

STAT/MA 41600
In-Class Problem Set #37 part 2: November 17, 2014

- 1.** If X and Y are two independent Gamma random variables that each have parameters $r = 500$ and $\lambda = 5$, find the probability that X and Y differ by 3 or more. In other words, find $P(|X - Y| \geq 3)$.
- 2.** If X and Y are two independent Negative Binomial random variables that each have parameters $r = 100$ and $p = 4/5$, find the probability that X and Y differ by 3 or more. In other words, find $P(|X - Y| \geq 3)$.
- 3.** If X and Y are two independent Poisson random variables that each have parameters $\lambda = 800$, find the probability that X and Y differ by 25 or more. In other words, find $P(|X - Y| \geq 25)$.
- 4.** Suppose that X is a Binomial random variable with $n = 20,000$ and $p = 1/2500$.
 - 4a.** Find a Poisson approximation for $P(X \geq 5)$.
 - 4b.** Find a Normal approximation for $P(X \geq 5)$.
- 5.** During a 365-day year, Alain looks for rain every day. Each day, Alain estimates that there is rain with probability $1/4$, and that the chances on separate days are independent. Similarly, in a different city, Brent looks for rain every day. His chances of rain are also assumed to be independent from day to day, and are independent from Alain's chances; he has an estimated chance of $1/5$ rain on a given day. Let X and Y denote the number of rainy days seen by Alain and Brent during the year, respectively.
 - 5a.** Write an exact expression of $P(X > Y)$. You do not need to evaluate the expression.
 - 5b.** Find a good estimate for $P(X > Y)$.
- 6.** Assume that U_1, \dots, U_{800} are independent continuous random variables that are each Uniformly distributed on $[0, 6]$. Also assume that X is a Normal random variable, independent from the U_j 's, with $\mathbb{E}(X) = 2500$ and $\text{Var}(X) = 900$. Find a good estimate for $P(X > U_1 + \dots + U_{800})$.