STAT/MA 41600
In-Class Problem Set #17: September 26, 2016

1. A political company calls people to see whether they plan to watch the Clinton/Trump debate tonight. Suppose that each person they talk to has an 80% chance of watching the debate, and that these decisions are independent, from person to person. They continue making such calls *until they have found 10 people who plan to watch the debate.*
1a. Find the probability that they need to call 12 or more people, to achieve their goal.
1b. Given that they need to call 12 or more people, what is the probability that they need to call 14 or more people?
1c. What is the expected number of people that they need to call?
1d. What is the variance of the number of people that they need to call?

2. Let $X_1, \ldots, X_4$ be independent Geometric random variables, each with expected value $5/2$. Let Y be a Negative Binomial random variable, with $r = 4$ and $p = 2/5$. Let $Z = 4X_1$.
2a. Find $\mathbb{E}(X_1 + \cdots + X_4)$ and $\mathbb{E}(Y)$ and $\mathbb{E}(Z)$.
2b. Find $\mathrm{Var}\,(X_1 + \cdots + X_4)$ and $\mathrm{Var}\,(Y)$ and $\mathrm{Var}\,(Z)$.

3a. In the previous problem set (on Geometric random variables), question #1, let U denote the number of Rhonda's rolls, and let V denote the number of Bernadette's rolls. Is $U + V$ a Negative Binomial random variable? If so, what are the parameters? If not, then why not?
3b. Suppose that (independently of Rhonda and Bernadette) another student named James rolls a 6-sided die until the first occurrence of "6" and then he stops afterwards. Let X denote the number of Rhonda's rolls plus the number of James's rolls. What is the probability mass function of X?

4. Review question: Suppose that Geraldine flips a fair coin until she gets her first occurrence of heads, and then she stops afterwards. Let X denote the number of flips.
4a. Find the probability that X is an even number.
4b. Find the probability that X is a multiple of 3.
4c. Find the probability that X is a multiple of 4.
4d. Can you generalize? If n is a fixed positive integer, find the probability that X is a multiple of n.