000)$.]
 - (b) Using a suitable convolution.