EXERCISE 13.1

Question 1:

A survey was conducted by a group of students as a part of their environment awareness programme, 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.

No. 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

Solution:

Number of plants	Class mark (x_i)	Number of houses (f_i)	f_ix_i
0 – 2	1	1	01
2 – 4	3	2	06
4 – 6	5	1	05
6 – 8	7	5	35
8 – 10	9	6	54
10 – 12	11	2	22
12 – 14	13	3	39
Total		$\Sigma f_i = 20$	$\Sigma f_ix_i = 162$

We have, Mean $(\bar{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{162}{20} = 8.1$ plants. The mean of the data is 8.1.

Since the values of x_i and f_i are small, so we have used direct method to find the mean.

Question 2:

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

Daily wages (in ₹)	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.

Solution:

In this case, we can use step-deviation method because the sata is large.

Here, a = 150 and h = 20

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

$$\therefore \text{Mean, } \bar{x} = a + h\left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right)$$

$$= 150 + 20\left(\frac{-12}{50}\right) = 150 - \frac{240}{50}$$

$$= 150 - \frac{24}{5} = \frac{750 - 24}{5}$$

$$= \frac{726}{5} = 145.20.$$

Hence, mean daily wages of the workers are ₹ **145.20**.

Question 3:

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

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

Solution:

Daily pocket allowance (in ₹)	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		$\Sigma f_i = 44 + f$		$\Sigma f_i d_i = 2f - 40$

We have, $\text{Mean} = a + \frac{\Sigma f_i d_i}{\Sigma f_i}$

$\Rightarrow \quad 18 = 18 + \frac{2f - 40}{44 + f}$ [$\because$ Mean = 18 (given)]

$\Rightarrow \quad 0 = \frac{2f - 40}{44 + f} \Rightarrow 2f - 40 = 0 \Rightarrow 2f = 40 \Rightarrow f = \frac{40}{2} = 20$

Question 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

Solution:

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
	$\Sigma f_i = 30$		$\Sigma f_i x_i = 2277$

$$\therefore \text{Mean of data} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{2277}{30} = \mathbf{75.9}.$$

Question 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

Solution:

Here h = 3

Number of mangoes	Class mark (x_i)	Number of boxes (f_i)	$u_i = \frac{x_i - 57}{3}$	$f_i u_i$
50 – 52	51	15	–2	–30
53 – 55	54	110	–1	–110
56 – 58	57 = a (Let)	135	0	0
59 – 61	60	115	1	115
62 – 64	63	25	2	50
Total		$\Sigma f_i = 400$		$\Sigma f_i u_i = 25$

We have, $\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 57 + \frac{25 \times 3}{400}$

$= 57 + 0.19 = 57.19$ mangoes.

Step deviation method.

Question 6:

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

Daily expenditure (in ₹)	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.

Solution:

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
	$\Sigma f_i = 25$			$\Sigma f_i u_i = -7$

$$\therefore \text{Mean, } \bar{x} = a + h\left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right) = 225 + 50\left(\frac{-7}{25}\right)$$

$$= 225 - 14 = 211.$$

Hence, the mean daily ecpenditure on food is ₹ 211.

Question 7:

To find out 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

Solution:

Here h = 0.04

Concentration of SO_2 (in ppm)	Class mark (x_i)	Frequency (f_i)	$u_i = \frac{x_i - 0.10}{0.04}$	$f_i u_i$
0.00 – 0.04	0.02	4	–2	–8
0.04 – 0.08	0.06	9	–1	–9
0.08 – 0.12	0.10 = a (Let)	9	0	0
0.12 – 0.16	0.14	2	1	2
0.16 – 0.20	0.18	4	2	8
0.20 – 0.24	0.22	2	3	6
Total		$\Sigma f_i = 30$		$\Sigma f_i u_i = -1$

We have, $\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$

$= 0.10 + \frac{(-1) \times 0.04}{30} = 0.10 - 0.001 = 0.099$ ppm.

Question 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.

No. of days	No. of students
0 – 6	11
6 – 10	10
10 – 14	7
14 – 20	4
20 – 28	4
28 – 38	3
38 – 40	1

Solution:

Class interval	Frequency (f_i)	Class marks (x_i)	$f_i x_i$
0 – 6	11	3	33
6 – 10	10	8	80
10 – 14	7	12	84
14 – 20	4	17	68
20 – 28	4	24	96
28 – 38	3	33	99
38 – 40	1	39	39
	$\Sigma f_i = 40$		$\Sigma f_i x_i = 499$

$$\therefore \text{Mean number of days} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{499}{40}$$

$$= \mathbf{12.48\ days.}$$

Question 9:

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

Literacy rate (in %)	No. of cities
45 – 55	3
55 – 65	10
65 – 75	11
75 – 85	8
85 – 95	3

Solution:

Here h = 10

Literacy rate (in%)	**Class mark (x_i)**	**Number of cities (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 = a (Let)	11	0	0
75 – 85	80	8	1	8
85 – 95	90	3	2	6
Total		$\Sigma f_i = 35$		$\Sigma f_i u_i = -2$

$$\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 70 + \frac{(-2) \times 10}{35} = 70 - 0.57 = 69.43\%$$