



# Homework 5

PSTAT 5A: Spring 2023, with Ethan P. Marzban

## **i** Instructions

- Please submit your work to Gradescope by no later than **11:59pm on Wednesday, May 10**. As a reminder, late homework will not be accepted.
- Recall that you will be asked to upload a **single** PDF containing your work for *both* the programming and non-programming questions to Gradescope.
  - You can merge PDF files using either Adobe Acrobat, or using adobe's online PDF merger at [this](#) link.

## Problem 1: Browsing Habits

Suppose that the time a randomly-selected person spends on their phone in a day is found to be a random variable that follows the normal distribution with mean 195 minutes and standard deviation 50 minutes.

- a. Define the random variable of interest, and call it  $X$ .
- b. What is the probability that a randomly-selected person spends less than one hour per day on their phone?
- c. What proportion of the population spends greater than 173 minutes per day on their phone?
- d. What proportion of the population spends between 170 minutes and 200 minutes on their phone in a given day?

## Problem 2: Trees!

The heights of trees in a particular forest are found to vary uniformly between 10ft and 100ft. A park ranger is interested in the heights of randomly-selected trees.

- a. Define the random variable of interest, and call it  $X$ .
- b. What proportion of trees have heights between 25 and 87 feet?
- c. What proportion of trees have heights between 25 and 150 feet?
- d. What proportion of trees have heights larger than 63 feet?
- e. Suppose the ranger collects a sample of 50 different tree heights (assume the sample was taken *with* replacement). What is the probability that exactly 22 of these trees had heights larger than 63 feet? **Hint:** You may need to define another random variable, and, consequently, use *another* distribution!

### **Problem 3: Parameter or Statistic?**

In each of the parts below, determine whether the provided quantity is a population parameter or a sample statistic. Use this to further determine whether the quantity is a deterministic (i.e. non-random) constant, or a random variable.

- a. The median score of 80 students, sampled from a class of 100.
- b. The maximum amount of time (in minutes) any human can hold their breath under water.
- c. The true IQR of incomes in Brazil.
- d. The standard deviation of the times it took 40 randomly-selected runners to complete a marathon.

### **Problem 4: Reducing Blood Pressure**

A new drug is advertised to significantly reduce systolic blood pressure. To test these claims, a clinician takes a representative sample of 120 volunteers to whom she administers the drug. She records the difference in (systolic) blood pressure pre- and post- administration of the drug for each of the 120 volunteers, and finds that the volunteers had an average difference of  $-8$  mm Hg (millimeters of mercury).

- a. Identify the population of interest.
- b. Identify the sample.
- c. Is the mean difference of  $-8$  mm HG a population parameter or an observed instance of a sample statistic?

### **Problem 5: College Degrees**

Suppose that 33% of a particular country's population has a college degree. A representative sample of 243 people is taken, and the proportion of these people who have a college degree is recorded.

- a. Define the parameter, and use the notation discussed in Lecture 10.
- b. Define the random variable of interest, and use the notation discussed in Lecture 10.
- c. Check whether the success-failure conditions are satisfied.
- d. What is the probability that over 30% of the sample have college degrees?
- e. What is the probability that the proportion of people in the sample who have college degrees lies within 5% of the true proportion of 33%.

***There is no programming part on this homework.***