Pre-class preparation

Please read the following textbook sections from Degroot and Schervish's *Probability and Statistics* (fourth edition) or watch the video, as indicated:

- Video: `https://expl.ai/KGHGEYX`; and

- Textbook: Section 12.6 (just pages 839 - 840; the section titled **Introduction**). *Note: while we have been using F to denote the CDF of a random variable, in this section the textbook uses the notation F to represent the overall distribution of a random variable. For example, if I say "X is a standard normal random variable", then in 12.6, F = standard normal, and not strictly $F = \Phi$.*

Objectives

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

- State the definition of the empirical CDF and explain how it relates to the true CDF of a random variable

- State the Glivenko-Cantelli Lemma and interpret it in everyday language.

- Summarize the general principle of bootstrap analysis.

- Explain the difference between parametric and nonparametric bootstraps.

Reflection Questions

Please submit your answers to the following questions to the corresponding Canvas assignment by 8:45AM:

1. Suppose n is a large positive integer, and let $x_1, \ldots, x_n$ be the observed values of $X_1, \ldots, X_n$ that are IID continuous random variables with common CDF F_X. Let $\hat{F}_n$ be the empirical CDF obtained from this sample of n observations. Briefly describe how the shape of the graph of $\hat{F}_n(x)$ compares to the graph of $F_X(x)$ for $x \in \mathbb{R}$.

2. Suppose X_1, X_2, X_3, X_4 are and IID sample from a distributions whose CDF is F_X. Further suppose we observed the following values:

$$X_1 = 5, X_2 = 3, X_3 = 0, X_4 = 7$$

Let $\hat{F}_4$ be the empirical CDF constructed from this sample of $n = 4$ observations. Give clear, step-by-step instructions for how we would simulate a sample of IID random variables $X_1^*, X_2^*, X_3^*, X_4^*$ such that the CDF of each X_i^* is $\hat{F}_4$.

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?