Exercise 7.3   Page No: 7.22

1. The following table gives the distribution of total household expenditure (in rupees) of manual workers in a city.

Expenditure (in rupees) (x)	Frequency (f_i)	Expenditure (in rupees) (x_i)	Frequency (f_i)
100 – 150	24	300 – 350	30
150 – 200	40	350 – 400	22
200 – 250	33	400 – 450	16
250 – 300	28	450 – 500	7

Find the average expenditure (in rupees) per household.

Solution:

Let the assumed mean (A) = 275

Class interval	Mid value (x_i)	$d_i = x_i – 275$	$u_i = (x_i - 275)/50$	Frequency f_i	$f_i u_i$
100 – 150	125	-150	-3	24	-72
150 – 200	175	-100	-2	40	-80
200 – 250	225	-50	-1	33	-33
250 – 300	275	0	0	28	0
300 – 350	325	50	1	30	30
350 – 400	375	100	2	22	44
400 – 450	425	150	3	16	48
450 – 500	475	200	4	7	28
				N = 200	$\Sigma\, f_i u_i = -35$

It's seen that A = 275 and h = 50
So,

$$Mean = A + h \times (\Sigma f_i\, u_i/N)$$
$$= 275 + 50\,(-35/200)$$
$$= 275 – 8.75$$
$$= 266.25$$

2. A survey was conducted by a group of students as a part of their environmental awareness program, in which they collected the following data regarding the number of plants in 200 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 house:	1	2	1	5	6	2	3

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

Solution:
From the given data,

To find the class interval we know that,
Class marks (x_i) = (upper class limit + lower class limit)/2
Now, let's compute x_i and f_ix_i by the following

Number of plants	Number of house (f_i)	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
Total	N = 20		$\Sigma f_iu_i = 162$

Here,
$$\text{Mean} = \Sigma f_iu_i / N$$
$$= 162/ 20$$
$$= 8.1$$
Thus, the mean number of plants in a house is 8.1

We have used the direct method as the values of class mark x_i and f_i is very small.

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

Daily wages (in ₹)	100 - 120	120 - 140	140 - 160	160 - 180	180 - 200
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:

Let the assume mean (A) = 150

Class interval	Mid value x_i	$d_i = x_i - 150$	$u_i = (x_i - 150)/20$	Frequency f_i	f_iu_i
100 – 120	110	-40	-2	12	-24
120 - 140	130	-20	-1	14	-14
140 - 160	150	0	0	8	0
160 - 180	170	20	1	6	6
180 - 200	190	40	2	10	20
				N= 50	$\Sigma f_iu_i = -12$

It's seen that,
$$A = 150 \text{ and } h = 20$$
So,
$$\text{Mean} = A + h \times (\Sigma f_i u_i/N)$$

= 150 + 20 x (-12/50)
= 150 – 24/5
= 150 = 4.8
= 145.20

4. Thirty women were examined in a hospital by a doctor and the number of heart beats per minute recorded and summarized as follows. Find the mean heart beats 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:

Using the relation (x_i) = (upper class limit + lower class limit)/ 2
And, class size of this data = 3
Let the assumed mean (A) = 75.5
So, let's calculate d_i, u_i, $f_i u_i$ as following:

Number of heart beats per minute	Number of women (f_i)	x_i	$d_i = x_i – 75.5$	$u_i = (x_i - 755)/h$	$f_i u_i$
65 – 68	2	66.5	-9	-3	-6
68 – 71	4	69.5	-6	-2	-8
71 – 74	3	72.5	-3	-1	-3
74 – 77	8	75.5	0	0	0
77 – 80	7	78.5	3	1	7
80 – 83	4	81.5	6	2	8
83 – 86	2	84.5	9	3	6
	N = 30				$\Sigma f_i u_i = 4$

From table, it's seen that
　　　N = 30 and h = 3
So, the mean = A + h x ($\Sigma f_i u_i$/N)
　　　　　= 75.5 + 3 x (4/30
　　　　　= 75.5 + 2/5
　　　　　= 75.9
Therefore, the mean heart beats per minute for those women are 75.9 beats per minute.

Find the mean of each of the following frequency distributions: (5 - 14)
5.

