I. **Pre-class material** Either read the indicated textbook sections OR watch the indicated video.

(a) **Sections to Read** (All content from Blitzstein and Hwang's *Introduction to Probability* unless otherwise noted). A digital copy of the textbook is available for free via the authors' website.

- 7.1 (Just part 7.1.1 on Discrete Variables)

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

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

II. **Objectives** (By the end of the day's class, students should be able to do the following:)

- 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.

III. **Reflection Questions** (Submit answers on Gradescope `https://www.gradescope.com/courses/425901`)

1) The textbook's definition of the marginal PMF 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 the definition of the marginal PMF?
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 immediately tell that N and K are independent without any calculation.

IV. **Additional Feedback** Are there any topics you would like further clarification about? Do you have any additional questions based on the readings / videos? *If not, you may leave this section blank.*