NCERT Solutions for Class 10 MATHS – Statistics



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### 1. Consider the following distribution of daily wages of 50 workers of a factory.

Daily wages (in Rs.)	500 - 520	520 - 540	540 - 560	560 - 580	580 -600
Number of workers	12	14	8	6	10

Find the mean daily wages of the workers of the factory by using an appropriate method.

Daily Wages	No. of workers $(f_i)$	Class Mark $(x_i)$	$f_i x_i$
500 - 520	510	12	6120
520 - 540	530	14	7420
540 - 560	550	8	4400
560 - 580	570	6	3420
580 - 600	590	10	5900
	$\sum f_i = 50$		$\sum f_i x_i = 27260$

Mean 
$$= \frac{\sum f_i x_i}{\sum f_i} = \frac{27260}{50} = Rs. 545.2$$

2. The following distribution shows the daily pocket allowance of children of a locality. The mean pocket allowance is Rs 18. Find the missing frequency f.

Daily pocket allowances (in Rs.)	11-13	13-15	15-17	17-19	19-21	21-23	23-25
Number of children	7	6	9	13	f	5	4

Sol.

Sol.

Daily pocket allowance (in Rs.)	Class mark $(x_i)$	Number of children $(f_i)$	$d_i = x_i - 18$	$f_i d_i$
11 – 13	12	7	-6	-42
13 - 15	14	6	-4	-24
15 - 17	16	9	-2	-18
17 - 19	18 = a (Let)	13	0	0
19 - 21	20	f	2	2f
21 - 23	22	5	4	20
23 - 25	24	4	6	24
Total		$\sum f_i = 44 + f$		$\sum f_i d_i = 2f - 40$





We have, Mean  $= a + \frac{\sum f_i d_i}{\sum f_i}$   $\Rightarrow \quad 18 = 18 + \frac{2f - 40}{44 + f}$   $\Rightarrow \quad 0 = \frac{2f - 40}{44 + f}$   $\Rightarrow \quad 2f - 40 = 0$   $\Rightarrow \quad 2f = 40$  $\Rightarrow \quad f = \frac{40}{2} = 20$ 

[:: Mean = 18 (given)]

Hence, the value of missing frequency is 20.

**3.** Thirty women were examined in a hospital by a doctor and the number of heartbeats per minute were recorded and summarised as follows. Find the mean heartbeats per minute for these women, choosing a suitable method.

Number of heartbeats per minute	65 - 68	68 - 71	71 - 74	74 - 77	77 - 80	80 - 83	83 - 86
Number of women	2	4	3	8	7	4	2

**Sol.** Let us find the mean of the data by direct method.

Class interval	Frequency $(f_i)$	Class marks $(x_i)$	$f_i x_i$
65 - 68	2	66.5	133
68 - 71	4	69.5	278
71 - 74	3	72.5	217.5
74 - 77	8	75.5	604
77 - 80	7	78.5	549.5
80 - 83	4	81.5	326
83 - 86	2	84.5	169
	$\sum f_i = 30$		$\sum f_i x_i = 2277$

:. Mean of data 
$$=\frac{\sum f_i x_i}{\sum f_i} = \frac{2277}{30} = 75.9.$$

Therefore, mean heart beats per minute for these women are 75.9 beats per minute.





**4.** In a retail market, fruit vendors were selling mangoes kept in packing boxes. These boxes contained varying number of mangoes. The following was the distribution of mangoes according to the number of boxes.

Number of mangoes	50 - 52	53 - 55	56 - 58	59 - 61	62 - 64
Number of boxes	15	110	135	115	25

Find the mean number of mangoes kept in a packing box. Which method of finding the mean did you choose?

Sol.

Number of mangoes	Number of boxes $(f_i)$
50 - 52	15
53 – 55	110
56 - 58	135
59 - 61	115
62 - 64	25

It can be observed that class intervals are not continuous. There is a gap of 1 between two class intervals. Therefore,  $\frac{1}{2}(0.5)$  has to be added to the upper class limit and  $\frac{1}{2}(0.5)$  has to be subtracted from the lower class limit of each interval. Class mark  $(x_i)$  can be obtained by using the following relation.

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

Class size (h) of this data = 3. Taking 57 as assumed mean  $(a), d_i, u_i, f_i u_i$  are calculated as follows.

