# MOD 8 PART 1: MEASURES OF CENTER - EXPLORING "TYPICAL VALUES"

Learning Goal

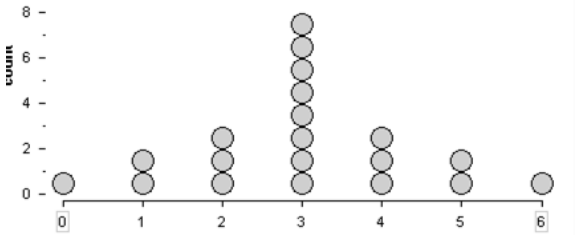
- Use mean and median to describe the center of a distribution

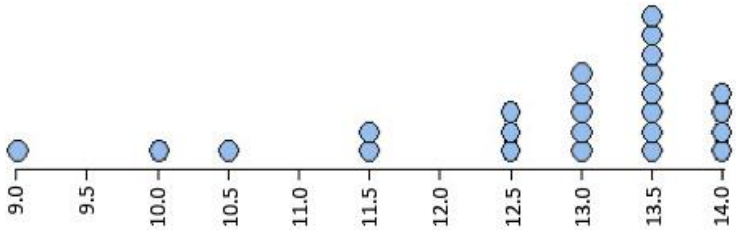
1) Use the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.
   a) Find five digits that have a median of 7 and a mean of 7 (repeats allowed).

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

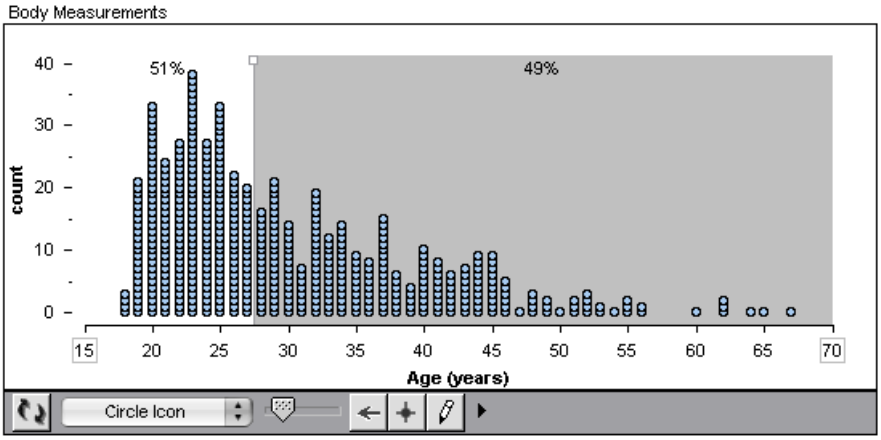
   c) Pick five digits that have a median of 7 and a mean that is more than 7 (repeats allowed.) Give the mean and median of your 5 digits. Find a different set of 5 digits that work

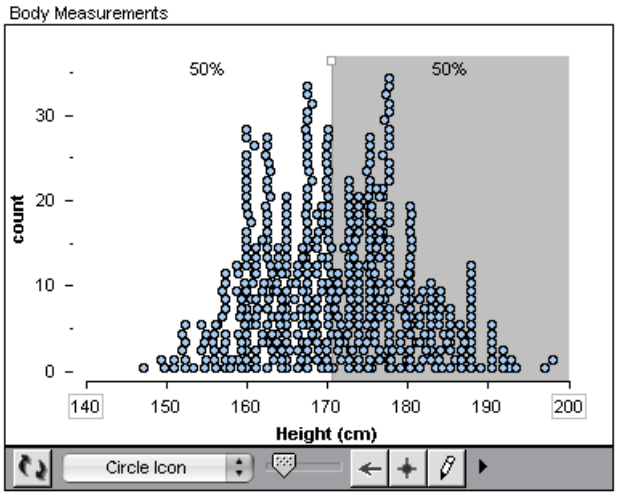
2) For each of the distributions pictured below, find the mean and the median. What happens to the mean when the data is skewed?



