

### Exercise 9F

1. Write the median class of the following distribution:

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70
Frequency	4	4	8	10	12	8	4

**Sol:**

To find median let us put the data in the table given below:

Class	Frequency ( $f_i$ )	Cumulative frequency (cf)
0-10	4	4
10-20	4	8
20-30	8	16
30-40	10	26
40-50	12	38
50-60	8	46
60-70	4	50
Total	$N = \sum f_i = 50$	

Now,  $N = 50 \Rightarrow \frac{N}{2} = 25$

The cumulative frequency just greater than 25 is 26, and the corresponding class is 30-40. Thus, the median class is 30-40.

2. What is the lower limit of the modal class of the following frequency distribution?

Age (in years)	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
Number of patients	16	13	6	11	27	18

**Sol:**

Here the maximum class frequency is 27, and the class corresponding to this frequency is 40-50. So the modal class is 40-50.

Now,

Modal class = 40-50, lower limit (/) of modal class = 40.

Thus, lower limit (/) of modal class is 40

3. The monthly pocket money of 50 students of a class are given in the following distribution:

Monthly pocket money (in ₹)	0 - 50	50 – 100	100 – 150	150 -200	200 – 250	250 - 300
Number of Students	2	7	8	30	12	1

Find the modal class and give class mark of the modal class.

**Sol:**

Here the maximum class frequency is 30, and the class corresponding to the frequency is 150-200. So, the modal class is 150-200.

Also, class mark of the modal class is  $\frac{150+200}{2} = 175$ .

4. A data has 25 observations arranged in a descending order. Which observation represents the median?

**Sol:**

If the number of observations is odd, then the median is  $\left(\frac{n+1}{2}\right)$ th observation.

Thus,  $\left(\frac{25+1}{2}\right) = 13$ th observation represents the median.

5. For a certain distribution, mode and median were found to be 1000 and 1250 respectively. Find mean for this distribution using an empirical relation.

**Sol:**

There is an empirical relationship between the three measures of central tendency:

$$3\text{median} = \text{mode} + 2\text{Mean}$$

$$\Rightarrow \text{Mean} = \frac{3\text{Median} - \text{Mode}}{2}$$

$$= \frac{3(1250) - 1000}{2}$$

$$= 1375$$

Thus, the mean is 1375.

6. In a class test, 50 students obtained marks as follows:

Marks obtained	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Number of Students	4	6	25	10	5

Find the modal class and the median class.

**Sol:**

Here the maximum class frequency is 25, and the class corresponding to this frequency is 40-60.

So, the modal class is 40-60.

Now, to find the median class let us put the data in the table given below:

Marks Obtained	Number of students ( $f_i$ )	Cumulative frequency (cf)
0-20	4	4
20-40	6	10
40-60	25	35
60-80	10	45
80-100	5	50
Total	$N = \sum f_i = 50$	

Now,  $N = 50 \Rightarrow \frac{N}{2} = 25$ .

The cumulative frequency just greater than 25 is 35, and the corresponding class is 40-60.

Thus, the median class is 40-60.

7. Find the class marks of classes 10 -25 and 35 – 55.

**Sol:**

$$\text{Class mark} = \frac{\text{Upper limit} + \text{Lower limit}}{2}$$

$$\therefore \text{class mark of } 10-25 = \frac{10+25}{2}$$

$$= 17.5$$

$$\text{And class mark of } 35-55 = \frac{35+55}{2}$$

$$= 45$$

8. While calculating the mean of a given data by the assumed-mean method, the following values were obtained.

$$A=25, \sum f_i d_i = 110, \sum f_i = 50$$

Find the mean.

**Sol:**

According to assumed-mean method,

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

$$= 25 + \frac{110}{50}$$

$$= 25 + 2.2$$

$$= 27.2$$

Thus, mean is 27.2.

9. The distribution X and Y with total number of observations 36 and 64, and mean 4 and 3 respectively are combined. What is the mean of the resulting distribution X + Y?

**Sol:**

According to the question,

$$4 = \frac{X}{36} \text{ and } 3 = \frac{Y}{64}$$

$$\Rightarrow X = 4 \times 36 \text{ and } Y = 3 \times 64$$

$$\Rightarrow X = 144 \text{ and } Y = 192$$

$$\text{Now, } X + Y = 144 + 192 = 336$$

$$\text{And total number of observations} = 36 + 64 = 100$$

$$\text{Thus, mean} = \frac{336}{100} = 3.36.$$

10. In a frequency distribution table with 12 classes, the class-width is 2.5 and the lowest class boundary is 8.1, then what is the upper class boundary of the highest class?

**Sol:**

$$\text{Upper class boundary} = \text{Lowest class boundary} + \text{width} \times \text{number of classes}$$

$$= 8.1 + 2.5 \times 12$$

$$= 8.1 + 30$$

$$= 38.1$$

Thus, upper class boundary of the highest class is 38.1.

