

## Measures of Position

- ▶ They are used to locate the relative position of the data value in the data set.

Or

- ▶ They are used to find the position of a value, relative to other values in a set of observations/data. The most common measures of position are percentiles, quartiles, Deciles, and standard scores (z-scores).

## Percentiles

- ▶ A percentile is a value below which a certain percentage of observations lie.
- ▶ Percentile divide the data set into 100 equal groups/parts.
- ▶ Percentiles are position measures used mostly in educational and health related fields to indicate the position of an individual in a group.

► Percentiles are not the same as percentages.

► Example: If a student gets 67 points in a test out of 100, it means she has 67%.

There is no indication of her position with respect to her class. May be her score is highest, the lowest, or somewhere in between.

If 67 points corresponds to 58<sup>th</sup> percentile, then it means she performed better than 58% of her class.

Example: The marks of 10 students are given below. Find the percentile rank of the score of 62.

76, 56, 59, 87, 90, 34, 49, 48, 75, 62

► Percentile formula:

$$\text{Percentile} = \frac{(\text{number of values below } X) + 0.5}{\text{Total number of Values}} * 100$$

Solution: Arrange the data in order:

34, 48, 49, 56, 59, 62, 75, 76, 87, 90

Put the values in formula:

$$\text{Percentile} = \frac{5 + 0.5}{10} * 100$$

=55th percentile

A student whose score was 62, did better than 55%

Example: The marks of 10 students are given below.  
Find the percentile rank of the score of 87.

76, 56, 59, 87, 90, 34, 49, 48, 75, 62

► Percentile formula:

$$\text{Percentile} = \frac{(\text{number of values below } X) + 0.5}{\text{Total number of Values}} * 100$$

Solution: Arrange the data in order:

34, 48, 49, 56, 59, 62, 75, 76, 87, 90

Put the values in formula:

$$\text{Percentile} = \frac{8 + 0.5}{10} * 100$$

=85th percentile

A student whose score was 87, did better than 85%.

## Finding a data value corresponding to a given percentile.

1. Arrange the data in order from lowest to highest.
2. Put the value into the formula  $c = \frac{n \cdot p}{100}$   $n = \text{total number of values}$   
 $p = \text{percentile}$
3. If  $c$  is not a whole number, round up to the next whole number. Starting at the lowest value, count over to the number that corresponds to the rounded up value.
4. If  $c$  is a whole number, use the value half way between the  $c$ th and  $(c+1)$ st value when counting up from the lowest value.

Example: The marks of 10 students are given below.  
Find the value corresponding to 25<sup>th</sup> percentile.

76, 56, 59, 87, 90, 34, 49, 48, 75, 62

Solution: Arrange the data in order:

34, 48, 49, 56, 59, 62, 75, 76, 87, 90

Put the values in formula:

$$c = \frac{n \cdot p}{100}$$

$$c = \frac{10 \cdot 25}{100}$$

$$c = 2.5$$

If c is not a whole number, round up to the next whole number. So c = 3, now start at the lowest value and count over to the third value, which is 49, so the value 49 corresponds to the 25<sup>th</sup> percentile.

To arrange data in ascending order  $\Rightarrow$

34, 48, 49, 56, 59, 62, 75, 76, 87, 90

Given percentile  $p=25$  and no. of values  $n=10$

Value  $c=n \cdot p/100$

$$c=10 \cdot 25/100$$

$$c=250/100$$

$$c=2.5 \text{ round up } c=3 \Rightarrow 49$$

Example: The marks of 10 students are given below.  
Find the value corresponding to 70<sup>th</sup> percentile.

76, 56, 59, 87, 90, 34, 49, 48, 78, 62

Solution: Arrange the data in order:

34, 48, 49, 56, 59, 62, 76, 78, 87, 90

Put the values in formula:

$$c = \frac{n \cdot p}{100}$$

$$c = \frac{10 \cdot 70}{100}$$

$$c = 7$$

Since c is a whole number, use the value halfway between the c and c + 1 value when counting up from the lowest value, in this case 76 and 78, add them and divide by 2. It means 77 corresponds to 70<sup>th</sup> percentile, means obtaining 77 marks would have done better than 70% of the class.

34, 48, 49, 56, 59, 62, 76, 78, 87, 90

$$c = n \cdot p / 100$$

$$c = 10 \cdot 70 / 100$$

$$c = 7$$

c and (c+1) ==> 7th and 8th

$$(76 + 78) / 2 ==> 77$$