3) For each distribution give an estimate for the median. Then say whether the mean is probably greater than, less than, or about equal to the median and then provide a detailed explanation of your reasoning.



4) Which of the following distributions is likely to have a mean that is smaller than the median? Explain why.

a) the salaries of NBA basketball players where most players earn close to the league minimum and a few superstars make a lot more

b) repeated measurements of the volume of peanut M & Ms in a "one-pound" bag

c) the scores on the Module 7 Checkpoint, where most of the grades were A's and B's, and only a few scores were F's

# MOD 8 PART 2: MEASURES OF CENTER (BALANCING ON THE MEAN)

Learning Goal

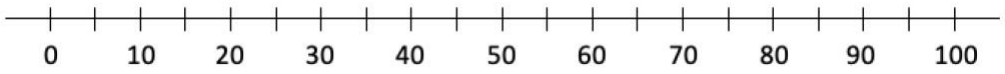
- Describe the mean as a balancing point for a distribution

1) Borna Jabbapore is taking Statistics again. Last semester he did not prepare for the in-class quizzes (each quiz was worth 100 points), and his quiz average was 38. Even so, he almost passed because he did very well on all of his other assignments and fairly well on the final exam. He learned from his instructor that he would have passed the class if he had just averaged 45 on his quizzes.

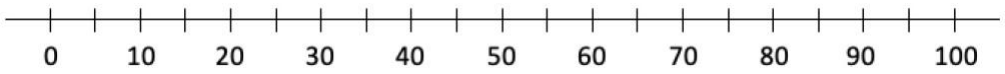
   This semester he intends to do well on all of his assignments and review for the quizzes. Even though he has test anxiety, Borna knows that with a little more effort, he can easily average 45 on the quizzes. His instructor warns that he should strive for a higher quiz average just in case he does not perform as well on the final exam, but Borna dreads in-class quizzes and plans to shoot for an average of 45. The syllabus indicates that there will be 8 quizzes this semester. So Borna wants a mean quiz score of 45 on the 8 quizzes. Write this mean using "x-bar" notation, $\bar{x}$.

2) For each of the following situations, create a dot-plot of 8 quiz scores that meets the **specified conditions** and has a mean 45. Be sure to use the Δ symbol to point to the mean on each dot-plot.

   a) All the quiz scores are the same value (i.e. the same quiz score 8 times).




   b) Most of the quiz scores are the same value, but one quiz score is 20. Explain what you had to do to keep a mean quiz score of 45.

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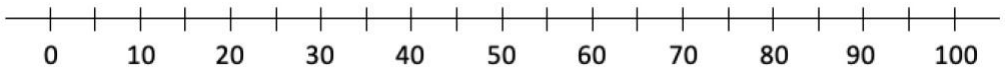
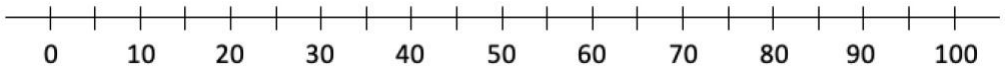
c) Most of the quiz scores are the same but one quiz score is 100. Explain what you had to do to keep a mean quiz score of 45.




d) Two quiz scores are 100. Explain what you had to do to keep a mean quiz score of 45.



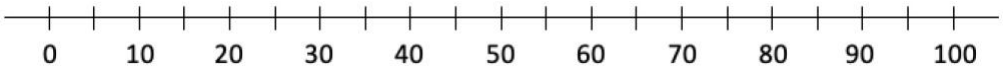

e) What is the maximum number of 100-point quiz scores possible with a mean quiz score of 45? How do you know?

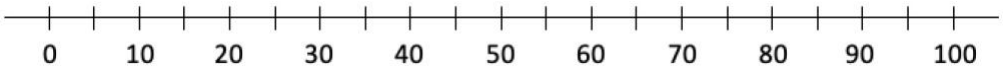
3) Draw two dot-plots of 8 quiz scores such that:

a) both have a mean of 45 (be sure to point to the mean on each dot-plot),

b) one has very little spread, and

c) one has a lot of spread.




