

Statistics: Exercise - 14.1

Q.1 A survey was conducted by a group of students as a part of their environment awareness programmer, in which they collected the following data regarding the number of plants in 20 houses in a locality. Find the mean number of plants per house.

Number of plants	No. of houses
0 – 2	1
2 – 4	2
4 – 6	1
6 – 8	5
8 – 10	6
10 – 12	2
12 – 14	3

Which method did you use for finding the mean, and why?

Sol. Calculation of Mean:

No. of plants	No. of houses (f_i)	Mid - point (x_i)	$f_i x_i$
0 – 2	1	1	1
2 – 4	2	3	6
4 – 6	1	5	5
6 – 8	5	7	35
8 – 10	6	9	54
10 – 12	2	11	22
12 – 14	3	13	39
Total	20		162

$$\begin{aligned}\text{Hence, mean } \bar{x} &= \frac{1}{n} \sum f_i x_i \\ &= \frac{1}{20} \times 162 \\ &= 8.1 \text{ plants}\end{aligned}$$

We have used direct method because numerical values of x_i and f_i are small.

Q.2 Consider the following distribution of daily wages of 50 workers of a factory.

Daily wages (in Rs)	No. of workers
100 – 120	12
120 – 140	14
140 – 160	8
160 – 180	6
180 – 200	10

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

Sol. Firstly, assumed mean, $A = 150$; class-interval, $h = 20$

$$\text{so } u_i = \frac{x_i - A}{h} = \frac{x_i - 150}{20}$$

Table:

Class interval	Mid - value (x_i)	Frequency (f_i)	$u_i = \frac{x_i - 150}{20}$	$f_i u_i$
100 – 120	110	12	-2	-24
120 – 140	130	14	-1	-14
140 – 160	150	8	0	0
160 – 180	170	6	1	6
180 – 200	190	10	2	20
Total		50		-12

$$\begin{aligned}\bar{x} &= A + h \frac{\sum f_i u_i}{\sum f_i} \\ &= 150 + 20 \times \frac{-12}{50} \\ &= 150 - 4.8 = 145.2\end{aligned}$$

Thus, mean = Rs 145.20

Q.3 The following distribution shows the daily pocket allowance of children locality mean. The mean pocket allowance is Rs 18. Find the missing frequency f .

Daily pocket allowance (in Rs)	No. of children
11 – 13	7
13 – 15	6
15 – 17	9
17 – 19	13
19 – 21	f
21 – 23	5
23 – 25	4

Sol. Firstly, assumed mean, $A = 16$, class interval, $h = 2$

$$\text{So, } u_i = \frac{x_i - A}{h} = \frac{x_i - 16}{2}$$

Class interval	Mid - value (x_i)	(f_i)	$u_i = \frac{x_i - 16}{2}$	$f_i u_i$
11 – 13	12	7	-2	-14
13 – 15	14	6	-1	-6
15 – 17	16	9	0	0
17 – 19	18	13	1	13
19 – 21	20	f	2	$2f$
21 – 23	22	5	3	15
23 – 25	24	4	4	16
	$N = \sum f_i$ $= f + 44$		$\sum f_i u_i$ $= 2f + 24$	

$$\bar{x} = 18, A = 16 \text{ and } h = 2$$

$$\text{Thus, } \bar{x} = A + h \left(\frac{1}{N} \sum f_i u_i \right)$$

$$\Rightarrow 18 = 16 + 2 \left(\frac{2f + 24}{f + 44} \right)$$

$$\Rightarrow f + 44 = 2f + 24$$

$$\Rightarrow 2f - f = 44 - 24$$

$$\Rightarrow f = 20$$

Thus, the missing frequency is 20.

Q.4 Thirty women were examined in a hospital by a doctor and the number of heart beats per minute were recorded and summarised as follows. Find the mean heart beats per minute for these women, choosing a suitable method.

Number of heart beats per minute	No. of women
65 – 68	2
68 – 71	4
71 – 74	3
74 – 77	8
77 – 80	7
80 – 83	4
83 – 86	2

Sol. Assumed mean, $A = 75.5$, class interval, $h = 3$

$$\text{So, } u_i = \frac{x_i - A}{h} = \frac{x_i - 75.5}{3}$$

Class interval	Mid - value (x_i)	(f_i)	$u_i = \frac{x_i - 75.5}{3}$	$f_i u_i$
65 – 68	66.5	2	–3	–6
68 – 71	69.5	4	–2	–8
71 – 74	72.5	3	–1	–3
74 – 77	75.5	8	0	0
77 – 80	78.5	7	1	7
80 – 83	81.5	4	2	8
83 – 86	84.5	2	3	6
Total		30		4

$$\bar{x} = A + h \left(\frac{\sum f_i u_i}{\sum f_i} \right) = 75.5 + 3 \times \frac{4}{30}$$

$$= 75.5 + 0.4 = 75.9$$

Thus, the mean heart beats per minute for these women = 75.9

Q.5 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.

