STA 2495 Non-Life Insurance Mathematics

Continuous Assessment Test **Time 1 hour**

Instructions: Attempt as many questions as possible, BUT the more the better!!

1. Outline the process of retention setting in non-life insurance companies.

2. Briefly discuss the commonly used continuous distributions for modelling individual claim sizes.

3. If $X_1 \sim Poisson(\lambda)$ and $X_2 \sim Poisson(\mu)$ are independent random variables, find the probability function of $Z = X_1 + X_2$ using convolutions.

4. Let K be the number of claims on a risk in one year. Suppose claims $\{X_1, X_2, ...\}$ are independent, identically distributed random variables, independent of K. Let Z be the total amount claimed.

   (a) Derive $E(Z)$ and $var(Z)$ in terms of the mean and variance of K and X_1

   (b) Derive an expression for the moment generating function $M_Z(t)$ of Z in terms of the moment generating functions $M_X(t)$ and $M_K(t)$ of X_1 and K respectively.

   (c) If K has a Poisson distribution with mean λ, show that:

   $$M_Z(t) = \exp(\lambda(M_X(t) - 1))$$

   (d) If K has a binomial distribution with parameters m and q, determine the moment generating function of Z in terms of m, q and $M_X(t)$.

5. The distribution of the number of claims from a non-life insurance business class is negative binomial with parameters $k = 4$ and $p = 0.9$. The claim size distribution is Pareto with parameters $\alpha = 5$ and $\lambda = 1,200$. Calculate the mean and variance of the aggregate claim distribution.