Measures of Central Tendency

Median

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Median is the value of the variable which divides the whole set of data into two equal parts. It is the value such that in a set of observations, 50% observations are above and 50% observations are below it. Hence the median is a positional average.

(a) Median for Ungrouped or Raw data:

In this case, the data is arranged in either ascending or descending order of magnitude.

(i) If the number of observations n is an odd number, then the median is represented by the numerical value of x, corresponds to the positioning point of $\frac{n+1}{2}$ in ordered observations. That is,

$$\text{Median} = \text{value of } \left(\frac{n+1}{2}\right)^{th} \text{ observation in the data array}$$

(ii) If the number of observations n is an even number, then the median is defined as the arithmetic mean of the middle values in the array That is,

$$\text{Median} = \frac{\text{value of } \left(\frac{n}{2}\right)^{th} \text{observation} + \text{value of } \left(\frac{n}{2}+1\right)^{th} \text{observation}}{2}$$

The number of rooms in the seven five stars hotel in Chennai city is 71, 30, 61, 59, 31, 40 and 29. Find the median number of rooms

The export of agricultural product in million dollars from a country during eight quarters in 1974 and 1975 was recorded as 29.7, 16.6, 2.3, 14.1, 36.6, 18.7, 3.5, 21.3

Find the median of the given set of values

Cumulative Frequency

In a grouped distribution, values are associated with frequencies. The cumulative frequencies are calculated to know the total number of items above or below a certain limit. This is obtained by adding the frequencies successively up to the required level. This cumulative frequencies are useful to calculate median, quartiles, deciles and percentiles.

(b) Median for Discrete grouped data

We can find median using following steps

   (i) Calculate the cumulative frequencies

   (ii) Find $\dfrac{N+1}{2}$, Where $N = \sum f =$ total frequencies

   (iii) Identify the cumulative frequency just greater than $\dfrac{N+1}{2}$

   (iv) The value of x corresponding to that cumulative frequency $\dfrac{N+1}{2}$ is the median.

The following data are the weights of students in a class. Find the median weights of the students

Weight(kg)	10	20	30	40	50	60	70
Number of Students	4	7	12	15	13	5	4

(c) Median for Continuous grouped data

In this case, the data is given in the form of a frequency table with class-interval etc., The following formula is used to calculate the median.

$$\text{Median} = l + \frac{\frac{N}{2} - m}{f} \times c$$

Where

l = Lower limit of the median class

N = Total Numbers of frequencies

f = Frequency of the median class

m = Cumulative frequency of the class preceding the median class

c = the class interval of the median class.

From the formula, it is clear that one has to find the median class first. Median class is, that class which correspond to the cumulative frequency just greater than $\frac{N}{2}$.

The following data attained from a garden records of certain period Calculate the median weight of the apple

Weight in grams	410 – 420	420 – 430	430 – 440	440 – 450	450 – 460	460 – 470	470 – 480
Number of apples	14	20	42	54	45	18	7

The following table shows age distribution of persons in a particular region:

Age (years)	No. of persons (in thousands)
Below 10	2
Below20	5
Below30	9
Below 40	12
Below 50	14
Below 60	15
Below 70	15.5
Below 80	15.6

Find the median age.

The following is the marks obtained by 140 students in a college. Find the median marks

| Marks	Number of students
10-19	7
20-29	15
30-39	18
40-49	25
50-59	30
60-69	20
70-79	16
80-89	7
90-99	2

Graphical method for Location of median

Median can be located with the help of the cumulative frequency curve or 'ogive'. The procedure for locating median in a grouped data is as follows:

Step 1 : The class intervals, are represented on the horizontal axis (x-axis)

Step 2 : The cumulative frequency corresponding to different classes is calculated. These cumulative frequencies are plotted on the vertical axis (y-axis) against the upper limit of the respective class interval

Step 3 : The curve obtained by joining the points by means of freehand is called the *'less than ogive'*.

Step 4 : A horizontal straight line is drawn from the value $\frac{N}{2}$ or $\frac{N+1}{2}$ on the y-axis parallel to x- axis to meet the ogive. (depending on N is odd or even)

Step 5 : From the point of intersection, draw a line, perpendicular to the horizontal axis which meet the x axis at m say.

Step 6 : The value m at x axis gives the value of the median.

Draw ogive curves for the following frequency distribution and determine the median.

