I. **Sections to Read** (All content from Blitzstein and Hwang's *Introduction to Probability* unless otherwise noted)

- 7.1 (Focus on the first part on discrete r.v)

II. **Videos to Watch** (All videos from Blitzstein's Math 110 YouTube channel, unless otherwise noted)

- Lecture 18: MGFs continued (from 26:00 to end)

III. **Objectives**

- State the definition of the joint CDF of two or more random variables.
- Calculate the joint PMF given marginal and conditional PMFs of discrete random variables, and vice verse, both explicitly as functions and using contingency tables.
- Construct two-way tables for a pair of discrete random variables.
- Determine whether two or more r.v are independent by analyzing their joint, conditional and marginal distributions.

IV. **Quiz Questions** (Submit answers on Gradescope)

1) The textbook's definition of the marginal PDF of X is reminiscent of a certain 'Law' we encountered much earlier in the course. What is the name of this law, and what is the relationship between the law and this definition?
2) Suppose you know that the marginal distribution of X is $\text{Bin}(5, \frac{1}{2})$ and that the marginal distribution of Y is $\text{Bin}(10, \frac{1}{2})$. Find the joint distribution of X and Y, or explain why there is not enough information to do so.
3) Suppose $N \sim \text{Geom}(p)$ and $K \sim \text{Pois}(\lambda)$ and that the joint PMF for (N, K) is

$$p(n,k) = \frac{(1-p)^n p \lambda^k}{k! e^{\lambda}}.$$

Explain how you can tell that N and K are independent without calculating their conditional distributions.