MEDIAN

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A median is the middle-most value in a set of observed values or data. For finding the median of ungrouped data, the observed values of data are arranged first in ascending order. Then, if n (number of data) is odd, the median is the {(n+1)/2}th observed value. And, if n is even, then the median will be the average of the (n/2)th and the {(n/2) +1}th observed values. It is a positional average. It divides the all data into two halves; in one half all values are lower than the median, whereas in the other half all values are higher than the median. Like mean, it also acts as a representative figure for the all observed values or data. But unlike mean, it is not affected by the values of extreme variations which are situated on the two ends of the data series.

A. MEDIAN OF UNGROUPED DATA

Ungrouped data is raw data or values that have not been categorized into groups under different intervals of same range. For finding the median of ungrouped data, the observed values of data are arranged first in ascending order. Then, if n (number of data) is odd, the median is the {(n+1)/2}th observed value. And, if n is even, then the median will be the average of the (n/2)th and the {(n/2) +1}th observed values.

Example: The resting heart rates (beats per minute or bpm) of 10 men and 11 women are shown in table below:

Resting Heart rates (bpm) of 10 men	63, 67, 69, 72, 72, 72, 74, 74, 77 and 80
Resting Heart rates (bpm) of 11 women	61, 66, 66, 69, 72, 72, 73, 74, 75, 81 and 83

Calculate/ Find the median of the resting heart rates of the men and women separately.

Answer:

Median of men's resting heart rates

For men, n=10, and 10 is even. Here, the median will be the average of the (n/2)th and the {(n/2)+1}th observed values, i.e., the 5^{th} and 6th observed values. To find 5^{th} and 6th observed values, all observed values are arranged as follows:

Resting heart rates of men in ascending order	Position of observed value in ascending order
60	1st
67	2nd
69	3rd
72	4th
72	5th
72	6th
74	7th
74	8th
77	9th
80	10th

. In the above table, it is observed that:

5th observed value is 72
6th observed value is 72

So, median = (72+72)/2
= 144/2
= 72

Therefore, the median of the men's resting heart rates is 72 bpm.

Median of women's resting heart rates

For women, n=11, and 11 is odd. Here, the median will be the {(n+1)/2}th observed value, i.e., the 6th observed value. To find this observed value, all observed values are arranged as follows:

Resting heart rates of men in ascending order	Position of observed value in ascending order
61	1st
66	2nd
66	3rd
69	4th
72	5th
72	6th
73	7th
74	8th
75	9th
81	10th
83	11th

In the above table, it is observed that:

6th observed value is 72

Therefore, the median of the women's resting heart rates is 72 bpm.

B. MEDIAN OF GROUPED DATA

Grouped data are data constituted by arranging individual observed values or data of a variable into groups under different intervals of same range. The median of the grouped frequency data is calculated using the following formula:

Median = l + {(n/2 – cf)/f} x h

Where l = lower limit of median class,

n = number of observations,

cf = cumulative frequency of class preceding the median class,

f = frequency of median class,

h = class size.

Example: Body weights (kg) of 40 men of a certain village are presented in the table given below:

Class intervals of body weight (kg)	Frequency i.e., Number of men (f)
45 – 50	3
50 – 55	5
55 – 60	7
60 – 65	11
65 – 70	5
70 – 75	7
75 – 80	2

Find the mean body weight of the village men.

Answer:

The median of the above-mentioned grouped frequency data can be calculated using the following formula:

Median = l + {(n/2 – cf)/f} x h

Where l = lower limit of median class,

n = number of observations,

cf = cumulative frequency of class preceding the median class,

f = frequency of median class,

h = class size.

For the above-mentioned grouped frequency data, cf can be calculated in the manner as shown in the following table:

Class intervals of body weight (kg)	Frequency i.e., Number of men (f)	Cumulative frequency (cf)
45 – 50	3	3
50 – 55	5	8
55 – 60	7	15
60 – 65	11	26
65 – 70	5	31
70 – 75	7	38
75 – 80	2	40

To find the class containing the middle-observed value, the cumulative frequencies of all the classes and n/2 are determined. Then, the class whose cumulative frequency is greater than (and nearest to) n/2 is determined. This class is called the **median class**.

Here, n/2 = 40/2 = 20. The cumulative frequency 26 is greater than and nearest to 20, and lies in the class 60-65. So, the class 60-65 is called the modal class. The lower limit (l) and frequency (f) of the modal class is 60 and 11 respectively, and the cumulative frequency of the class preceding the modal class is 15. Besides, here the class size (h) is 5.

So, median = 60 + {(20 – 15)/11} x 5

= 60 +25/11

= 60 + 2.27

= 62.27

Therefore, the median of the body weights is 62.27 kg.

Note: There is an empirical relationship between the mean, mode and median (i.e., three measures of central tendency) of the given set of data:

3 Median = Mode + 2 Mean