Homework 3

1. Suppose that I make an average of 3 mistakes per class. What is the PMF of X, the number of mistakes I will make next class? What is the probability that I will make at least one mistake?

2. A transmitter sends out either a 1 with probability p or a 0 with probability $1-p$, independently of earlier transmissions. If the number of transmissions within a given time interval has a Poisson PMF with parameter λ, show that the number of 1's transmitted in that same time interval has a Poisson PMF with parameter $p\lambda$.

3. A particular professor is known for his arbitrary grading policies. Each paper receives a grade from the set $\{A, A-, B+, B, B-, C+\}$ with equal probability, independent of other papers. How many papers do you expect to hand in before you receive each possible grade at least once?

4. Suppose that X is a normal random variable with mean 5. If $P(X > 9) = 0.2$, approximately what is $var(X)$?

5. Suppose that the height (in inches) of a 25-year old male living in Baltimore is a normal RV with mean 71 and variance 6.25. What percentage of 25-year old men in Baltimore are over 6 feet tall? What percentage of Baltimore 25-yr-old men who are taller than 6 feet are taller than 6 feet, 6 inches?

6. Show that the exponential distribution is memoryless. That is, show that $P(X > s + t \mid X > t) = P(X > s)$.

7. Show that Beta distribution family is an exponential family when:

   (a) α is a known constant and β is the only unknown parameter;

   (b) α is the only unknown parameter and β is constant;

   (c) both α and β are unknown parameters.