				<b>.</b>	
Class interval	$(f_i)$	$(x_i)$	$d_i = x_i - 57$	$u_i = \frac{dt}{3}$	$f_i u_i$
49.5 - 52.5	15	51	-6	-2	-30
52.5 - 55.5	110	54	-3	-1	-110
55.5 - 58.5	135	57	0	0	0
58.5 - 61.5	115	60	3	1	115
61.5 - 64.5	25	63	6	2	50
Total	$\sum f_i = 400$				$\sum f_i u_i = 25$

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It can be observed that  $\sum f_i = 400, \sum f_i u_i = 25, a = 57$  and h = 3

Mean 
$$(\bar{x}) = a + \left(\frac{\sum f_i u_i}{\sum f_i}\right) h = 57 + \left(\frac{25}{400}\right) \times 3 = 57 + \frac{3}{16} = 57 + 0.1875 = 57.1875 = 57.19$$

Mean number of mangoes kept in a packing box is 57.19.

Step deviation method is used here as the values of  $f_i$ ,  $d_i$  are big and also, there is a common multiple between all  $d_i$ .

5. The table below shows the daily expenditure on food of 25 households in a locality.

Daily expenditure (in Rs.)	100 - 150	150 - 200	200 - 250	250 - 300	300 - 350
Number of households	4	5	12	2	2

Find the mean daily expenditure on food by a suitable method.

**Sol.** Here, a = 225 and h = 50

Class interval	$  Frequency (f_i) $	Class marks $(x_i)$	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
100 - 150	4	125	-2	-8
150 - 200	5	175	-1	-5
200 - 250	12	225 = a	0	0
250 - 300	2	275	1	2
300 - 350	2	325	2	• 4
Total	Z	$\sum f_i = 25$	UTU.	$\sum f_i u_i = -7$

... Mean, 
$$\overline{x} = a + h\left(\frac{\sum f_i u_i}{\sum f_i}\right) = 225 + 50\left(\frac{-7}{25}\right)$$
  
= 225 - 14 = 211.

Hence, the mean daily expenditure on food is Rs. 211. Therefore mean daily expenditure on food is Rs. 211.







#### 6. The following table shows the ages of the patients admitted in a hospital during a year:

Age (in years)	5 - 15	15 - 25	25 - 35	35 - 45	45 - 55	55 - 65
Number of patients	6	11	21	23	14	5

Find the mode and the mean of the data given above. Compare and interpret the two measures of central tendency.

#### Sol. For Mode:

Age (in years)	5 - 15	15 - 25	25 - 35	35 - 45	45 - 55	55 - 65
Number of patients	6	11	21	23	14	5

:: Maximum frequency = 23

 $\therefore$  Modal class = 35 - 45

Here,  $l = 35, f_1 = 23, f_0 = 21, f_2 = 14, h = 10$ 

Mode 
$$= l = \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h = 35 + \left[\frac{23 - 21}{46 - 21 - 14}\right] \times 10 = 35 + \frac{2}{11} \times 10$$
  
=  $35 + \frac{20}{2} = 36.8$  years.

$$=35+\frac{20}{11}=36.8$$
 y

For Mean :

Age (in years)	$\frac{\text{Class marks}}{(x_i)}$	Number of patients $(f_i)$	$u_i = \frac{x_i - 30}{10}$	$f_i u_i$
5 - 15	10	6	-2	-12
15 – 25	20	11	111	-11
25 - 35	30 = a (Let)	21	0	0
35 - 45	40	23		23
45 – 55	50	14	2	28
55 - 65	60	5	3	15
Total		$\sum f_i = 80$		$\sum f_i u_i = 43$

Here, 
$$a = 30, \sum f_i u_i = 43, \sum f_i = 80, h = 10$$

We have, Mean 
$$= a + \frac{\sum f_i u_i}{\sum f_i} \times h = 30 + \frac{43 \times 10}{80} = 30 + 5.375 = 35.375$$
 years

We conclude that the maximum number of patients in the hospital are of the age 36.8 years. While on an average the age of patient admitted to the hospital is 35.37 years.

# Did you know?



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### 7. If the median of the distribution given below is 28.5, find the values of x and y.

<b>Class interval</b>	Frequency
0 - 10	5
10 - 20	x
20 - 30	20
30 - 40	15
40 - 50	У
50 - 60	5
Total	60

Sol.

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Class interval	Frequency	Cumulative frequency
0 - 10	5	5
10 - 20	x	5 + x(c)
20 - 30	20(f)	25 + x
30 - 40	15	40 + <i>x</i>
40 - 50	у	40 + x + y
50 - 60	5	45 + x + y
Total	<i>n</i> = 60	

We have 45 + x + y = 60 .....(i)

[Given]

$$\therefore \qquad n = 60 \\ n \quad 60$$

$$\therefore \qquad \frac{n}{2} = \frac{60}{2} = 30$$

Since the median lies in the class interval (20 - 30), so the median class is (20 - 30). Hence, l = 20, f = 20, cf = 5 + x and h = 10.

