

Homework Assignment 1 (Due Wednesday, February 14, 2024)

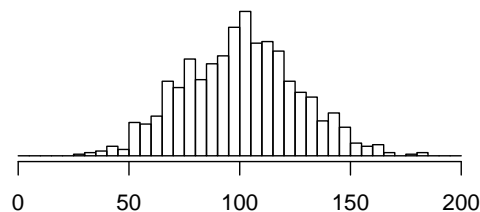
The homework is due at 10.30am in the dropbox on the Course Plus page (you can find the dropbox under the 'Resources' tab in the upper right). For exercises involving R code, please knit a document from your R markdown (Rmd) file. Generate a single pdf file for your entire submission and give it a name that makes it identifiable (calling it `140.615.HW.Number.Lastname.Firstname` or similar). Show your work.

1. It has been determined that the chance of becoming infected by a disease after contact with a particular parasite is 15%. If 50 individuals were in contact with the parasite:
 - (a) What is the chance that no-one got infected?
 - (b) What is the chance that at most 10 people got infected?
 - (c) What is the chance more than 5 people got infected?
 - (d) How many people got infected if the calculated probability of this event was 3.3% (rounded)?

2. A rare genetic disease with late onset is discovered. Although only one in a million people are carriers for the variant, you consider getting screened. You are told that the genetic test is extremely accurate: it is 100% sensitive (i.e., it is always correct if you have the disease) and 99.99% specific (i.e., it gives a false positive result only 0.01% of the time). Having recently learned Bayes' theorem, you decide not to take the test after all. Why?

3. Suppose a new drug (B) improves upon an older one (A) by increasing the probability of self-reported relief from gastric distress from 40% to 65%. Suppose drug A is given to 10 randomly-sampled patients and drug B is given to a second 10. Let Y_A and Y_B be the number out of 10 patients that will experience relief in each group. Plot the probability distributions for Y_A and Y_B .

4. Consider the following histogram.



- (a) Which of the following is true? Choose one and explain briefly.
 - i. The mean is larger than the median.
 - ii. The median is larger than the mean.
 - iii. The mean and the median are about the same.
- (b) Is the standard deviation about 10, about 25 or about 50? Explain briefly.