Week 3 - Discussion

Problem 1. In this problem, you will learn how to show the mean of a geometric random variable by R code or theoretical proof.

- a. In R, you can use function rgeom(n, p) + 1 to generate a value from $X \sim \text{Geom}(p)$. Apply rgeom(10000, 0.2) + 1 to generate a vector, can you verify the probability of X = 2 is around 0.16 for $X \sim \text{Geom}(0.2)$?
- b. Take advantage of $rgeom(\cdot)$ function. How can you check the expected value of $X \sim \text{Geom}(0.2)$?
- c. For $X \sim \text{Geom}(p)$, write down the expression of E(X) and (1-p)E(X), can you derive the $E(X) = \frac{1}{p}$ using these two series?

Problem 2. Assume you play a game of chance that you can either win or lose. The probability of losing is 0.16.

- If you play 10 games, let X be the total number of games you win.
- a. Find the probability that you win 4 times.
- b. Draw the scatter plot of the probability of $X = x, x \in \{0, 1, 2, 3, ..., 10\}$ in R through the $plot(\cdot)$ function.

Let Y be the number of games you play until you lose.

- c. Find the probability of winning consecutive 5 times, and you loss at the 6th time.
- d. Draw the scatter plot of the probability of $Y = y, y \in \{1, 2, 3, ..., 10\}$ in R through the $plot(\cdot)$ function.