

**6. An aircraft has 120 passenger seats. The number of seats occupied during 100 flights is given in the following table :**

**Number of seats 100-104 104-108 108-112 112-116 116-120**

**Frequency 15 20 32 18 15**

**Determine the mean number of seats occupied over the flights.**

**Solution:**

<b>Class Interval</b>	<b>Class Marks (<math>x_i</math>)</b>	<b>Frequency (<math>f_i</math>)</b>	<b>Deviation (<math>d_i = x_i - a</math>)</b>	<b><math>f_i d_i</math></b>
100 - 104	102	15	- 8	- 120
104 - 108	106	20	- 4	- 80
108 - 112	110	32	0	0
112 - 116	114	18	4	72
116 - 120	118	15	8	120
		$N = \sum f_i = 100$		$\sum f_i d_i = - 8$

$\therefore$  Assumed mean,  $a = 110$

Class width,  $h = 4$

And total observations,  $N = 100$

Hence, finding mean,

$$\text{Mean}(\bar{X}) = a + \frac{\sum f_i d_i}{\sum f_i}$$

$$= 110 + (-8/100)$$

$$= 110 - 0.08$$

$$= 109.92$$

But we know that the seats cannot be in decimal.

Therefore, the number of seats = 109.

**Sample Question 3 :** The percentage of marks obtained by 100 students in an examination are given below:

Marks	30-35	35-40	40-45	45-50	50-55	55-60	60-65
Frequency	14	16	18	23	18	8	3

Determine the median percentage of marks.

**Solution :**

Marks (Class)	Number of Students (Frequency)	Cumulative frequency
30-35	14	14
35-40	16	30
40-45	18	48
45-50	23	71 ← Median class
50-55	18	89
55-60	8	97
60-65	3	100

Here,  $n = 100$ .

Therefore,  $\frac{n}{2} = 50$ , This observation lies in the class 45-50.

$l$  (the lower limit of the median class) = 45

$cf$  (the cumulative frequency of the class preceding the median class) = 48

$f$  (the frequency of the median class) = 23

$h$  (the class size) = 5

$$\text{Median} = l + \left( \frac{\frac{n}{2} - cf}{f} \right) h$$

$$= 45 + \left( \frac{50 - 48}{23} \right) \times 5$$

$$= 45 + \frac{10}{23} = 45.4$$

So, the median percentage of marks is 45.4.

**Hint:** The cumulative frequency of a class is the frequency obtained by adding the frequencies of all the classes preceding the given class.

**Sample Question 1:** The following is the cumulative frequency distribution (of less than type) of 1000 persons each of age 20 years and above. Determine the mean age.

<b>Age below (in years)</b>	30	40	50	60	70	80
<b>Number of persons</b>	100	220	350	750	950	1000

**Solution :** First, we make the frequency distribution of the given data and then proceed to calculate mean by computing class marks ( $x_i$ ),  $u_i$ 's and  $f_i u_i$ 's as follows :

<b>Class</b>	<b>Frequency (<math>f_i</math>)</b>	<b>Class mark (<math>x_i</math>)</b>	$u_i = \frac{x_i - 45}{10}$	$f_i u_i$
20-30	100	25	-2	-200
30-40	120	35	-1	-120
40-50	130	45	0	0
50-60	400	55	1	400
60-70	200	65	2	400
70-80	50	75	3	150
	$f_i = 1000$			$f_i u_i = 630$

**17. The monthly income of 100 families are given as below :**

**Income (in Rs) Number of families**

**0-5000 8**

**5000-10000 26**

**10000-15000 41**

**15000-20000 16**

**20000-25000 3**

**25000-30000 3**

**30000-35000 2**

**35000-40000 1**

**Calculate the modal income.**

**Solution:**

According to the data given,

The highest frequency = 41,

41 lies in the interval 10000 - 15000.