Class interval:	0 – 6	6 - 12	12 - 18	18 – 24	24 - 30
Frequency:	6	8	10	9	7

Solution:

Let's consider the assumed mean (A) = 15

Class interval	Mid - value x_i	$d_i = x_i - 15$	$u_i = (x_i - 15)/6$	f_i	$f_i u_i$
0 – 6	3	-12	-2	6	-12
6 - 12	9	-6	-1	8	-8
12 - 18	15	0	0	10	0
18 – 24	21	6	1	9	9
24 - 30	27	12	2	7	14
				N = 40	Σ $f_i u_i$ = 3

From the table it's seen that,

A = 15 and h = 6

Mean = A + h x (Σ$f_i u_i$/N)

= 15 + 6 x (3/40)

= 15 + 0.45

= 15.45

6.

Class interval:	50 – 70	70 – 90	90 – 110	110 – 130	130 – 150	150 - 170
Frequency:	18	12	13	27	8	22

Solution:

Let's consider the assumed mean (A) = 100

Class interval	Mid - value x_i	$d_i = x_i - 100$	$u_i = (x_i - 100)/20$	f_i	$f_i u_i$
50 – 70	60	-40	-2	18	-36
70 – 90	80	-20	-1	12	-12
90 – 110	100	0	0	13	0
110 – 130	120	20	1	27	27
130 – 150	140	40	2	8	16
150 - 170	160	60	3	22	66
				N= 100	Σ $f_i u_i$ = 61

From the table it's seen that,

A = 100 and h = 20

Mean = A + h x (Σ$f_i u_i$/N)

= 100 + 20 x (61/100)

= 100 + 12.2

= 112.2

7.

Class interval:	0 – 8	8 - 16	16 - 24	24 – 32	32 - 40
Frequency:	6	7	10	8	9

Solution:

Let's consider the assumed mean (A) = 20

Class interval	Mid - value x_i	$d_i = x_i - 20$	$u_i = (x_i - 20)/8$	f_i	f_iu_i
0 – 8	4	-16	-2	6	-12
8 – 16	12	-8	-1	7	-7
16 – 24	20	0	0	10	0
24 – 32	28	8	1	8	8
32 – 40	36	16	2	9	18
				N = 40	$\Sigma\ f_iu_i = 7$

From the table it's seen that,

    A = 20 and h = 8

    Mean = A + h x ($\Sigma f_i\ u_i/N$)

        = 20 + 8 x (7/40)

        = 20 + 1.4

        = 21.4

8.

Class interval:	0 – 6	6 - 12	12 - 18	18 – 24	24 - 30
Frequency:	7	5	10	12	6

Solution:

Let's consider the assumed mean (A) = 15

Class interval	Mid - value x_i	$d_i = x_i - 15$	$u_i = (x_i - 15)/6$	f_i	f_iu_i
0 – 6	3	-12	-2	7	-14
6 - 12	9	-6	-1	5	-5
12 - 18	15	0	0	10	0
18 – 24	21	6	1	12	12
24 - 30	27	12	2	6	12
				N = 40	$\Sigma\ f_iu_i = 5$

From the table it's seen that,

    A = 15 and h = 6

    Mean = A + h x ($\Sigma f_i\ u_i/N$)

        = 15 + 6 x (5/40)

= 15 + 0.75
= 15.75

9.

Class interval:	0 - 10	10 - 20	20 - 30	30 – 40	40 - 50
Frequency:	9	12	15	10	14

Solution:

Let's consider the assumed mean (A) = 25

Class interval	Mid - value x_i	$d_i = x_i - 25$	$u_i = (x_i - 25)/10$	f_i	f_iu_i
0 – 10	5	-20	-2	9	-18
10 – 20	15	-10	-1	12	-12
20 – 30	25	0	0	15	0
30 – 40	35	10	1	10	10
40 - 50	45	20	2	14	28
				N = 60	$\Sigma f_iu_i = 8$

From the table it's seen that,
  A = 25 and h = 10
  Mean = A + h x ($\Sigma f_i u_i/N$)
    = 25 + 10 x (8/60)
    = 25 + 4/3
    = 79/3 = 26.333

10.