11. The observation 29, 32, 48, 50, x, x+2, 72, 78, 84, 95 are arranged in ascending order. What is the value of x if the median of the data is 63?

**Sol:**

If number of observations is even, then the median will be the average of  $\left(\frac{n}{2}\right)$ th and the  $\left(\frac{n}{2} + 1\right)$ th observations.

In the given case,  $n = 10 \Rightarrow \left(\frac{n}{2}\right)th = 5th$  and  $\left(\frac{n}{2} + 1\right)th = 6th$  observation.

$$\text{Thus, } 63 = \frac{x+(x+2)}{2}$$

$$\Rightarrow 126 = 2x + 2$$

$$\Rightarrow 124 = 2x$$

$$\Rightarrow x = 62$$

Thus, the value of x is 62.

12. The median of 19 observations is 30. Two more observation are made and the values of these are 8 and 32. Find the median of the 21 observations taken together.

**Hint** Since 8 is less than 30 and 32 is more than 30, so the value of median (middle value) remains unchanged.

**Sol:**

Since, 8 is less than 30 and 32 is more than 30, so the middle value remains unchanged

Thus, the median of 21 observations taken together is 30.

13. If the median of  $\frac{x}{5}, \frac{x}{4}, \frac{x}{2}, x$  and  $\frac{x}{3}$ , where  $x > 0$ , is 8, find the value of x.

**Hint** Arranging the observations in ascending order, we have  $\frac{x}{5}, \frac{x}{4}, \frac{x}{3}, \frac{x}{2}, x$  Median =  $\frac{x}{3} = 8$ .

**Sol:**

Arranging the observations in ascending order, we have

$$\frac{x}{5}, \frac{x}{4}, \frac{x}{3}, \frac{x}{2}, x$$

Thus, the median is  $\frac{x}{3}$

$$\Rightarrow \frac{x}{3} = 8$$

$$\Rightarrow x = 3 \times 8$$

$$\Rightarrow x = 24$$

Thus, the value of x is 24.

14. What is the cumulative frequency of the modal class of the following distribution?

Class	3 – 6	6 – 9	9 – 12	12 – 15	15 – 18	18 – 21	21 – 24
Frequency	7	13	10	23	54	21	16

**Sol:**

Here the maximum class frequency is 23, and the class corresponding to this frequency is 12-15.

So, the modal class is 12.15.

Now, to find the cumulative frequency let us put the data in the table given below:

Class	Frequency ( $f_i$ )	Cumulative frequency ( $cf$ )
3-6	7	7
6-9	13	20
9-12	10	30
12-15	23	53
15-18	4	57
18-21	21	78
21-24	16	94
Total	$N = \sum f_i = 94$	

Thus, the cumulative frequency of the modal class is 53.

15. Find the mode of the given data:

Class Interval	0 – 20	20 – 40	40 – 60	60 – 80
Frequency	15	6	18	10

**Sol:**

Here the maximum class frequency is 18, and the class corresponding to this frequency is 40-60.

So, the modal class is 40-60.

Now,

Modal class = 40-60, lower limit ( $l$ ) of modal class = 40, class size ( $h$ )=20,

Frequency ( $f_1$ ) of the modal class =18,

Frequency ( $f_0$ ) of class preceding the modal class =6,

Frequency ( $f_2$ ) of class succeeding the modal class = 10.

Now, let us substitute these values in the formula:

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

$$= 40 + \left( \frac{18-6}{36-6-10} \right) \times 20$$

$$= 40 + \left( \frac{12}{20} \right) \times 20$$

$$= 40 + 12$$

$$= 52$$

Hence, the mode is 52.

16. The following are the ages of 300 patients getting medical treatment in a hospital on a particular day:

Age (in years)	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 -70
Number of patients	6	42	55	70	53	20

Form a 'less than type' cumulative frequency distribution.

**Sol:**

A 'less than type' cumulative frequency distribution table is given below:

Age (in years)	Cumulative frequency ( <i>cf</i> )
Less than 20	60
Less than 30	102
Less than 40	157
Less than 50	227
Less than 60	280
Less than 70	300

17. In the following data, find the values of  $p$  and  $q$ . Also, find the median class and modal class.

Class	Frequency ( $f$ )	Cumulative frequency ( $cf$ )
100 – 200	11	11
200 – 300	12	$P$
300 – 400	10	33
400- 500	$Q$	46
500 – 600	20	66
600 – 700	14	80

**Sol:**

Here,  $p = 11 + 12 = 23$

And  $33 + q = 46$

$\Rightarrow q = 46 - 33$

$= 13$

Thus,  $p$  is 23 and  $q$  is 13.

Now,

Here the maximum class frequency is 20, and the class corresponding to this frequency is 500-600.

So, the modal class is 500-600.

Also,  $\Sigma f = N = 80$

$\Rightarrow \frac{N}{2} = 40.$

The cumulative frequency just greater than 40 is 46, and the corresponding class is 400-500.

Thus, the median class is 400-500.

