

## AVERAGES OR MEASURES OF CENTRAL TENDENCY

One of the most obvious requirements when handling data from any sample or population is to be able to specify some sort of typical, average or representative value. We shall be considering three such values or measures of central tendency -the mode, the median and the arithmetic mean.

### The Mode

The mode is defined as the value which occurs with greatest frequency. For example, consider the observations 2, 3, 7, 8, 9, 8, 5, 8, 4. Here the value 8 occurs 3 times. All the other numbers occur only once; hence the mode is 8. Note that the mode can be very easily determined from the frequency distribution of the data.

In situations where all values occur with equal frequency, no modal value can be calculated. Thus for the set of observations 2, 7, 16, 19, 20, 25 no mode can be obtained. Similarly, the observations 2, 2, 4, 3, 4, 3, do not permit the calculation of a modal value since all values occur twice.

In the case where two adjacent values (i.e. values which are adjacent when the numbers are put in order) occur with the same frequency, which is larger than the frequency of occurrence of other values, the mode may be taken rather arbitrarily as the mean of the two adjacent values. For example, consider the observations 2, 7, 5, 4, 3, 5, 8, 4. Here both 4 and 5 share the highest frequency and mode is taken as 4.5.

When two nonadjacent values occur with the same frequency, which is larger than the frequency of occurrence of the other values, then each value is considered as a mode. For example, in the set of observations 2, 7, 2, 5, 4, 3, 5, 8 there are two modes 2, and 5. This set of observations is said to be bimodal.

The mode can be a useful measure when: (1) the quickest possible estimate of central tendency in the data is required, and (2), somewhat obviously, when we want to report the score obtained by

the largest number of subjects, etc. However, although the mode is a good descriptive measure, it is of no use as an inferential tool.

### **The Median**

The median is simply that point which divides the total observations into 2 parts which are equal in number. To find the median, it is first necessary to arrange all the values in the sample in ascending order of magnitude. If there is an odd number of observations, the median is then by definition, the middle value. For example, the median of the observations 1, 2, 4, 8, 9 is 4. If there is an even number of observations, the median is obtained by averaging then two middle values. For example, the median of the observations 1, 4, 5, 7 is 4.5.

The median is a particularly useful statistic when the distribution of the data departs from the normal or when there is some doubt about the 'normality' of the distribution, a point to be dealt with in detail later in the course. The shortcoming of the median is that, like the mode, it is not representative of the entire set of data.

### **The Mean**

The arithmetic mean, or simply the mean, is obtained by adding together all the values in the sample and then by dividing the total number of values. This process of finding the mean can be simply written in shorthand by using a few symbols to represent the quantities and the arithmetic procedures involved.

#### **Example**

Find the mean IQ ( $\bar{X}$ ) for the five persons whose individual IQs are 100, 105, 90, 115, 110

$$\begin{aligned} X &= \frac{100 + 105 + 90 + 115 + 110}{5} \\ &= \frac{520}{5} \\ &= 104 \end{aligned}$$

The mean is the most useful of the three measures of central tendency for three reasons: (1) it is based on all of the data in the distribution and not just a limited portion of it like the median and the mode,

(2) it is a more reliable or stable measure than the median or the mode; and

(3) it is the basis of many important statistical procedures and tests.

Now, calculate the mean, median and mode of the following:

a. 8, 3, 9, 4, 7, 1, 1, 8, 1, 10, 3

b. 1, 9, 7, 3, 3, 5, 7, 5, 5

### Questions

1. What is the most striking feature of the three values obtained in a?
2. What is the most striking feature of the three values obtained in b?

From these examples, you can see that it is possible for the mean, median and mode to be all the same value, or all different. It should be noted here that the mean, median and mode can all be called "averages" because they are all indicators of the typical or representative or average point in a set of numbers.