

# Basic statistics

## Median

The median of a set of data is the middlemost number or centre value in the set. The median is also the number that is halfway into the set.

To find the median, the data should be arranged first in order of least to greatest or greatest to the least value. A median is a number that is separated by the higher half of a data sample, a population or a probability distribution from the lower half. The median is different for different



types of distribution.

For example, the median of 3, 3, 5, 9, 11 is 5. If there is an even number of observations, then there is no single middle value; the median is then usually defined to be the mean of the two middle values: so the median of 3, 5, 7, 9 is  $(5+7)/2 = 6$ .

### Odd Number of Observations

If the total number of observations given is odd, then the formula to calculate the median is:

$$Median = \left(\frac{n+1}{2}\right)^{th} term$$

where n is the number of observations

### **Even Number of Observations**

If the total number of observation is even, then the median formula is:

$$Median = \frac{\left(\frac{n}{2}\right)^{th} term + \left(\frac{n}{2} + 1\right)^{th} term}{2}$$

Where n is the number of observations

### **Example 1:**

Find the Median of 14, 63 and 55

Solution:

Put them in ascending order: 14, 55, 63

The middle number is 55, so the median is 55.

### **Example 2:**

Find the median of the following:

4, 17, 77, 25, 22, 23, 92, 82, 40, 24, 14, 12, 67, 23, 29

Solution:

When we put those numbers in the order, we have:

4, 12, 14, 17, 22, 23, 23, 24, 25, 29, 40, 67, 77, 82, 92,

There are fifteen numbers. Our middle is the eighth number:

The median value of this set of numbers is 24.

### **Example 3:**

Rahul's family drove through 7 states on summer vacation. The prices of Gasoline differ from state to state. Calculate the median of gasoline cost.

1.79, 1.61, 2.09, 1.84, 1.96, 2.11, 1.75

Solution

By organizing the data from smallest to greatest, we get:

1.61, 1.75, 1.79, 1.84, 1.96, 2.09, 2.11

Hence, the median of gasoline cost is 1.84. There are three states with greater gasoline costs and 3 with smaller prices

**Example 4** : in a data set of {3, 13, 2, 34, 11, 26, 47},

the sorted order becomes {2, 3, 11, 13, 26, 34, 47}.

The median is the number in the middle {2, 3, 11, 13, 26, 34, 47},

which in this instance is 13 since there are three numbers on either side.

To find the median value in a list with an even amount of numbers, one must determine the middle pair, add them, and divide by two. Again, arrange the numbers in order from lowest to highest.

**Example 5** :in a data set of {3, 13, 2, 34, 11, 17, 27, 47},

the sorted order becomes {2, 3, 11, 13, 17, 27, 34, 47}.

The median is the average of the two numbers in the middle {2, 3, 11, 13, 17, 26 34, 47},

which in this case is 15 or  $(13 + 17) \div 2 = 15$

**Example 6.**

The weights of 55 children in a class were recorded, to the nearest kg, as follows:

Wt. (in nearest kg)	45	49	53	54	56	57	59
No. of children	6	5	9	15	12	5	3

Calculate the median weight of the class.

Solution: For tabulated data, we have to first calculate the cumulative frequency (c.f.). The c.f. of the first observation will remain the same. For the second observation, we will add the frequency of the first observation and the frequency of the second observation. The result of this addition will be added to the frequency of the third observation, to make the c.f. for the third observation. Repeat the process for the rest of the observations

<b>Weight (x)</b>	<b>No. of children (f)</b>	<b>Cumulative frequency (c.f.)</b>
45	6	6
49	5	$6+5=11$
53	9	$11+9=20$
54	15	$20+15=35$
56	12	$35+12=47$
57	5	$47+5=52$
59	3	$52+3=55$
	n=55	

The total number of children (n)=55, which is odd,

Therefore,

$$\begin{aligned}\text{Median} &= \left(\frac{n+1}{2}\right)^{\text{th}} \text{term} \\ &= \left(\frac{55+1}{2}\right)^{\text{th}} \text{term} = 28^{\text{th}} \text{term}\end{aligned}$$

=

Median weight = weight of 28th child

In the above table, look at the column of cumulative frequency, and observe that the weight of each child from 21st child to 35th child is 54kg.

Therefore,

The weight of the 28th child = 54kg

Hence,

The median weight = 54kg

**Example 7.** The heights of 46 children in a class were recorded, to the nearest cm, as follows:

Height (in nearest cm)	148	149	150	152	154	155
No. of children	9	6	8	11	5	4

Calculate the median height of the class.

Solution: First calculate the cumulative frequency of the given data as follows:

Height (x)	No. of children (f)	Cumulative frequency (c.f.)
148	9	9
149	6	$9+6=15$
150	8	$15+8=23$
152	11	$23+11=34$
154	5	$34+5=39$
155	4	$39+4=43$
158	3	$43+3=46$
	n=46	

Total number of children (n)=46, which is even,



Therefore,

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

$$\text{Median} = \frac{\left(\frac{46}{2}\right)^{\text{th}} \text{term} + \left(\frac{46}{2} + 1\right)^{\text{th}} \text{term}}{2}$$

$$= \frac{1}{2} [23^{\text{rd}} \text{term} + 24^{\text{th}} \text{term}]$$

From the cumulative frequency column, we observe that the height of 23<sup>rd</sup> child is 150cm and the height of each child after 23<sup>rd</sup> child to 34<sup>th</sup> child is 152cm. So the height of 24<sup>th</sup> child is 152cm.

Hence,

$$\text{Median} = (150 + 152) / 2 = 302 / 2$$

$$= 151 \text{cm}$$