Class interval:	0 - 8	8 - 16	16 – 24	24 – 32	32 - 40
Frequency:	5	9	10	8	8

Solution:

Let's consider the assumed mean (A) = 20

Class interval	Mid - value x_i	$d_i = x_i - 20$	$u_i = (x_i - 20)/8$	f_i	f_iu_i
0 – 8	4	-16	-2	5	-10
8 – 16	12	-4	-1	9	-9
16 – 24	20	0	0	10	0
24 – 32	28	4	1	8	8
32 – 40	36	16	2	8	16
				N = 40	$\Sigma f_iu_i = 5$

From the table it's seen that,
  A = 20 and h = 8
  Mean = A + h x ($\Sigma f_i u_i/N$)

= 20 + 8 x (5/40)
= 20 + 1
= 21

11.

Class interval:	0 – 8	8 - 16	16 - 24	24 – 32	32 – 40
Frequency:	5	6	4	3	2

Solution:

Let's consider the assumed mean (A) = 20

Class interval	Mid - value x_i	$d_i = x_i - 20$	$u_i = (x_i - 20)/8$	f_i	$f_i u_i$
0 – 8	4	-16	-2	5	-12
8 – 16	12	-8	-1	6	-8
16 – 24	20	0	0	4	0
24 – 32	28	8	1	3	9
32 – 40	36	16	2	2	14
				N = 20	$\Sigma f_i u_i$ = -9

From the table it's seen that,
A = 20 and h = 8
Mean = A + h x ($\Sigma f_i u_i/N$)
= 20 + 6 x (-9/20)
= 20 – 72/20
= 20 – 3.6
= 16.4

12.

Class interval:	10 - 30	30 - 50	50 - 70	70 – 90	90 - 110	110 - 130
Frequency:	5	8	12	20	3	2

Solution:

Let's consider the assumed mean (A) = 60

Class interval	Mid - value x_i	$d_i = x_i - 60$	$u_i = (x_i - 60)/20$	f_i	$f_i u_i$
10 – 30	20	-40	-2	5	-10
30 – 50	40	-20	-1	8	-8
50 – 70	60	0	0	12	0
70 – 90	80	20	1	20	20
90 – 110	100	40	2	3	6
110 – 130	120	60	3	2	6
				N = 50	$\Sigma f_i u_i$ = 14

From the table it's seen that,

A = 60 and h = 20

Mean = A + h x ($\Sigma f_i u_i$/N)

= 60 + 20 x (14/50)

= 60 + 28/5

= 60 + 5.6

= 65.6

13.

Class interval:	25 – 35	35 - 45	45 - 55	55 – 65	65 – 75
Frequency:	6	10	8	12	4

Solution:

Let's consider the assumed mean (A) = 50

Class interval	Mid - value x_i	$d_i = x_i - 50$	$u_i = (x_i - 50)/10$	f_i	$f_i u_i$
25 - 35	30	-20	-2	6	-12
35 - 45	40	-10	-1	10	-10
45 - 55	50	0	0	8	0
55 - 65	60	10	1	12	12
65 - 75	70	20	2	4	8
				N = 40	$\Sigma f_i u_i$ = -2

From the table it's seen that,

A = 50 and h = 10

Mean = A + h x ($\Sigma f_i u_i$/N)

= 50 + 10 x (-2/40)

= 50 - 0.5

= 49.5

14.

Class interval:	25 – 29	30 – 34	35 – 39	40 – 44	45 – 49	50 – 54	55 – 59
Frequency:	14	22	16	6	5	3	4

Solution:

Let's consider the assumed mean (A) = 42

Class interval	Mid - value x_i	$d_i = x_i - 42$	$u_i = (x_i - 42)/5$	f_i	$f_i u_i$
25 – 29	27	-15	-3	14	-42
30 – 34	32	-10	-2	22	-44

35 – 39	37	-5	-1	16	-16
40 – 44	42	0	0	6	0
45 – 49	47	5	1	5	5
50 – 54	52	10	2	3	6
55 – 59	57	15	3	4	12
				N = 70	$\Sigma\ f_i u_i$ = -79

From the table it's seen that,

A = 42 and h = 5

Mean = A + h x ($\Sigma f_i u_i$/N)

= 42 + 5 x (-79/70)

= 42 – 79/14

= 42 – 5.643

= 36.357