Median

The median is that value of the variable which divides the group into two equal parts, one part comprising all the values greater and the other, all the values less than median.

Calculation

Ungrouped Data

If the number of observations is odd, then the median is the middle value after the observations have been arranged in ascending or descending order.

Ex : 35, 12, 40, 8, 60

After Rearranging 8, 12, (35), 40, 60

↓

Median

In case of even number of observations median is obtained as the arithmetic mean of the two middle observations after they are arranged in ascending or descending order.

Ex : 8, 12, 35, 40, 50, 60

Median : $\frac{35+40}{2} = 37.5$ Ans.

Frequency Distributions

(i) Prepare the less than cumulative frequency distribution

(ii) Find N/2.

(iii) See the c.f just greater than N/2.

(iv) The corresponding value of the variable gives median.

Examples

x	f	less than c.f
0	1	1
1	9	10
2	26	36
3	59	95
4	72	(167)
5	52	219
6	29	248
7	7	255
8	1	256
	$\Sigma f = 256$	

$N = \Sigma f = 256$

$\Rightarrow \frac{N}{2} = 128$

The cumulative frequency just greater than 128 is 167 and the value of x corresponding to 167 is 4. Here, the median is 4.

Continuous Frequency Distributions

(i) prepare c.f distributions
(ii) Find N/2.
(iii) See c.f is just greater than N/2.
(iv) The corresponding class contains the median value and is called the median class.

$$\therefore \text{Median} = l + \frac{h}{f}\left(\frac{N}{2} - c\right)$$

where as:

l -> lower limit of the median class
f -> frequency of the median class
h -> width of the median class
$N \Rightarrow \Sigma f$, summation of total frequency.
c -> Cumulative frequency of the class preceding the median class.

Example

class	frequency	cf
0-10	2	2
10-20	3	5
20-30	4	(9)
30-40	3	12
40-50	2	14
50-60	1	15
60-70	0.5	15.5
70 & above	0.1	15.6

$N = \Sigma f = 15.6$

$\therefore \frac{N}{2} = \frac{15.6}{2} = 7.8$

-> cumulative frequency greater than 7.8.

Median class 20-30.

$\text{Median} = l + h/f\,(N/2 - c)$

$= 20 + \frac{10}{4}(7.8 - 5)$

$= 20 + 5/2\,(2.8)$

$= 20 + 5\,(1.4)$

$= 27$ Ans

Merits

(1) Easy to understand and calculate.
(2) It is not affected by extreme observations.
(3) Can be computed even while dealing with the distributions of open ended classes.
(4) Median is the only average to be used while dealing with qualitative characteristics.

Demerits

(1) Cannot be exactly determined in case of ungrouped even observations data.
(2) It is not based on each and every item of the distribution.
(3) It is not suitable for further mathematical treatment.
(4) Median is relatively less stable than mean, particularly for small samples.

Reference: Fundamentals of Statistics by S.C. Gupta.