**The Median**

Median is the value which divides the data into two equal parts after arranging values in ascending or descending order.

$$\tilde{X}=\frac{n+1}{2}th value in the data$$

**Example: Find the median of the numbers i) 4, 8, 6, 7, 3, 2, 10 and ii) 5, 6, 10, 4, 6, 9**

1. Arranging the observations from smallest to largest

2, 3, 4, 6, 7, 8, 10 n=7

$$\tilde{X}=\frac{n+1}{2}=\frac{7+1}{2}=4th value $$

$$\tilde{X}=6$$

1. 5, 6, 10, 4, 6, 9

Arranging the observations from smallest to largest

4, 5, 6, 6, 9, 10 n=6

**Method # 1** $\tilde{X}=\left(\frac{n}{2}+1\right)th value=(\frac{6}{2}$+1) =4th value=6

**Method # 2** $\tilde{X}=\frac{n+1}{2}=\frac{6+1}{2}=3.5th value$

$$=3rd value+0.5(4th value-3rd value)$$

$$\tilde{X}=6+0.5\left(6-6\right)=6$$

**Median for Grouped data**

$$Median=l\_{b}+\frac{h}{f}\left(\frac{n}{2}-c\right)$$

Where

$$l\_{b}=lower class boundary of median class (the class corresponding to the cumulative$$

$$ frequency in which \left(\frac{n}{2}\right) lies$$

$$h=class interval size of median class$$

$$f=frequency of the median class$$

$$n=total frequency$$

$$c=cumulative frequency lower than median class $$

**Example**

|  |  |  |  |
| --- | --- | --- | --- |
| **Class limits** | **Class boundaries** | **Frequency (f)** | **Cumulative frequency** |
| 45-49 | 44.5-49.5 | 1 | 1 |
| 50-54 | 49.5-54.5 | 4 | 5 |
| 55-59 | 54.5-59.5 | 17 | 22 |
| 60-64 | 59.5-64.5 | 28 | 50 |
| 65-69 | 64.5-69.5 | 25 | 75 |
| 70-74 | 69.5-74.5 | 18 | 93 |
| 75-79 | 74.5-79.5 | 13 | 106 |
| 80-84 | 79.5-84.5 | 6 | 112 |
| 85-89 | 84.5-89.5 | 5 | 117 |
| 90-94 | 89.5-94.5 | 2 | 119 |
| 95-99 | 94.5-99.5 | 1 | 120 |
| **Sum** |  | **120** |  |

$$Median=l\_{b}+\frac{h}{f}\left(\frac{n}{2}-c\right)$$

$$\frac{n}{2}=\frac{\sum\_{}^{}f}{2}=\frac{120}{2}=60$$

$$Median=64.5+\frac{5}{25}\left(60-50\right)$$

$$Median=66.5$$

**Quantiles:** Quartiles, deciles, Percentiles

**Quartiles: Divide the data into four equal parts**

$$Q\_{1}, Q\_{2}, Q\_{3}$$

$$Q\_{1}:Lower quartile$$

$$Q\_{3}:Upper quartile$$

$$Q\_{1}=\frac{n+1}{4}th value in the data$$

$$Q\_{3}=\frac{3(n+1)}{4}th value in the data$$

**For grouped data**

$$Q\_{1}=l\_{b}+\frac{h}{f}\left(\frac{n}{4}-c\right)$$

$$Q\_{3}=l\_{b}+\frac{h}{f}\left(\frac{3n}{4}-c\right)$$

**Deciles: divide the data into ten equal parts**

$$D\_{1, } D\_{2}, ……..D\_{9}$$

$$D\_{1}=\frac{n+1}{10}th value in the data$$

$$D\_{5}=\frac{5(n+1)}{10}th value in the data$$

$$D\_{9}=\frac{9(n+1)}{10}th value in the data$$

**For Grouped data**

$$D\_{1}=l\_{b}+\frac{h}{f}\left(\frac{n}{10}-c\right)$$

$$D\_{9}=l\_{b}+\frac{h}{f}\left(\frac{9n}{10}-c\right)$$

**Percentiles: Divide the data into 100 parts**

$$P\_{1}, P\_{2}, ……..P\_{99}$$

$$P\_{1}=\frac{n+1}{100}th value in the data$$

$$P\_{75}=\frac{75(n+1)}{100}th value in the data$$

**For Grouped data**

$$P\_{1}=l\_{b}+\frac{h}{f}\left(\frac{n}{100}-c\right)$$

$$P\_{99}=l\_{b}+\frac{h}{f}\left(\frac{99n}{100}-c\right)$$