4) Suppose that Borna earned the following scores on his quizzes this semester.

10, 27, 35, 35, 41, 62, 70, 80

Calculate Borna's mean quiz score and write it above the table below. Record Borna's quiz scores in the table. Finally, for each quiz score, record its deviation from the mean (i.e. its "signed distance" from the mean where negative numbers indicate the data value is "below" the mean and positive numbers indicate the data value is "above" the mean).

Borna's Mean Quiz Score: $\bar{x} =$

| **Quiz Score** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Deviation from the Mean** | | | | | | | | |

Now add up the deviations (signed distances) from the mean. What value did you get?

5) Make up a list of eight quiz scores between 0 and 100 points with a mean a of 70 AND more quiz scores above the mean than at or below the mean. Then calculate the deviation from the mean for each data value.

$\bar{x} = 70$

| **Quiz Score** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Deviation from the Mean** | | | | | | | | |

Now add up the deviations from the mean (i.e. the signed distances from the mean). What value did you get?

6) For any set of data, if we add up the deviations (signed distances) from the mean, do you think we will always get the same number? Provide a detailed explanation of your reasoning.

7) Explain why folks call the mean the "balancing point".

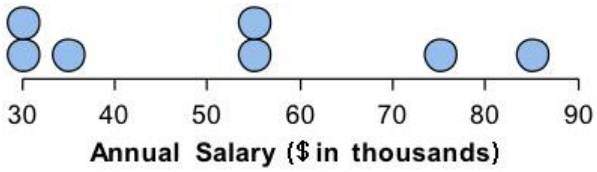
## MOD 8 PART 3: MEASURES OF CENTER (THE MEDIAN)

Learning Goals

- Describe the median as a balancing point for a distribution
- Based on the shape of a distribution of data, determine whether to use the median or the mean as the measure of central tendency

This example is used to illustrate the difference between the two different types of average: the *mean* and the *median*. Let's imagine that the salaries of the patrons currently eating at a local diner (before Bill Gates walks in) are given below.

| Patron | Salary |
|---|---|
| Anna | $30,000 |
| Bob | $75,000 |
| Cathy | $55,000 |
| Dave | $55,000 |
| Eric | $30,000 |
| Fran | $85,000 |
| Gail | $35,000 |




1) Find the mean and median salary *before* Bill Gates walks into the diner.

2) Are the two measurements close? Would they represent a *typical* customer's salary? Which would you choose to represent a typical customer's salary?

Suppose that Bill Gates walks into the diner with an annual income of, say, $1 billion.

3) Find the mean and median salary ***after*** Bill Gates walked into the diner. Show your work.

4) Are the two measurements close? Which measurement would you choose (the mean or the median) to represent a typical customer's salary? Briefly explain your choice.

5) Imagine that we have redrawn the dot-plot to include Bill Gates annual salary. Describe the shape, center, and spread.

6) You've graduated from college with a very prestigious degree (and some hefty student loans) and companies are now actively recruiting you. One particular firm has invited you to apply for an entry-level job, but the application process involves a lot of work and is VERY time consuming. Also, you've learned that new hires typically put in very long hours for the first couple of years. So you decide to look at the firm's typical salaries to determine if it will be worth your effort to go through the application process – after all you need to earn a salary that will allow you to support yourself and pay off those student loans (not to mention those long hours for a couple of years if you get the job).

   a) While investigating the salary information, you learn that the mean salary is $175,000 per year. Will you apply for the job (you know the work will be interesting, and you suspect that you will enjoy the folks you will be working with, but the grueling application process and those long hours for the first couple of years … hmmm)?

   b) You're just about to start the application process when you learn that the median salary is $19,500 per year (and remember … those first couple of years you'll be putting in some really long hours each and every week). What happened? How could the mean salary be $175,000 and the median salary only be $19,500 per year?

   c) If you could only learn about one measure of center before deciding to invest your time and energy in the application process for this firm, which would you like to know, the mean or the median? Explain your choice.