ACSC/STAT 4703, Actuarial Models II

FALL 2024

Toby Kenney

Homework Sheet 3

Due: Thursday 3rd Octomber: 11:30

Basic Questions

1. Loss amounts follow a gamma distribution with shape $\alpha = 3.4$ and scale $\theta = 700$. The distribution of the number of losses is given in the following table:

Number of Losses	Probability
0	0.750
1	0.114
2	0.085
3	0.051

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 \$7,000. Calculate the expected payment for this excess-of-loss reinsurance.

2. Loss frequency follows a negative binomial distribution with $r = 7$ and $\beta = 0.25$. Loss severity (in thousands) has the following distribution:

Severity	Probability
0	0.44
1	0.27
2	0.11
3	0.09
4 or more	0.09

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 Burr distribution with $\alpha = 3$, $\gamma = 2$ and $\theta = 1$.

(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 4.5.

Standard Questions

4. The number of claims an insurance company receives follows a compound Poisson-negative binomial distribution with $\lambda = 2099$ for the primary distribution and $r = 0.7, \beta = 1.3$ for the secondary distribution. Claim severity follows a Poisson distribution with $\lambda = 5$. Calculate the probability that aggregate losses exceed \$10,000.

   (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.