EXERCISE 14.1 PAGE: 270

1. A survey was conducted by a group of students as a part of their environment awareness program, 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	**0-2**	**2-4**	**4-6**	**6-8**	**8-10**	**10-12**	**12-14**
Number of Houses	**1**	**2**	**1**	**5**	**6**	**2**	**3**

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

Solution:

To find the mean value, we will use the direct method because the numerical value of f_i and x_i are small.

Find the midpoint of the given interval using the formula.

Midpoint (x_i) = (upper limit + lower limit)/2

No. of plants (Class interval)	No. of houses Frequency (f_i)	Mid-point (x_i)	f_ix_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
	Sum f_i = 20		Sum f_ix_i = 162

The formula to find the mean is:

Mean = $\bar{x} = \sum f_i x_i / \sum f_i$

= 162/20

= 8.1

Therefore, the mean number of plants per house is 8.1.

2. 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.

Solution:

Find the midpoint of the given interval using the formula.

Midpoint (x_i) = (upper limit + lower limit)/2

In this case, the value of mid-point (x_i) is very large, so let us assume the mean value, a = 550.

Class interval (h) = 20

So, $u_i = (x_i – a)/h$

$u_i = (x_i – 550)/20$

Substitute and find the values as follows:

Daily wages (Class interval)	Number of workers frequency (f_i)	Mid-point (x_i)	$u_i = (x_i – 550)/20$	f_iu_i
500-520	12	510	-2	-24
520-540	14	530	-1	-14
540-560	8	550 = a	0	0
560-580	6	570	1	6
580-600	10	590	2	20
Total	Sum f_i = 50			Sum f_iu_i = -12

So, the formula to find out the mean is:

Mean = $\bar{x} = a + h(\sum f_iu_i /\sum f_i)$ = 550 + [20 × (-12/50)] = 550 – 4.8 = 545.20

Thus, mean daily wage of the workers = Rs. 545.20

3. 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 Allowance(in c)	**11-13**	**13-15**	**15-17**	**17-19**	**19-21**	**21-23**	**23-35**
Number of children	**7**	**6**	**9**	**13**	**f**	**5**	**4**

Solution:

To find out the missing frequency, use the mean formula.

Given, mean $\bar{x} = 18$

Class interval	Number of children (f_i)	Mid-point (x_i)	f_ix_i
11-13	7	12	84
13-15	6	14	84
15-17	9	16	144
17-19	13	18	234
19-21	f	20	20f
21-23	5	22	110
23-25	4	24	96
Total	f_i = 44+f		Sum f_ix_i = 752+20f

The mean formula is

Mean = $\bar{x} = \sum f_ix_i / \sum f_i = (752 + 20f)/ (44 + f)$

Now substitute the values and equate to find the missing frequency (f)

$\Rightarrow 18 = (752 + 20f)/ (44 + f)$

$\Rightarrow 18(44 + f) = (752 + 20f)$

$\Rightarrow 792 + 18f = 752 + 20f$

$\Rightarrow 792 + 18f = 752 + 20f$

$\Rightarrow 792 – 752 = 20f – 18f$

$\Rightarrow 40 = 2f$

$\Rightarrow f = 20$

So, the missing frequency, f = 20.

4. 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 heart beats 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**

Solution:

From the given data, let us assume the mean as a = 75.5

x_i = (Upper limit + Lower limit)/2

Class size (h) = 3

Now, find the u_i and f_iu_i as follows:

Class Interval	Number of women (f_i)	Mid-point (x_i)	$u_i = (x_i – 75.5)/h$	f_iu_i
65-68	2	66.5	-3	-6
68-71	4	69.5	-2	-8
71-74	3	72.5	-1	-3
74-77	8	75.5 = a	0	0
77-80	7	78.5	1	7
80-83	4	81.5	2	8
83-86	2	84.5	3	6
	Sum f_i= 30			Sum f_iu_i = 4

Mean = $\bar{x} = a + h(\sum f_iu_i / \sum f_i)$

= 75.5 + 3 × (4/30)

= 75.5 + (4/10)

= 75.5 + 0.4

= 75.9

Therefore, the mean heart beats per minute for these women is 75.9

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.