18. The following frequency distribution gives the monthly consumption of electricity of 64 consumers of locality.

Monthly consumption (in units)	65 – 85	85 – 105	105 – 125	125 – 145	145 – 165	165 – 185
Number of consumers	4	5	13	20	14	8

Form a 'more than type' cumulative frequency distribution.

**Sol:**

The cumulative frequency distribution table of more than type is as follows:

Monthly consumption (in units) (lower class limits)	Cumulative frequency ( $cf$ )
More than 65	$60 + 4 = 64$
More than 85	$55 + 5 = 60$
More than 105	$42 + 13 = 55$
More than 125	$22 + 20 = 42$
More than 145	$8 + 14 = 22$
More than 165	8

19. The following table gives the life-time (in days) of 100 electric bulbs of a certain brand.

Life-time (in days)	Less than 50	Less than 100	Less than 150	Less than 200	Less than 250	Less than 300
Number of Bulbs	7	21	52	79	91	100

**Sol:**

The frequency distribution is as follows:

Life-time (in days)	Frequency ( $f$ )
0-50	7
50-100	14
100-150	31
150-200	27
200-250	12
250-300	9

20. The following table, construct the frequency distribution of the percentage of marks obtained by 2300 students in a competitive examination.

Marks obtained (in percent)	11 – 20	21 – 30	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80
Number of Students	141	221	439	529	495	322	153

- (a) Convert the given frequency distribution into the continuous form.  
 (b) Find the median class and write its class mark.  
 (c) Find the modal class and write its cumulative frequency.

**Sol:**

- (a) The frequency distribution into the continuous form is as follows:

Marks obtained (in per cent)	Number of students ( $f$ )
10.5-20.5	141
20.5-30.5	221
30.5-40.5	439
40.5-50.5	529

50.5-60.5	495
60.5-70.5	322
70.5-80.5	153

(b) Now, to find the median class let us put the data in the table given below:

Marks obtained (in percent)	Number of students (f)	Cumulative frequency (cf)
10.5-20.5	141	141
20.5-30.5	221	362
30.5-40.5	439	801
40.5-50.5	529	1330
50.5-60.5	495	1825
60.5-70.5	322	2147
70.5-80.5	153	2300

Now,  $N = 2300$

$$\Rightarrow \frac{N}{2} = 1150$$

The cumulative frequency just greater than 1150 is 1330, and the corresponding class is 40.5-50.5.

Thus, the median class is 40.5-50.5

Now, class mark =  $\frac{\text{upper class limit} + \text{lower class limit}}{2}$

$$\frac{40.5 + 50.5}{2} = \frac{91}{2} = 45.5$$

Thus, class mark of the median class is 45.5

(c) Here the maximum class frequency is 529, and the class corresponding to this frequency is 40.5-50.5.

So, the modal class is 40.5-50.5 and its cumulative frequency is 1330.

21. If the mean of the following distribution is 27, find the value of p.

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	8	P	12	13	10

**Sol:** The given data is shown as follows:

Class	Frequency (f)	Class mark ( $x_i$ )	$f_i x_i$
0 – 10	8	5	40
10 – 20	P	15	15p
20 – 30	12	25	300
30 – 40	13	35	455
40 – 50	10	45	450
Total	$\sum f_i = 43 + p$		$\sum f_i x_i = 1245 + 15p$

The mean of given data is given by  $x = \frac{\sum f_i x_i}{\sum f_i}$



$$\Rightarrow 27 = \frac{1245 + 15p}{43 + p}$$

$$\Rightarrow 1161 + 27p = 1245 + 15p$$

$$\Rightarrow 27p - 15p = 1245 - 1161$$

$$\Rightarrow 12p = 84$$

$$\Rightarrow p = 7$$

Thus, the value of  $p$  is 7.

22. Calculate the missing frequency form the following distribution, it being given that the median of the distribution is 24.

Age (in years)	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Number of persons	5	25	?	18	7

**Sol:**

Let the missing frequency be  $x$ .

To find the median let us put data in the table given below:

Age (in years)	Number of persons ( $f$ )	Cumulative frequency ( $cf$ )
0-10	5	5
10-20	25	30
20-30	$X$	$30 + x$
30-40	18	$48 + x$
40-50	7	$55 + x$

The given median is 24,

$\therefore$  the median class is 20-30.

$\therefore l = 20, h = 10, N = 55 + x, f = x$  and  $cf = 30$

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

$$\Rightarrow 24 = 20 + \left( \frac{\frac{55+x}{2} - 30}{x} \right) \times 10$$

$$\Rightarrow 24 - 20 = \left( \frac{55+x-60}{2x} \right) \times 10$$

$$\Rightarrow 4 = \left( \frac{x-5}{2x} \right) \times 10$$

$$\Rightarrow 8x = 10x - 50$$

$$\Rightarrow 2x = 50$$

$$\Rightarrow x = 25$$

Thus, the missing frequency is 25.