MATH 10B
Section 205
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Student:
SID:
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Quiz 7 Solution

True/False - No explanation needed. (For each: 1 point if correct, 0 points if not answered, -1 points if incorrect)

1. X is a Poisson random variable and Y is a geometric variable counting the number of failures. X and Y have the same range. True/False

   True. In both cases the range is $\{0, 1, 2, \ldots\}$

2. The St. Petersburg Paradox proves that the expectation of a random variable does not have to be finite. True/False

   True. This is an example of a problem with infinite expectation.

Problems - Needs justification.

1. Out of the $50,000$ people in Hoboken, we expect there to be 10 werewolves.

   (a) Use **two different** probability distributions to estimate the PMF function of X, where X is the number of werewolves in Hoboken. You only need write a formula, not calculate the actual value.

   (b) Do you expect the PMF functions to be close to each other or not? Why?

   (10 points)

   a) First way is binomial. The expectation of the binomial distribution is np, so p must be $\frac{10}{50,000} = \frac{1}{5,000}$. Therefore the PMF is

   $$P(X = k) = \binom{50,000}{k}(\frac{1}{5,000})^k(\frac{4,999}{5,000})^{n-k}$$

   Second way is Poisson. Here we're given $\lambda = 10$, so

   $$P(X = k) = \frac{10^k e^{-10}}{k!}$$

   b) We expect these functions to be close, as the Poisson approximates the binomial if p is small and n is large.