

# Central Tendency

Central tendency is a descriptive summary of a dataset through a single value that reflects the center of the data distribution.

It is a single value that attempts to describe a set of data by identifying the central position within that set of data.

Along with the dispersion, central tendency is a branch of descriptive statistics

Example: Based on the grouped data below, find the median:

| Time to travel to work | Frequency |
|------------------------|-----------|
| 1 – 10                 | 8         |
| 11 – 20                | 14        |
| 21 – 30                | 12        |
| 31 – 40                | 9         |
| 41 – 50                | 7         |

**Solution:**

**1<sup>st</sup> Step:** Construct the cumulative frequency distribution

| Time to travel to work | Frequency | Cumulative Frequency |
|------------------------|-----------|----------------------|
| 1 – 10                 | 8         | 8                    |
| 11 – 20                | 14        | 22                   |
| 21 – 30                | 12        | 34                   |
| 31 – 40                | 9         | 43                   |
| 41 – 50                | 7         | 50                   |

$$\frac{n}{2} = \frac{50}{2} = 25 \rightarrow \text{class median is the 3<sup>rd</sup> class}$$

So,  $F = 22$ ,  $f_m = 12$ ,  $L_m = 20.5$  and  $i = 10$

Example:

find the percentiles P8, P50, and P85 of the following data .

| Columns Load | Frequency (fi) |
|--------------|----------------|
| 50 - 69      | 3              |
| 70 - 89      | 7              |
| 90 - 109     | 4              |
| 110 - 129    | 4              |
| 130 - 149    | 9              |

Solution:

find the cumulative frequency and the summation of frequencies and real interval limit.

| Columns Load | Frequency (fi) | Cumulative frequency | Real interval |
|--------------|----------------|----------------------|---------------|
| 50 - 69      | 3              | 3                    | 49.5 - 69.5   |
| 70 - 89      | 7              | 10                   | 69.5 - 89.5   |
| 90 - 109     | 4              | 14                   | 89.5 - 109.5  |
| 110 - 129    | 4              | 18                   | 109.5 - 129.5 |
| 130 - 149    | 9              | 27                   | 129.5 - 149.5 |

P8

2) find the arrangement number of percentiles to find percentiles interval P8.

$$p8 = (8/100) \times n = (8/100) \times 27 = 2.16$$

The interval of percentiles number 8 is have the cumulative frequency = 3

$$P = a + \left[ \frac{p - n_1}{f_p} \right] \cdot C$$

a = the real lower limit of percentiles interval

$n_1$  = the cumulative frequency of the previous interval of the percentiles interval

$f_p$  = the frequency of percentiles interval

C = the length of percentiles interval

= 49.5

= 0

= 3

= 20

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| Columns Load | Frequency (fi) | Cumulative frequency | Real interval |     |
|--------------|----------------|----------------------|---------------|-----|
| 50 - 69      | 3              | 3                    | 49.5 - 69.5   | P8  |
| 70 - 89      | 7              | 10                   | 69.5 - 89.5   |     |
| 90 - 109     | 4              | 14                   | 89.5 - 109.5  | P50 |
| 110 - 129    | 4              | 18                   | 109.5 - 129.5 |     |
| 130 - 149    | 9              | 27                   | 129.5 - 149.5 | P85 |

Example:

find the percentiles arrangement of 115 in the above data .

$$P = a + \left[ \frac{p - n_1}{f_p} \right] \cdot C$$

$a$  = the real lower limit of percentiles interval = 109.5  
 $n_1$  = the cumulative frequency of the previous interval of the percentiles interval = 14  
 $f_p$  = the frequency of percentiles interval = X  
 $C$  = the length of percentiles interval = 20

$$115 = 109.5 + \left[ \frac{X - 14}{4} \right] \cdot 20 \quad \text{then, } X = 15.1$$

$$\text{then, percentiles arrangement} = \frac{15.1}{27} \times 100\% = 56\%$$