1. Compute the mean and variance of the Poisson and Gamma distributions.

2. Let $X$ and $Y$ be independent (unit exponential) random variables with respective density functions

$$f_X(x) = e^{-x}, x > 0 \quad \text{and} \quad f_Y(y) = e^{-y}, y > 0.$$ 

Find the cumulative distribution and probability density function of $Z = Y/X$.

3. Let $X_1, \ldots, X_n$ be a sample of iid variables, with $X_i \sim Exp(\theta)$ so that its density is $f(x) = \theta e^{-\theta x}, x > 0$.

   a. Use problem 1 to show that $E(X_i) = 1/\theta$.

   b. Is $\bar{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$ an unbiased estimator of $1/\theta$? Is it consistent?

   c. Is $1/\bar{X}$ unbiased for $\theta$? Is it consistent?