

## **L3: Measures of Center**

The median and the mean apply are only quantitative data, whereas the mode can be used with either quantitative or qualitative data.

### **4.1 The Mode**

The **sample mode** of a qualitative or a discrete quantitative variable occurs with the greatest frequency in a data set.

Definition 4.1 (Mode). Obtain the frequency of each observed value of the variable in a data and note the greatest frequency.

1. If the greatest frequency is 1 (i.e. no value occurs more than once), then the variable has no mode.
2. If the greatest frequency is 2 or greater, then any value that occurs with that greatest frequency is called a sample mode of the variable.

To obtain the mode(s) of a variable, we first construct a frequency distribution for the data using classes based on single value. The mode(s) can then be determined easily from the frequency distribution.

Example 4.1. Let us consider the frequency table for blood types of 40 persons

**BLOOD**

BLOOD		Statistics	
		Frequency	Percent
Valid	O	16	40.0
	A	18	45.0
	B	4	10.0
	AB	2	5.0
	Total	40	100.0

We can see from frequency table that the mode of blood types is A.

When we measure a continuous variable (or discrete variable having a lot of different values) such as height or weight of person, all the measurements may be different. In such a case there is no mode because every observed value has frequency 1. However, the data can be grouped into class intervals and the mode can then be defined in terms of class frequencies. With grouped quantitative variable, the mode class is the class interval with highest frequency.

Example 4.2. Let us consider the frequency table for prices of hot-dogs

**Frequencies of prices of hotdogs (\$/oz.)**

		Frequency	Percent	Cumulative Percent
Valid	0.045-0.065	5	9.3	9.3
	0.065-0.085	15	27.8	37.0
	0.085-0.105	10	18.5	55.6
	0.105-0.125	9	16.7	72.2
	0.125-0.145	4	7.4	79.6
	0.145-0.165	2	3.7	83.3
	0.165-0.185	3	5.6	88.9
	0.185-0.205	3	5.6	94.4
	0.205-0.225	1	1.9	96.3
	0.225-0.245	1	1.9	98.1
	0.245-0.265	1	1.9	100.0
	Total	54	100.0	

## 4.2 The Median

The median is a "central" value – there are as many values greater than it as there are less than it. The value that divides the set of observed values in half, so that the observed values in one half are less than or equal to the median value and the other half are greater or equal to the median value.

To obtain the median of the variable, we arrange observed values in a data set in increasing order and then determine the middle value in the ordered list.

1. If the number of observation is odd, then the sample median is the observed value exactly in the middle of the ordered list.
2. If the number of observation is even, then the sample median is the number halfway between the two middle observed values in the ordered list.

-In both cases, if we let **n** denote the number of observations in a data set, then the sample median is at position  $\frac{n+1}{2}$  *in the ordered list.* in the ordered list.

Example 7 participants in bike race had the following finishing times in minutes:

28,22,26,29,21,23,24.

What is the median?

Example 8 participants in bike race had the following finishing times

in minutes: 28,22,26,29,21,23,24,50.

What is the median?

The median in SPSS: Analyze -> Descriptive Statistics -> Frequencies

### 4.3 The Mean

The most commonly used measure of center for quantitative variable. It is the sum of observed values in a data divided by the number of observations.

The mean= 

sum of value
Number of value

 or  $\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$  or  $\frac{\sum x_i}{n}$ .

Example 7 participants in bike race had the following finishing times in minutes:  
28,22,26,29,21,23,24.

What is the mean?

Example 8 participants in bike race had the following finishing times in minutes:  
28,22,26,29,21,23,24,50.

What is the mean?

The mean in SPSS:

Analyze -> Descriptive Statistics -> Frequencies

Analyze -> Descriptive Statistics -> Descriptive