Lab 2a: Measures of Center and Boxplots

Stat 131A, Fall 2018

Learning Objectives:

- Find the mean and median from different representations of data.
- Develop number sense with mean and median by creating different data sets with a given mean or median.

General Instructions

- Write your solutions in an `Rmd` (R markdown) file.
- Name this file as `lab02a-first-last.Rmd`, where `first` and `last` are your first and last names (e.g. `lab02a-gaston-sanchez.Rmd`).
- Knit your `Rmd` file as an html document (default option).
- Submit your `Rmd` and `html` files to bCourses, in the corresponding lab assignment.

Problem 1

Here are two sets of exam scores, one for a class that has 4 students and one for a class that has 15 students.

- Class A: 80, 90, 90, 100
- Class B: 60, 65, 65, 70, 70, 70, 75, 75, 80, 80, 80, 80, 80, 85, 100

a) Without doing any calculations, which class do you think will have a larger mean? Why?

b) Now calculate the mean for each class (try doing this in R). Which is larger? Why does this make sense?

Problem 2

Ten people in a room have an average height of 5 feet 6 inches. An 11th person, who is 6 feet 5 inches tall, enters the room. Find the average height of all 11 people. *Hint: 1 foot = 12 inches.*

Problem 3

Twenty-one people in a room have an average height of 5 feet 6 inches. A 22nd person, who is 6 feet 5 inches tall, enters the room. Find the average height of all 22 people. Compare with the previous problem.

Problem 4

Twenty-one people in a room have an average height of 5 feet 6 inches. A 22nd person enters the room. How tall would he have to be to raise the average height by 1 inch?

Problem 5

This table gives quiz scores for a different class.

Scores	Number of Students
5	1
6	3
7	5
8	3
9	1

a) What kind of graph could you use to visualize this data?

b) What is the mean? Show your work, or code, or explain how you got your answer.

c) What is the median? Show your work, or code, or explain how you got your answer.

d) Which measure (the mean or the median) is the better way to represent the "typical"" performance on this quiz? Why?

Problem 6

In this problem, we explore the effect on the mean, median, and mode of: 1) adding the same number to each data value, and 2) of multiplying each data value by the same number. Tryi using R to do calculations; you may want to use the following functions: `mean()`, `median()`, `table()` and `which.max()`.

Consider the data set:

```
set <- c(2, 2, 3, 6, 10)
```

a. Compute the mode, median, and mean.

b. Add 5 to each of the data values. Compute the mode, median, and mean.

c. Compare the results of parts (a) and (b). In general, how do you think the mode, median, and mean are affected when the same constant is added to each data value in a set?

d. Multiply each data value by 5. Compute the mode, median, and mean.

e. Compare the results of parts (a) and (b). In general, how do you think the mode, median, and mean are affected when each data value in a set is multiplied by the same constant?

Problem 7

Average hourly earnings are computed each month by the Bureau of Labor Statistics using payroll data from commercial establishments. The Bureau figures the total wages paid out (to nonsupervisory personnel), and divides by the total hours worked. During recessions, average hourly earnings typically go up. When the recession ends, average hourly earnings often start going down. How can this be?

Problem 8

For this problem, use the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

a) List five digits that have a median of 7 and a mean of 7 (repeats allowed). Find a different set of 5 digits that work.

b) List five digits that have a median of 7 and a mean that is less than 7 (repeats allowed.) Give the mean of your 5 digits. Find a different set of 5 digits that work.

c) List five digits that have a median of 7 and a mean that is more than 7 (repeats allowed.) Give the mean of your 5 digits. Find a different set of 5 digits that work.

Problem 9

Imagine that you have a bag filled with 9 numbers. The mean and the median of the numbers in the bag are both 6.

a) You draw a number out of the bag. It is a 4. You replace it with a 1; Does the mean of the numbers in the bag get bigger, smaller, or stay the same? What about the median? Jot down some notes to explain how you figured this out.

b) You draw a number out of the bag. It is an 8. You replace it with 8 ones. Does the mean of the numbers in the bag get bigger, smaller, or stay the same? What about the median? Jot down some notes to explain how you figured this out.

Problem 10

A small accounting firm pays each of its five clerks $35,000, two junior accountants $80,000 each, and the firm's owner $320,000.

    a. What is the mean salary paid at this firm?

    b. How many of the employees earn less than the mean?

    c. What is the median salary?

Problem 11

The firm in the previous question gives no raises to the clerks and junior accountants, while the owner's take increases to $455,000.

    a. How does this change affect the mean?

    b. How does it affect the median?

Problem 12

Consider two data sets A and B. The set A has 5 values and a mean of 10. The set B has 50 values and a mean of 10.

    a. Suppose the number 20 is included as an additional data value in set A. Compute the mean for the new data set.

    b. Suppose the number 20 is included as an additional data value in set B. Compute the mean for the new data set.

    c. Why does the addition of the number 20 to each data set change the mean for set A more than it does for set B?

Problem 13

Consider a data set with at least three data values. Suppose the highest value is increased by 10 and the lowest is decreased by 10.

    a. Does the mean change? Explain.

    b. Does the median change? Explain

    c. Is it possible for the mode to change? Explain.

Don't forget to submit your `Rmd` and knitted `html` file to bCourses.