Age groups	No. of people
0 – 10	6
10 – 20	12
20 – 30	10
30 – 40	32
40 – 50	22
50 – 60	18
60 – 70	15
70 – 80	5
80 – 90	4
90 – 100	3

Class boundary	Cumulative Frequency	
	Less than	More than
0	0	127
10	6	121
20	18	109
30	28	99
40	60	67
50	82	45
60	100	27
70	115	12
80	120	7
90	124	3
100	127	0
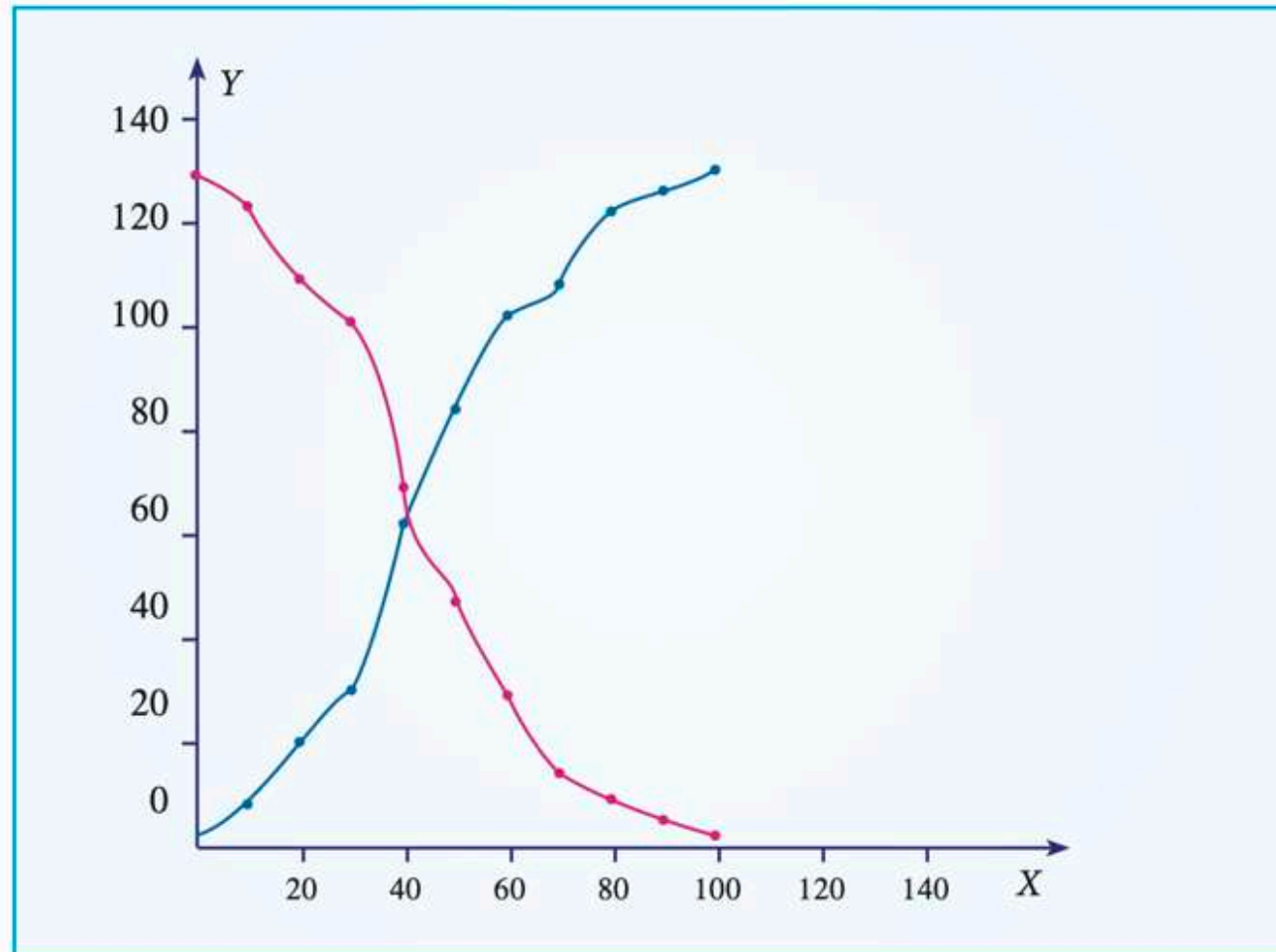
The median value from the graph is 42

Merits

- It is easy to compute. It can be calculated by mere inspection and by the graphical method

- It is not affected by extreme values.

- It can be easily located even if the class intervals in the series are unequal

Limitations

- It is not amenable to further algebraic treatment

- It is a positional average and is based on the middle item

- It does not take into account the actual values of the items in the series