

Using Mean, Median, and Mode

Whether you use mean, median, or mode depends both

- on the **type of data** and
- on the **shape of distribution**.

Example. This distribution of science quiz scores is heavily skewed (asymmetrical), and its “peak” is at 6. Which of the three measures of center would best describe this distribution?

Let’s calculate the mean, median, and mode.

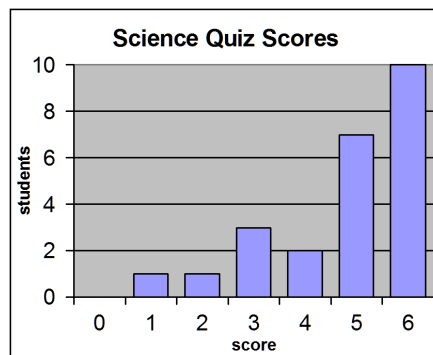
Mode: We can see from the graph that the mode is 6.

Median: There are 24 students. The students’ actual scores are 1, 2, 3, 3, 3, 4, 4, 5, 5, 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6, 6, 6.

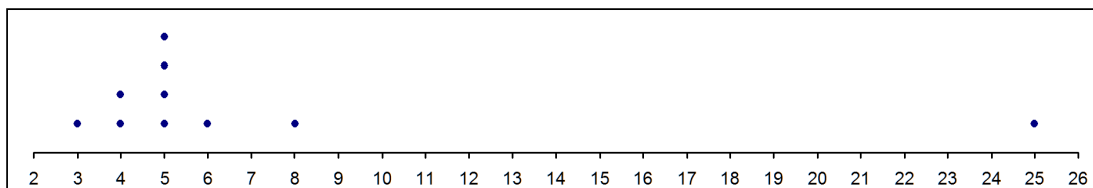
The median is the average of the 12th and 13th scores, which is 5.

The mean is $\frac{1 + 2 + 3 + 3 + 3 + 4 + 4 + 7 \times 5 + 10 \times 6}{24} = 4.79167 \approx 4.79$.

Notice that the mean is less than 5, but the two highest bars on the graph are at 5 and 6. In this case, the mean does *not* describe the peak of the distribution very well because it actually falls outside the peak! Both the median and the mode do describe it well.



1. a. Find the mean, median, and mode of this data set: 3, 4, 4, 5, 5, 5, 5, 6, 8, 25.



mean _____ median _____ mode _____

- b. Which of the three, mean, median, or mode, best describes the center of this data?

Clearly, either the _____ or the _____, but *not* the _____!

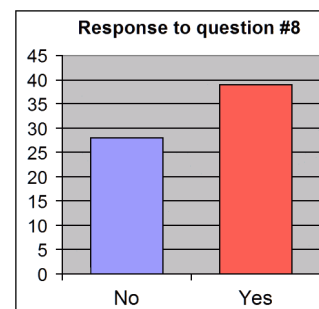
The _____ is off from the central peak of the distribution.

The reason for this is that the data item “25” throws it off. This 25 is very different from the other data items in the set, and could even be a typing error! Such an item is called an **outlier**.

2. The graph shows the response to a certain question in a survey. It was measured as a *yes/no* question. Which of the below are possible to determine? (Mark with an “x”).

_____ mean _____ median _____ mode

Hint: Imagine what the original data that was used to create the graph looks like.



Guidelines for using the mean, median, and mode

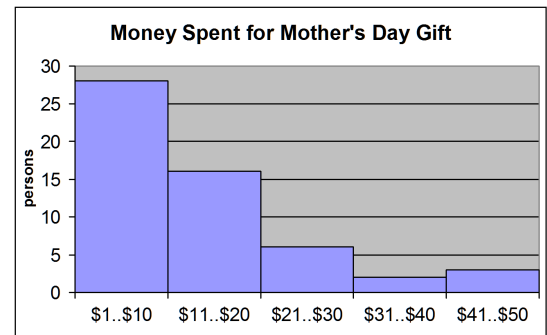
- The *mode* can be used with any type of data.
- The *median* can only be used if the data can be put in order.
- The *mean* can only be used if the data is numerical.

Sometimes, the median and the mean do not fall where the peak of the distribution is.

- The mean works best if the distribution is fairly close to a bell shape and does not have outliers.
- If the distribution is very skewed or has outliers, it is better to use median than mean.

3. Judith asked 55 teenagers about how much money they spent to purchase Mother's Day gifts.

- Which of the numbers \$11 and \$9 is the mean? Which is the median?
- Would mean or median better describe this data? Why?
- Approximately* what percentage of these teenagers spent \$10 or less on a Mother's Day gift?



- Name what is being studied (usually the *title* of the graph tells you this).
 - Describe how the data was measured and in what units. For example, the respondents have given numerical answers in dollars. Or perhaps they chose either “yes” or “no.”
 - Indicate whether the mean, median, or mode can be calculated. You do not have to find the mean, even when it is possible.

Hint: Think what kind of data was used to create the graph (the original data).

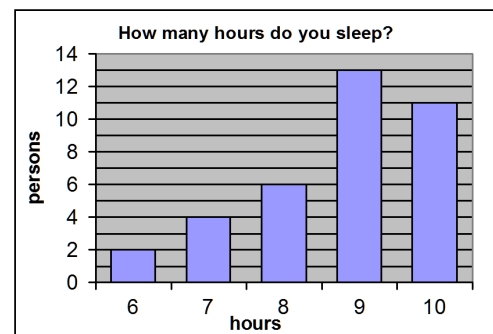
a. What is being measured or studied? _____

How is it measured?

Which are possible? (Mark with an “x”).

____ mean ____ median ____ mode

The mode is: _____ The median is: _____



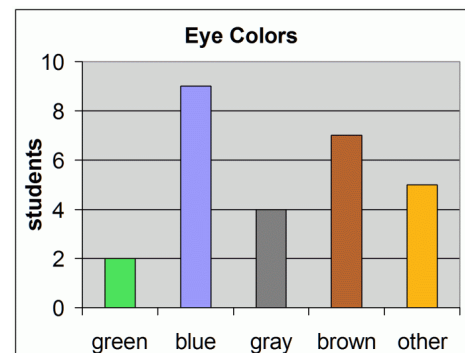
b. What is being measured or studied? _____

How is it measured?

Which are possible? (Mark with an “x”).

____ mean ____ median ____ mode

The mode is: _____ The median is: _____



For the following data sets:

- Create a dot plot or a bar graph.
- Name your graph.
- Describe the shape of the distribution.
- Indicate how many observations there are.
- Choose measure(s) of center that describe the peak of the distribution, and calculate them.

5. a. The length of words on three pages in a certain children's story book:

7 5 6 8 3 6 6 2 4 2 2 3 3 4 4 3 5 5 4
5 4 3 2 5 2 1 4 4 7 5 4 8 3 3 3 3 3 5
5 3 4 2 3 1 6 2 5 4 4 3 4 3 2 8

Here is the same data sorted:

1 1 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 4 4 4
4 4 4 4 4 4 4 4 5 5 5 5 5 5 5 5 5 5 6 6 6 6 7 7 8 8 8

b. A restaurant asked its customers some questions about their food and service. One question was, "How would you rate the meal you ate today?" There were five possible answers: "excellent," "good," "normal," "not so good," and "poor." The customers' responses are listed below:

normal poor excellent good good excellent good
normal not so good excellent good good good
normal normal good excellent good good good
not so good not so good excellent good

Puzzle Corner

Can you find a quick, *mental math* method for calculating the mean for this data set? 102, 94, 99, 105, 96, 107, 101, 104 (the weights of a litter of kittens at birth, in grams)