

ACSC/STAT 4703, Actuarial Models II

FALL 2023

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Homework Sheet 3

Due: Thursday 5th October: 14:30

Basic Questions

1. Loss amounts follow a gamma distribution with shape $\alpha = 2.4$ and scale $\theta = 500$. The distribution of the number of losses is given in the following table:

Number of Losses	Probability
0	0.880
1	0.074
2	0.035
3	0.011

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 \$2,000. Calculate the expected payment for this excess-of-loss reinsurance.

2. Loss frequency follows a binomial distribution with $n = 17$ and $p = 0.36$. Loss severity (in thousands) has the following distribution:

Severity	Probability
0	0.31
1	0.23
2	0.11
3	0.18
4 or more	0.17

Use the recursive method to calculate the exact probability that aggregate claims are at least \$4,000.

3. Use an arithmetic distribution ($h = 1$) to approximate a Gamma distribution with shape $\alpha = 3$ and scale $\theta = \frac{5}{12}$.
 - (a) Using the method of rounding, calculate the mean of the arithmetic approximation. [You can evaluate this numerically: use 5,000 terms in the sum.]
 - (b) Using the method of local moment matching, matching 1 moment on each interval, estimate the probability that the value is larger than 6.5.

Standard Questions

4. The number of claims an insurance company receives follows a compound Poisson distribution with $\lambda = 2548$ for the primary distribution and $\lambda = 0.7$ for the secondary distribution. Claim severity follows a negative binomial distribution with $r = 0.2$ and $\beta = 12$. Calculate the probability that aggregate losses exceed \$6,000.
 - (a) Starting the recurrence 6 standard deviations below the mean [You need to calculate 15,000 terms of the recurrence for f_s .]
 - (b) Using a suitable convolution.