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





 $\Rightarrow 28.5 = 20 + \left(\frac{30-5-x}{20}\right) \times 10$   $\Rightarrow 28.5 = 20 + \left(\frac{25-x}{2}\right)$   $\Rightarrow 57 = 40 + 25 - x \Rightarrow 25 - x = 57 - 40$   $\Rightarrow 25 - x = 17 \Rightarrow x = 25 - 17 = 8.$ Putting x = 8 in equation (i), we get:  $\Rightarrow 45 + 8 + y = 60 \Rightarrow y = 60 - 53 = 7.$ 

**8.** 100 surnames were randomly picked up from a local telephone directory and the frequency distribution of the number of letters in the English alphabets in the surnames was obtained as follows:

Number of letters	1 - 4	4 - 7	7 - 10	10 - 13	13 - 16	16 - 19
Number of surnames	6	30	40	16	4	4

Determine the median number of letters in the surnames. Find the mean number of letters in the surnames? Also, find the modal size of the surnames.

Sol. Here h = 3,

Class interval	Frequency (f <sub>i</sub> )	Cumulative frequency (cf)	Class marks (x <sub>i</sub> )	$u_i = \frac{x_i - h_i}{h_i}$	$\frac{a}{f_i u_i}$
1 – 4	6	6	2.5	-2	-12
4 - 7	$30(f_1)$	36(c)	5.5	-1	-30
7 – 10	$40(f_m)$	76	8.5 = a	0	0
10 - 13	16(f <sub>2</sub> )	92	11.5	1	16
13 – 16	4	96	14.5	2	8
16 – 19	4	100	17.5	3	12
			<i>n</i> = 100	ſ	$\Sigma f_i u_i = -6$

$$\therefore n = 100$$

$$\therefore \qquad \frac{n}{2} = \frac{100}{2} = 50$$

Since 40 is the maximum frequency, so the Median class is (7 - 10).

Here, l = 7,  $f_m = 40$ , cf = 36 and h = 3.





$$\therefore \quad \text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f_m}\right) \times h$$
$$= 7 + \left(\frac{50 - 36}{40}\right) \times 3 = 7 + \frac{14}{40} \times 3$$
$$= 7 + \frac{21}{20}$$
$$= 7 + 1.05 = 8.05$$
$$\text{Mean} = a + \frac{\sum f_i u_i}{\sum f_i} \times h = 8.5 + \frac{(-6)}{100} \times 3$$
$$= 8.5 + \frac{(-18)}{100} = 8.50 - 0.18 = 8.32$$

Now since the maximum number of letters in surnames = 40

$$\therefore$$
 Modal class =

Mode = 
$$l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$$
  
=  $7 + \left(\frac{40 - 30}{80 - 30 - 16}\right) \times 3$   
=  $7 + \frac{10}{34} \times 3 = 7 + \frac{30}{34} = 7 + 0.88 = 7.88$ 

7 - 10

9. The distribution below gives the weights of 30 students of a class. Find the median weight of the students.

Weight (in kg)	40 - 45	45 - 50	50 - 55	55 - 60	60 - 65	65 - 70	70 - 75
Number of students	2	3	8	6	6	3	2

Sol.

Weight ( in kg)	Number of students $(f_i)$	cf
40 - 45	2	2
45 - 50	3	5
50 - 55	8	13
55 - 60	6	19
60 - 65	6	25
65 - 70	3	28
70 – 75	2	30
Total	30	

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Sol.



Here,  $\frac{n}{2} = \frac{30}{2} = 15$ , ∴ Median class = 55 - 60, So, l = 55, f = 6, cf = 13, h = 5Median weight  $= l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$   $= 55 + \left(\frac{15 - 13}{6}\right) \times 5 = 55 + \frac{5}{3}$  $= 55 + 1.67 = 56.67 \, kg$ 

**10.** The following distribution gives the daily income of 50 workers of a factory.

Daily income (in Rs)	100 - 120	120 - 140	140 - 160	160 - 180	180 - 200
Number of workers	12	14	8	6	10

Convert the distribution above to a less than type cumulative frequency distribution, and draw its ogive.

Daily income (in Rs.)	No. of workers	Cumulative frequency
Less than 120	12	12
Less than 140	14	26
Less than 160	8	34
Less than 180	6	40
Less than 200	10	50
	n = 50	

Now, we plot the points (120, 12), (140, 26), (160, 34), (180, 40) and (200, 50) to get the required ogive as shown alongside.







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