Pre-class preparation

Please read the following textbook sections from Blitzstein and Hwang's *Introduction to Probability* (second edition) OR watched the indicated video from Blitzstein's Math 110 YouTube channel:

- Textbook: Sections 9.2-9.3, and skim 9.4
- Video:
  - Lecture 26: Conditional Expectation Continued (from 29:00 to end)
  - Lecture 27: Conditional Expectation given a R.V (from beginning to 30:00)

Objectives

By the end of the day's class, students should be able to do the following:

- Use properties of conditional expectation to compute the conditional expectation of a variable given another in a variety of situations.
- State and prove "Adam's Law".
- Distinguish between conditional expectation given an event, and conditional expectation given a random variable.

Reflection Questions

Please submit your answers to the following questions to the corresponding Canvas assignment by 7:45AM:

1. Let X and Y be discrete random variables. Describe at least one key difference between the expressions $\mathbb{E}[Y|X = x]$ and $\mathbb{E}[Y|X]$.
2. Suppose X and Y are random variables. Under what circumstances is $\mathbb{E}[X|Y] = X$? Under what circumstances is $\mathbb{E}[X|Y] = \mathbb{E}[X]$?
3. Suppose X and Y are random variables (not necessarily independent). In your own words, explain how conditional expectation allows us to decompose Y into a sum of two variables, one of which is a function of X and the other which is uncorrelated with X.
4. (Optional) Is there anything from the pre-class preparation that you have questions about? What topics would you like would you like some more clarification on?