No. of mangoes	No. of boxes
50 – 52	15
53 – 55	110
56 – 58	135
59 – 61	115
62 – 64	25

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

Sol. Since, the class intervals are formed by the exclusive method. If we make the series an inclusive one the mid-values remain same.

So, no need to convert the series.

Assumed mean, $A = 60$ and $h = 3$

$$\text{So, } u_i = \frac{x_i - A}{h} = \frac{x_i - 60}{3}$$

Mean:

No. of mangoes	Mid - value (x_i)	Frequency (f_i)	$u_i = \frac{x_i - 60}{3}$	$f_i u_i$
50 - 52	51	15	-3	-45
53 - 55	54	110	-2	-220
56 - 58	57	135	-1	-135
59 - 61	60	115	0	0
62 - 64	63	25	3	25
Total		400		-375

$$\begin{aligned}\bar{x} &= A + h \left(\frac{\sum f_i u_i}{\sum f_i} \right) = 60 + 3 \times \frac{-375}{400} \\ &= 60 - 2.8125 \\ &= 57.1875\end{aligned}$$

Thus, average number of mangoes per box = 57.19 (nearly)

Q.6 The table below shows the daily expenditure on food of 25 households in a locality.

Daily expenditure (in Rs)	No. of households
100 - 150	4
150 - 200	5
200 - 250	12
250 - 300	2
300 - 350	2

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

Sol. Assumed mean, $A = 225$, class interval, $h = 50$

$$\text{so } u_i = \frac{x_i - A}{h} = \frac{x_i - 225}{50}$$

Table:

Daily expenditure (in Rs)	Mid - value (x_i)	Frequency (f_i)	$u_i = \frac{x_i - 225}{50}$	$f_i u_i$
100 - 150	125	4	-2	-8
150 - 200	175	5	-1	-5
200 - 250	225	12	0	0
250 - 300	275	2	1	2
300 - 350	325	2	2	4
Total		25		-7

$$\begin{aligned}\bar{x} &= A + h \left(\frac{\sum f_i u_i}{\sum f_i} \right) = 225 + 50 \times \frac{-7}{25} \\ &= 225 - 14 = 211\end{aligned}$$

Thus, the mean daily expenditure of food is Rs 211.

Q.7 To find the concentration of SO₂ in the air (in parts per million, i.e., ppm), the data was collected for 30 localities in a certain city and is presented below:

Concentration of SO ₂ (in ppm)	Frequency
0.00 – 0.04	4
0.04 – 0.08	9
0.08 – 0.12	9
0.12 – 0.16	2
0.16 – 0.20	4
0.20 – 0.24	2

Find the mean concentration of SO₂ in the air.

Sol. Calculation of mean by direct method:

Concentration of SO ₂ (in ppm)	Mid - value (x_i)	Frequency (f_i)	$f_i x_i$
0.00 – 0.04	0.02	4	0.08
0.04 – 0.08	0.06	9	0.54
0.08 – 0.12	0.10	9	0.90
0.12 – 0.16	0.14	2	0.28
0.16 – 0.20	0.18	4	0.72
0.20 – 0.24	0.22	2	0.44
Total		30	2.96

$$\text{Thus, } \bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{2.96}{30} = 0.099 \text{ ppm}$$

Q.8 A class teacher has the following absentee record of 40 students of a class for the whole term. Find the mean number of days a student was absent.

Number of days	Number of students
0 – 6	11
6 – 10	10
10 – 14	7
14 – 20	4
20 – 28	4
28 – 38	3
38 – 40	1

Sol. Since, the class size varies, and x_i 's are small.

No. of days	Mid - point (x_i)	No. of students (f_i)	$f_i x_i$
0 – 6	3	11	33
6 – 10	8	10	80
10 – 14	12	7	84
14 – 20	17	4	68
20 – 28	24	4	96
28 – 38	33	3	99
38 – 40	39	1	39
Total		40	499

So, mean, $\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{499}{40} = 12.475$

Thus, mean = 12.48 days

Q.9 The following table gives the literacy rate (in percentage) of 35 cities. Find the mean literacy rate.

Literacy rate (in%)	45 – 55	55 – 65	65 – 75	75 – 85	85 – 95
Number of cities	3	10	11	8	3

Sol. Assumed mean, $A = 70$ and Class interval, $h = 10$

so $u_i = \frac{x_i - 70}{10}$

Literacy rate %	Mid - value (x_i)	Frequency (f_i)	$u_i = \frac{x_i - 70}{10}$	$f_i u_i$
45 – 55	50	3	-2	-6
55 – 65	60	10	-1	-10
65 – 75	70	11	0	0
75 – 85	80	8	1	8
85 – 95	90	3	2	6
Total		35		-2

Thus, $\bar{x} = A + h \times \frac{\sum f_i u_i}{\sum f_i}$

$= 70 + 10 \times \frac{-2}{35}$

$= 70 - 0.57 = 69.43$

Therefore, mean literacy rate is 69.43%