Here,  $l = 10000$ ,  $f_m = 41$ ,  $f_1 = 26$ ,  $f_2 = 16$  and  $h = 5000$

$$\begin{aligned}\therefore \text{Mode} &= l + \left( \frac{f_m - f_1}{2f_m - f_1 - f_2} \right) \times h \\ &= 10000 + \left( \frac{41 - 26}{2 \times 41 - 26 - 16} \right) \times 5000 \\ &= 10000 + \left( \frac{15}{82 - 42} \right) \times 5000 \\ &= 10000 + \left( \frac{15}{40} \right) \times 5000\end{aligned}$$

$$= 10000 + 15 \times 125$$

$$= 10000 + 1875$$

$$= 11875$$

Hence, the modal income = Rs.11875 per month.

15. Weekly income of 600 families is tabulated below :

Weekly income (in Rs)	Number of families
0-1000	250
1000-2000	190
2000-3000	100
3000-4000	40
4000-5000	15
5000-6000	5
<b>Total</b>	<b>600</b>

Compute the median income.

**Solution:**

Weekly Income	Number of families ( $f_i$ )	Cumulative frequency (cf)
0-1000	250	250
1000-2000	190	$250 + 190 = 440$
2000-3000	100	$440 + 100 = 540$
3000-4000	40	$540 + 40 = 580$
4000-5000	15	$580 + 15 = 595$
5000-6000	5	$595 + 5 = 600$

According to the question,

$$n = 600$$

$$\therefore n/2 = 600/2 = 300$$

Cumulative frequency 440 lies in the interval 1000 - 2000.

Hence, lower median class,  $l = 1000$

$$f = 190,$$

$$c_f = 250,$$

$$\text{Class width, } h = 1000$$

$$\text{And total observation } n = 600$$

$$\begin{aligned}\therefore \text{Median} &= l + \frac{\left(\frac{n}{2} - c_f\right)}{f} \times h \\ &= 1000 + \frac{(300 - 250)}{190} \times 1000 \\ &= 1000 + \frac{50}{190} \times 1000\end{aligned}$$

$$= 1000 + 5000/19$$

$$= 1000 + 263.15 = 1263.15$$

Hence, the median income is Rs.1263.15.

## Important Formulas and Concepts

1. The mean for grouped data can be found by :

a. the direct method :

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

b. the assumed mean method :

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

c. the step deviation method :

$$\bar{x} = a + \left( \frac{\sum f_i u_i}{\sum f_i} \right) \times h,$$

with the assumption that the frequency of a class is centred at its mid-point, called its class mark.

2. The mode for grouped data can be found by using the formula:

$$\text{Mode} = l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

3. The cumulative frequency of a class is the frequency obtained by adding the frequencies of all the classes preceding the given class.

4. The median for grouped data is formed by using the formula:

$$\text{Median} = l + \left( \frac{\frac{n}{2} - cf}{f} \right) \times h,$$

5. Representing a cumulative frequency distribution graphically as a cumulative frequency curve, or an ogive of the less than type and of the more than type.

6. The median of grouped data can be obtained graphically as the x-coordinate of the point of intersection of the two ogives for this data.

## Tips and Tricks

General ones:

1. From problem sets, you must have gotten the main idea of solving statistics concepts. Trick is to remember all the formulas and knowing when to use them. See formulas pdf file for material.
2. Note down all the formulas and keep them on your desk or wall, this way you can look at them and revise each and every day. Feel free to apply this trick to other chapters and subjects.
3. It is very simple chapter that can give boost to your marks. SO MAKE SURE TO COMPLETE THIS ONE.
4. Try to eliminate options that seem obviously wrong to you, to save time.

Topic related:

1. As mean, mode and median are all central tendencies; they generally lie in the place where data is dense. If used wisely this trick can help eliminating obvious wrong answers in objective questions.
2. Try to make graphs when necessary to solve statistics problems quickly.
3. The median of grouped data can be obtained graphically as the x-coordinate of the point of intersection of the two ogives for this data. This is an important trick for specific type questions.
4. And practice these formulas using timed tests.