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_iu_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	$\Sigma f_iu_i = -35$

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

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

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,

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 and h = 20

So,

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

= 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_iu_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_iu_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				$\Sigma f_iu_i = 4$

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_iu_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	$\Sigma f_iu_i = 3$

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 (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_iu_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	$\Sigma f_iu_i = 61$

From the table it's seen that,

A = 100 and h = 20

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

= 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

= 20.4

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_iu_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	$\Sigma f_iu_i = -9$

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_iu_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	$\Sigma f_iu_i = 14$

From the table it's seen that,

A = 60 and h = 20

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

$= 60 + 20 \times (14/50)$

$= 60 + 28/5$

$= 60 + 5.6$

$= 65.6$

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

$= 50 + 10 \times (-2/40)$

$= 50 - 0.5$

$= 49.5$

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