MEASURES OF CENTER

Suppose we have the following test scores. The question now is how do we find the center of this data? By center, we mean an average value.

40, 79, 83, 92, 92

There is one obvious way to find our center and that is by computing the average in the way we normally do, i.e. add up all the scores and divide by the total number. In statistics, we call this average the arithmetic mean or mean.

40, 79, 83, 92, 92

$$mean = \frac{\sum x}{n} = \frac{40 + 79 + 83 + 92 + 92}{5} = 77.2$$

A notation that we should point out is that if we are dealing with a population, then we denote its mean by the Greek letter "mu," and we denote a sample mean by "x-bar."

40, 79, 83, 92, 92

$$\text{population mean} = \mu = 77.2$$

$$\text{sample mean} = \bar{x} = 77.2$$

The best thing about the mean is that it is easily incorporated into more advanced statistical procedures.

40, 79, 83, 92, 92

$$\mu = \frac{\sum x}{n} = 77.2$$

The worst thing about the mean is that it is easily affected by extreme values.

40, 79, 83, 92, 92

$$\mu = \frac{\sum x}{n} = 77.2$$

We can also find the mean of grouped data by using class midpoints and frequencies. This is a type of weighted mean.

CLASS	FREQUENCY
40 - 49	3
50 - 59	4
60 - 69	3
70 - 79	4
80 - 89	3
90 - 99	3

Class midpoints: 44.5, 54.5, 64.5, 74.5, 84.5, 94.5

$$\mu = \frac{\sum f \cdot x}{\sum f}$$

$$= \frac{3(44.5) + 4(54.5) + 3(64.5) + 4(74.5) + 3(84.5) + 3(94.5)}{20}$$

$$= 69$$

The mean of grouped data can also easily be found by entering the data into your calculator and going to *Stat → Calc* to select *1-Var Stats.*

CLASS	FREQUENCY
40 - 49	3
50 - 59	4
60 - 69	3
70 - 79	4
80 - 89	3
90 - 99	3

Class midpoints: 44.5, 54.5, 64.5, 74.5, 84.5, 94.5

L1	L2	L3	2
44.5	3	------	
54.5	4		
64.5	3		
74.5	4		
84.5	3		
94.5	3		
------	------		

L2 = {3,4,3,4,3,3}

L1	L2	L3	2
44.5	3	------	
54.5	4		
64.5	3		
74.5	4		
84.5	3		
94.5	3		
------	------		

L2 = {3,4,3,4,3,3}

```
1-Var Stats L1,L
2
```

```
1-Var Stats
x̄=69
Σx=1380
Σx²=100715
Sx=17.00619082
σx=16.57558445
↓n=20
```

Another way to find the center or average of our data is the median. To find the median, arrange your values in order from lowest to highest, and locate the middle score.

40, 79, 83, 92, 92

$median$

$$\text{median} = \tilde{x} = 83$$

$$\text{position of the median} = \frac{n+1}{2} = 3$$

If there is no score exactly in the middle, then to find the median we average the two middle scores together.

$$40, 79, 83, 92$$

$$median = \frac{79+83}{2} = 81$$

$$median = \tilde{x} = 81$$

$$\text{position of the median} = \frac{n+1}{2} = 2.5$$

Unlike the mean, the median is not so affected by extreme scores.

40, 79, 83, 92

$$median = \frac{79+83}{2} = 81$$

$$median = \tilde{x} = 81$$

$$\text{position of the median} = \frac{n+1}{2} = 2.5$$

However, it is harder to incorporate into advanced statistical procedures.

40, 79, 83, 92

$$median = \frac{79 + 83}{2} = 81$$

$$median = \tilde{x} = 81$$

$$position\ of\ the\ median = \frac{n + 1}{2} = 2.5$$

Additionally, both the mean and the median of a list of numbers can easily be found using your calculator.

40, 79, 83, 92, 92

```
L1      L2      L3      1
40      ------  ------
79
83
92
92

L1(6)=
```

```
EDIT CALC TESTS
1:1-Var Stats
2:2-Var Stats
3:Med-Med
4:LinReg(ax+b)
5:QuadReg
6:CubicReg
7↓QuartReg
```

```
1-Var Stats
```

```
1-Var Stats
x̄=77.2
Σx=386
Σx²=31658
Sx=21.55690145
σx=19.28107881
↓n=5
```

```
1-Var Stats
↑n=5
 minX=40
 Q₁=59.5
 Med=83
 Q₃=92
 maxX=92
```

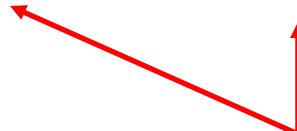A third type of average is called the mode. This is the data element that occurs most often.

40, 79, 83, 92, 92

$$\text{mode} = 92$$

However, sometimes more than one mode can exist.

40, 40, 79, 83, 92, 92

$$mode = 40, 92$$

Also, if each data element occurs the same number of times, then no mode exists.

40, 79, 83, 92

no mode

Nonetheless, the mode has one distinct advantage over other measures of central tendency. It can be used with nonnumerical data.

Sample of majors of students:

math   math   math   math

math   math   English   physics

physics   nursing   business   education

The average student majors in math!

Our last measure of average or central tendency is called the midrange. Why do you think this way of finding an average is almost worthless?

40, 79, 83, 92, 92

$$\text{midrange} = \frac{\text{high} + \text{low}}{2} = \frac{40 + 92}{2} = 66$$