Poisson Worksheet Version 1.1 **STAT 50 - Prof. Fitzgerald**

- The Probability Mass Function (PMF) for $X \sim \text{Poisson}(\lambda)$ is

$$f(k) = e^{-\lambda}\frac{\lambda^k}{k!}$$

1. Which of the following data generating processes could be modeled with a Poisson distribution? Why?
   (a) The count of individuals infected with COVID-19 arriving during a particular minute at SMF airport security checkpoint to board a plane.

   (b) The count of individuals infected with COVID-19 arriving at SMF in a particular minute on a plane.

   (c) The number of fleas on a dog.

   (d) The number of lottery winners.

   (e) The length of a part in manufacturing.

2. Suppose that in normal traffic conditions, vehicles enter the I50 on ramp at a rate of 10 vehicles per minute, with arrival times following a Poisson distribution.

   (a) What's the probability that exactly 10 vehicles enter the onramp in a given minute?

   (b) What's the largest value of k such that the probability that k or fewer cars arrive is less than 0.01?

   (c) Suppose that the vehicles on the onramp join the freeway where 1500 vehicles per hour pass on average, following a Poisson distribution, and this flow is independent of the onramp traffic. What's the probability that no cars are on the freeway after the on ramp for a 10 second period?

3. Let $X \sim \text{Poisson}(\lambda)$.

   (a) Let k be a positive integer. Show

$$\frac{P(X = k)}{P(X = k-1)} = \frac{\lambda}{k}$$

   (b) Show

$$\mu_X = \lambda.$$

   (c) Let $Y \sim \text{Poisson}(\kappa)$, and X, Y be independent. Show

$$X + Y \sim \text{Poisson}(\lambda + \kappa).$$