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 7.2 and 7.3

- Video:

    - Lecture 20: Multinomial and Cauchy (from beginning to 8:00)
    - Lecture 21: Covariance and Correlation (from beginning to 33:00)

Objectives

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

- State and apply 2D (and higher dimensional) versions of LOTUS

- Compute the covariance of a pair of random variables, and prove properties of covariance.

- Calculate the correlation of a pair of random variables and interpret its value as the strength of a linear relationship.

- Determine the variance of certain random variables by computing appropriate covariances.

Reflection Questions

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

1. Suppose X and Y are (not necessarily independent) Bernoulli($1/2$) variables, and let $p = P(X = 1, Y = 1)$. Use 2D LOTUS to express $E[XY]$ in terms of p.

2. Determine whether each of the following statements are true or false. Briefly justify your answer by citing the relevant property of Variance or Covariance from section 7.3.

    (a) $\text{Var}(X + X) = \text{Var}(X) + \text{Var}(X)$.
    (b) $\text{Cov}(X, X + 5) = \text{Var}(X)$.
    (c) If X and Y have $\text{Cov}(X, Y) = 0$, then X and Y are independent.
    (d) If X and Y are independent and both have variance 1, then $\text{Var}(X - Y) = \text{Var}(X) - \text{Var}(Y) = 0$.

3. (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?