

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.

- 9.5, 9.6

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

- Lecture 27: Conditional Expectation given a an R.V (from 30:00 to end)

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

- State the definition of Conditional Variance.
- Use Eve's Law to compute conditional variance.

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

- 1) Suppose X and Y are random variables. What is one circumstance where X **is not** a constant random variable, but where $\text{Var}(X|Y) = 0$?
- 2) Let $N \sim \text{Bin}(n, p)$ and for each $1 \leq k \leq n$, let $X_i \sim \text{Bern}(1/2)$ independently of each other, as well as of N . Define a variable S by $S = X_1 + X_2 + \cdots + X_N$ (that is, S is a variable containing a random sum of the variables $X_1, \dots, X_n$). Explain what is wrong with the following argument:

$$E[S] = E\left[\sum_{k=1}^N X_i\right] = \sum_{k=1}^N E[X_i] = \sum_{i=1}^N \frac{1}{2} = \frac{N}{2}.$$

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.*