

STATS 10 Assignment 4

Please submit both parts of the assignment in one single PDF file. You can use any PDF editor software to merge the two parts into one file. Please make sure that the questions are in the correct order and clearly labeled, and that the answers are legible and easy to read.

To submit your assignment, upload the PDF file under the designated assignment page on the course website before the deadline specified. **Email or hard copy submissions are not accepted.**

Part I

Include both the R commands and their corresponding outputs, results, or answers for all exercise questions in Part I.

Exercise 1

Use the applet: https://digitalfirst.bfwpub.com/stats_applet/stats_applet_7_norm.html

1. Set the mean to 0 and the standard deviation to 1.
2. The numbers on the horizontal axis represent the number of SD above or below the mean. So, 0 is the mean, +1 is one SD above the mean, -1 is one SD below the mean etc.
 - a. Place the flags 1 standard deviation on either side of the mean. What is the area between these two values? What does the empirical rule say this area is?
 - b. Repeat for 2 and 3 standard deviations on either side of the mean. Again, compare the empirical rule with the area given in the applet.
 - c. Using the applet, how many standard deviations above and below the mean do the quartiles of any normal distribution lie? Use the closest available values (the applet can't hit every value exactly).

Exercise 2

Adult male height (X) follows (approximately) a normal distribution with a mean of 69 inches and a standard deviation of 2.8 inches. Use R to find the answers for the following questions.

- a. What proportion of males are less than 65 inches tall? In other words, what is $P(X < 65)$?
- b. What proportion of males are more than 75 inches tall? In other words, what is $P(X > 75)$?
- c. What proportion of males are between 66 and 72 inches tall? In other words, what is $P(66 < X < 72)$?

Exercise 3

Suppose adult male height follows a normal distribution with a mean of 69 inches and a standard deviation of 2.8 inches. Use R to find the answers for the following questions.

- a. How tall must a male be in order to be among the shortest 0.5% of males?
- b. How tall must a male be in order to be among the tallest 0.25% of males?

Exercise 4

a. Run the entire chunk of code in the lab 4 section 3 to run a “for loop” that creates a vector of sample proportions. Using the results, create a relative frequency histogram of the sampling distribution of sample proportions.

Superimpose a normal curve to your histogram with following instructions:

- If you use the `histogram()` function from the `mosaic` package, add the argument: `fit = "normal"`.
- If you use the `hist()` function from base R, add the argument: `prob = TRUE`, then run the command: `curve(dnorm(x, mean(phats), sd(phats)), add = TRUE)`.

b. What is the mean and standard deviation of the simulated sample proportions?

c. Do you think the simulated distribution of sample proportions is approximately normal? Explain why or why not.

d. Using the theory-based method (i.e., normal approximation by invoking the Central Limit Theorem), what would you predict the mean and standard deviation of the sampling distribution of sample proportions to be? How close are these predictions to your answers from Part b?

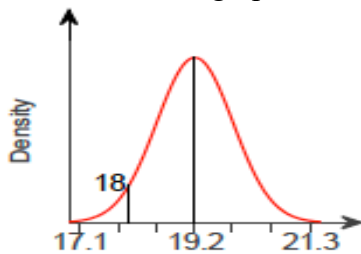
Part II

You may choose to type or write your answers electronically or scan your handwritten solutions. Please ensure that you show all steps and explanations to receive full credit, unless otherwise instructed.

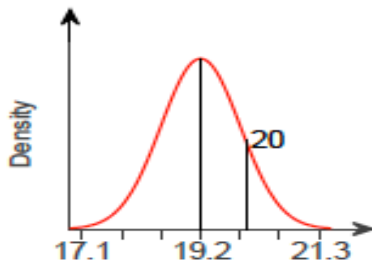
Exercise 1

According to a statistical journal, the average length of a newborn baby is 19.2 inches with a standard deviation of 0.7 inches. The distribution of lengths is approximately normal. Use your knowledge about normal distribution to answer questions below. (Round to four decimal places as needed.)

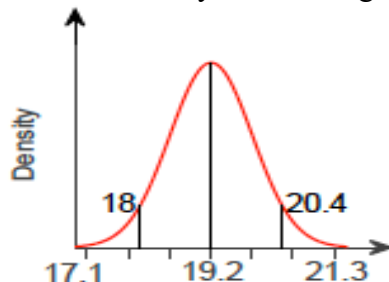
- a. What is the probability that a newborn baby will have a length of 18 inches or less? Shade the area of the graph that represents the probability and find the corresponding value.



- b. What percentage of newborn babies will be longer than 20 inches? Shade the area of the graph that represents the probability and find the corresponding value.



- c. Baby clothes are sold in a newborn size that fits infants who are between 18 and 20.4 inches long. What percentage of newborn babies will **NOT** fit into the "newborn" size either because they are too long or too short?



Exercise 2

A school gives an entry exam for admission. Suppose the score of this exam follows a normal distribution $N(400, 60)$. This year, the school decides to admit students who score in the top 30%. Suppose a student scored 428 on the test. Will the student be admitted? Explain your reasoning.

Exercise 3

According to a newspaper, 58% of high school seniors have a driver's license. Suppose we take a random sample of 100 high school seniors and find the proportion who have a driver's license.

- What value should we expect for our sample proportion?
- What is the standard error of the sample statistic? (Type an integer or decimal rounded to three decimal places as needed.)
- Use your answers to parts (a) and (b) to complete this sentence:
We expect _____% of the students in the sample to have their driver's license, give or take _____% (If your answer was a decimal, convert to percentage here).
- Suppose we increased the sample size from 100 to 700. What effect would this have on the standard error? Recalculate the standard error to see if your prediction was correct. (Type an integer or decimal rounded to three decimal places as needed.)

Exercise 4

According to a survey, 58% of young Americans aged 18 to 29 say the primary way they watch television is through streaming services on the Internet. Suppose a random sample of 300 Americans from this age group is selected.

- What percentage of the sample would we expect to watch television primarily through streaming services?
- Verify that the conditions for the Central Limit Theorem are met. And find the sampling distribution of the sample proportion.
- Would it be surprising to find that 181 people in the sample watched television primarily through streaming services? Why or why not?
- What is the probability of more than 65% of the sample watched television primarily through streaming services? (Type an integer or decimal rounded to three decimal places as needed.)

Exercise 5

A survey of 800 randomly selected adults in a certain country found that 82% believed that protecting the rights of those with unpopular views is a very important component of a strong democracy.

- a. Verify the Central Limit Theorem conditions.
- b. Find a 95% confidence interval for the proportion of adults in the country who believe that protecting the rights of those with unpopular views is a very important component of a strong democracy.
- c. Would a 90% confidence interval based on this sample be wider or narrower than the 95% interval? Give a reason for your answer.