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?

Solution:

The given data is not continuous, so we add 0.5 to the upper limit and subtract 0.5 from the lower limit as the gap between two intervals is 1.

Here, assumed mean (a) = 57

Class size (h) = 3

Here, the step deviation is used because the frequency values are big.

Class Interval	Number of boxes (f_i)	Mid-point (x_i)	$u_i = (x_i - 57)/h$	f_iu_i
49.5-52.5	15	51	-2	-30
52.5-55.5	110	54	-1	-110
55.5-58.5	135	57 = a	0	0
58.5-61.5	115	60	1	115
61.5-64.5	25	63	2	50
	Sum f_i = 400			Sum f_iu_i = 25

The formula to find out the Mean is:

Mean = $\bar{x} = a + h(\sum f_iu_i / \sum f_i)$

= 57 + 3(25/400)

= 57 + 0.1875

= 57.19

Therefore, the mean number of mangoes kept in a packing box is 57.19

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

Daily expenditure(in c)	**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.

Solution:

Find the midpoint of the given interval using the formula.

Midpoint (x_i) = (upper limit + lower limit)/2

Let us assume the mean (a) = 225

Class size (h) = 50

Class Interval	Number of households (f_i)	Mid-point (x_i)	$d_i = x_i - A$	$u_i = d_i/50$	f_iu_i
100-150	4	125	-100	-2	-8
150-200	5	175	-50	-1	-5
200-250	12	225 = a	0	0	0
250-300	2	275	50	1	2
300-350	2	325	100	2	4
	Sum f_i = 25				Sum f_iu_i = -7

Mean = $\bar{x} = a + h(\sum f_iu_i / \sum f_i)$

= 225 + 50(-7/25)

= 225 – 14

= 211

Therefore, the mean daily expenditure on food is 211.

7. To find out the concentration of SO_2 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 SO_2 in the air.

Solution:

To find out the mean, first find the midpoint of the given frequencies as follows:

Concentration of SO_2 (in ppm)	Frequency (f_i)	Mid-point (x_i)	f_ix_i
0.00-0.04	4	0.02	0.08
0.04-0.08	9	0.06	0.54
0.08-0.12	9	0.10	0.90
0.12-0.16	2	0.14	0.28
0.16-0.20	4	0.18	0.72
0.20-0.24	2	0.22	0.44
Total	Sum f_i = 30		Sum (f_ix_i) = 2.96

The formula to find out the mean is

Mean = $\bar{x} = \sum f_ix_i / \sum f_i$

= 2.96/30

= 0.099 ppm

Therefore, the mean concentration of SO_2 in the air is 0.099 ppm.

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

Solution:

Find the midpoint of the given interval using the formula.

Midpoint (x_i) = (upper limit + lower limit)/2

Class interval	Frequency (f_i)	Mid-point (x_i)	f_ix_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
	Sum f_i = 40		Sum f_ix_i = 499

The mean formula is,

Mean = $\bar{x} = \sum f_ix_i / \sum f_i$

= 499/40

= 12.48 days

Therefore, the mean number of days a student was absent = 12.48.

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**	**85-98**
Number of cities	**3**	**10**	**11**	**8**	**3**

Solution:

Find the midpoint of the given interval using the formula.

Midpoint (x_i) = (upper limit + lower limit)/2

In this case, the value of mid-point (x_i) is very large, so let us assume the mean value, a = 70.

Class interval (h) = 10

So, $u_i = (x_i – a)/h$

$u_i = (x_i – 70)/10$

Substitute and find the values as follows:

Class Interval	Frequency (f_i)	(x_i)	$u_i = (x_i – 70)/10$	f_iu_i
45-55	3	50	-2	-6
55-65	10	60	-1	-10
65-75	11	70 = a	0	0
75-85	8	80	1	8
85-95	3	90	2	6
	Sum f_i = 35			Sum f_iu_i = -2

So, Mean = $\bar{x} = a + (\sum f_iu_i / \sum f_i) \times h$

= 70 + (-2/35) × 10

= 69.43

Therefore, the mean literacy part = 69.43%