

## Ch 2.5 and 2.6 Measure of Center and Skewness

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**Center:** A measure of center is a value at the center or middle of a data set. It is used to provide a representative value that “summarize” the data.

**Measure of center: (mean, median, mode, midrange)**

1) **Mean:** the average of the data.

sample mean  $\bar{x} = \frac{\sum x}{n}$  ; n = sample size,  $\bar{x}$  is read as x-bar,

population mean  $\mu = \frac{\sum x}{N}$  ; N = population size,  $\mu$  is read as mu, a greek letter.

\*the term “average” is not used by statistician.

Important properties of mean:

- a) Use every data value (in a sample or population)
- b) Extreme value can change the value of mean substantially. Mean is not resistance.
- c)  $\bar{x}$  can be used to estimate  $\mu$  if sample is representative and not bias.

If the sample is voluntary response or biased  $\bar{x}$  will not be a good estimate of  $\mu$ .

Ex1: Mean of 78, 89, 75, 92, 66, 82 is 80.3

Mean of 78, 89, 75, 92, 66, 82, 5 is 69.6 (not middle)

Ex2: Mean of top 5 scores: 90, 95, 92, 98, 89;

$\bar{x}$  is 92.8 but is not a good estimate for the whole class mean because the sample is bias, not from random selection.

2) **Median:** the middle value when the data are arranged in order of increasing or decreasing magnitude.

How to calculate the median:

- a) Sort the values
- b) Odd number of values: Median is the middle one  
Even number of values: Median is the mean of the middle two values.

Properties of Median:

- a) The median does not change when we add a few extreme values. It is resistance.
- b) Median does not use every value.

Ex1: Median of 78, 89, 75, 92, 66, 82 is 80

Median of 78, 89, 75, 92, 66, 82, 5 is 78 (middle)

3) **Mode:** the value (s) that occur(s) with the greatest frequency. Can be calculated for qualitative data. Not common for quantitative continuous data.

Properties of mode:

- a) Data can have one, two, multiple or no modes.
- b) Bimodal – two data values occur with same greatest frequency.
- c) Multimodal – more than two data values occur with the same greatest frequency.
- d) No mode – no data value is repeated.

4) **Midrange**: the value that is midway between the maximum and minimum values in the dataset.

$$\text{midrange} = \frac{\text{maximum} + \text{minimum}}{2}$$

Properties of Midrange:

- a) Not resistance to extreme values.
- b) Easy to compute but rarely used.
- c) Midrange does not use all data. It is not the median and it is not half of range.

#### **Find Mean, median, and midrange by technology:**

Use Libretxts online calculator. [Link to one variable statistics calculator](#)

Input data separated by commas , check population standard deviation or sample standard deviation, and click calculate.

#### **Find mode by technology**

Use online calculator: (for multiple mode)

<https://www.calculatorsoup.com/calculators/statistics/mean-median-mode.php>

Input data to the window, click Calculate.

#### **Round off rules:**

- a) Mean, median and Midrange: carry one more decimal place than original data.
- b) Mode: leave the value as is without rounding.

Ex1. Find the mean, median, midrange, mode of the length of boats (in ft) parked in a marina.

16, 17, 19, 20, 20, 21, 23, 24, 25, 25, 25, 26, 26, 27, 27, 27, 28, 29, 30, 32, 33, 33, 34, 35, 37, 39, 40

- a) Find the mean, median, mode and midrange.

Which of the above is the best measure of center?

- b) Can this mean be used to estimate mean length of all boats in all marina? Explain.

a) Use [Libretxts Online Statistics calculator](#). and [online mode calculator](#).

Mean = 27.3, Median = 27, min = 16, max = 40

Midrange =  $(16 + 40)/2 = 28$ , Mode = 25 and 27.

Mean is a better choice because data is symmetrical and there are no outliers in the data.

- b) This mean is not representative because the sample is from one marina only.

Ex. 2 Which is the greatest, mean, median or mode?

11, 11, 12, 12, 12, 12, 13, 15, 17, 22, 22, 22

Use [Libretxts Online Statistics calculator](#). and [online mode calculator](#).

Mean = 15.1

Median = 12.5

Mode = 12

Midrange = 16.5

## Mean, median and skewness:



### Choose the best measure of center:

- Use mode for nominal data as center.
- Use mean if there is no extreme data.
- Use median if extreme data exist.
- Use median if data is skewed.

### Find mean from a frequency distribution:

grouped mean  $\bar{x} = \frac{\sum f \cdot x}{\sum f}$  ; is the mean from GFDT where

x is the class midpoint of each class.

f is the frequency of each class

### Find grouped-mean for GFDT by technology: [Libretexts Online Calculator](#)

- Enter lower limit to lower bounds, upper limit to upper bounds, enter frequencies for each row in the GFDT.
- Scroll to the bottom and click calculate.

Ex1. Find grouped mean from GFDT:

Grades	Freq
50 - 59	1
60 - 69	0
70 - 79	2
80 - 89	4
90 - 99	5

Enter the table to [Libretexts Online calculator](#) , calculate.

Ans: mean = 84.5

Ex2. Find the mean, median from the data in the histogram.



Write the frequency table by reading the classes and frequencies from the histogram as below:

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

Enter the table to [Libretexts Online calculator](#) , calculate.

Ans: mean = 4.06, median = 4

Note: when data is extremely skewed in a particular way, the mean and median can be the same.

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