ACSC/STAT 3703, Actuarial Models I

WINTER 2025
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Homework Sheet 6

Due: Thursday 20th March: 14:30

Note: This homework assignment is only valid for WINTER 2025. If you find this homework in a different term, please contact me to find the correct homework sheet.

Basic Questions

1. Let X follow a negative binomial distribution with $r = 2.5$ and $\beta = 3.1$. What is the probability that $X = 5$?

2. The number of claims on each insurance policy over a given time period is observed as follows:

Number of claims	Number of policies
0	423
1	486
2	561
3	412
4	183
5 or more	107

   Which distribution(s) from the $(a, b, 0)$-class and $(a, b, 1)$-class appear most appropriate for modelling this data?

3. X follows an extended modified negative binomial distribution with $r = -0.5$ and $\beta = 1.7$, and $p_0 = 0.6$. What is $P(X = 4)$?

4. Let X follow a mixed negative binomial distribution with $\beta = 0.5$ and r following a gamma distribution with $\alpha = 3$ and $\theta = 0.7$. What is the probability that $X = 3$?

Standard Questions

5. A random variable X is assumed to have distribution in the $(a, b, 1)$-class. The probability mass function satisfies the equations

$$P(X = 5) = 3P(X = 3)$$
$$P(X = 6) = 2P(X = 4)$$

What is the largest possible value of $P(X = 7)$?

6. If we extend the $(a, b, 0)$ class to a class satisfying the recurrence $p_n = \left(a + \frac{b}{n} + \frac{c}{n(n+1)}\right) p_{n-1}$, what values of a, b and c give rise to valid discrete distributions?