Pre-class preparation

Please watch the following video OR the following textbook sections from Blitzstein and Hwang's *Introduction to Probability* (second edition):

- Video: Inequalities
- Textbook: 10.1, starting at section 10.1.3 (skip content about Chernoff)

Objectives

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

- Prove the Markov inequality, then derive the Chebyshev inequality from Markov's inequality.
- Apply the Markov and Chebyshev inequalities to find upper bounds on probabilities for random variables.
- Understand how Chebyshev inequality is useful for understanding the behavior of the sample mean.

Reflection Questions

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

1. What is one circumstance where the Markov inequality can be used to estimate $P(|X| > a)$, but where the Chebyschev inequality cannot be used. *Hint: Think about what the assumptions made for the Chebyshev inequality, and compare to the assumptions made for the Markov inequality.*
2. Assume $X_1, X_2, \ldots$ are an iid sample of random variables with finite mean μ and variance σ^2. Using Chebyshev's inequality, what is an upper bound of the probability that the sample mean $\bar{X}_n = \frac{1}{n}\sum_{i=1}^{n} X_i$ is more than 2 standard deviations away from its mean? What is the interpretation of this probability as n gets larger?
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?