

### Exercise 7.3

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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 <sub>i</sub> )	Expenditure (in rupees) (x <sub>i</sub> )	Frequency (f <sub>i</sub> )
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 <sub>i</sub> )	d <sub>i</sub> = x <sub>i</sub> – 275	u <sub>i</sub> = (x <sub>i</sub> - 275)/50	Frequency f <sub>i</sub>	f <sub>i</sub> u <sub>i</sub>
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	Σ f <sub>i</sub> u <sub>i</sub> = -35

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

So,

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

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,

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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  $f_i x_i$  by the following

Number of plants	Number of house ( $f_i$ )	$x_i$	$f_i x_i$
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	N = 20		$\Sigma f_i u_i = 162$

Here,

$$\begin{aligned} \text{Mean} &= \Sigma f_i u_i / N \\ &= 162 / 20 \\ &= 8.1 \end{aligned}$$

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 $f_i$	$f_i u_i$
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	$\Sigma f_i u_i = -12$

It's seen that,

$$A = 150 \text{ and } h = 20$$

So,

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

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$$\begin{aligned}
 &= 150 + 20 \times (-12/50) \\
 &= 150 - 24/5 \\
 &= 150 - 4.8 \\
 &= 145.20
 \end{aligned}$$

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  $(x_i) = (\text{upper class limit} + \text{lower class limit})/ 2$

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 ( $f_i$ )	$x_i$	$d_i = x_i - 75.5$	$u_i = (x_i - 75.5)/h$	$f_i u_i$
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

$$N = 30 \text{ and } h = 3$$

So, the mean =  $A + h \times (\Sigma f_i u_i / N)$

$$= 75.5 + 3 \times (4/30)$$

$$= 75.5 + 2/5$$

$$= 75.9$$

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.

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

**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	$\Sigma f_i u_i = 3$

From the table it's seen that,

$$A = 15 \text{ and } h = 6$$

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

$$= 15 + 6 \times (3/40)$$

$$= 15 + 0.45$$

$$= 15.45$$

6.

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

**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	$\Sigma f_i u_i = 61$

From the table it's seen that,

$$A = 100 \text{ and } h = 20$$

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

$$= 100 + 20 \times (61/100)$$

$$= 100 + 12.2$$

$$= 112.2$$

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

**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	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	$\Sigma f_i u_i = 7$

From the table it's seen that,

$$A = 20 \text{ and } h = 8$$

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

$$= 20 + 8 \times (7/40)$$

$$= 20 + 1.4$$

$$= 21.4$$

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8.

<b>Class interval:</b>	<b>0 – 6</b>	<b>6 - 12</b>	<b>12 - 18</b>	<b>18 – 24</b>	<b>24 - 30</b>
<b>Frequency:</b>	<b>7</b>	<b>5</b>	<b>10</b>	<b>12</b>	<b>6</b>

**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	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	$\Sigma f_i u_i = 5$

From the table it's seen that,

$$A = 15 \text{ and } h = 6$$

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

$$= 15 + 6 \times (5/40)$$

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$$= 15 + 0.75$$

$$= 15.75$$

9.

<b>Class interval:</b>	<b>0 - 10</b>	<b>10 - 20</b>	<b>20 - 30</b>	<b>30 - 40</b>	<b>40 - 50</b>
<b>Frequency:</b>	<b>9</b>	<b>12</b>	<b>15</b>	<b>10</b>	<b>14</b>

**Solution:**

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

Class interval	Mid - value $x_i$	$d_i = x_i - 25$	$u_i = (x_i - 25)/10$	$f_i$	$f_i u_i$
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	$\Sigma f_i u_i = 8$

From the table it's seen that,

$$A = 25 \text{ and } h = 10$$

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

$$= 25 + 10 \times (8/60)$$

$$= 25 + 4/3$$

$$= 79/3 = 26.333$$

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10.

<b>Class interval:</b>	<b>0 - 8</b>	<b>8 - 16</b>	<b>16 - 24</b>	<b>24 - 32</b>	<b>32 - 40</b>
<b>Frequency:</b>	<b>5</b>	<b>9</b>	<b>10</b>	<b>8</b>	<b>8</b>

**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	-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	$\Sigma f_i u_i = 5$

From the table it's seen that,

$$A = 20 \text{ and } h = 8$$

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

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$$\begin{aligned}
 &= 20 + 8 \times (5/40) \\
 &= 20 + 1 \\
 &= 21
 \end{aligned}$$

11.

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

**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,

$$A = 20 \text{ and } h = 8$$

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

$$= 20 + 8 \times (-9/20)$$

$$= 20 - 72/20$$

$$= 20 - 3.6$$

$$= 16.4$$

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12.

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

**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	$\Sigma f_i u_i = 14$

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From the table it's seen that,

$$A = 60 \text{ and } h = 20$$

$$\begin{aligned} \text{Mean} &= A + h \times (\sum f_i u_i / N) \\ &= 60 + 20 \times (14/50) \\ &= 60 + 28/5 \\ &= 60 + 5.6 \\ &= 65.6 \end{aligned}$$

13.

<b>Class interval:</b>	<b>25 – 35</b>	<b>35 – 45</b>	<b>45 – 55</b>	<b>55 – 65</b>	<b>65 – 75</b>
<b>Frequency:</b>	<b>6</b>	<b>10</b>	<b>8</b>	<b>12</b>	<b>4</b>

**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	$\sum f_i u_i = -2$

From the table it's seen that,

$$A = 50 \text{ and } h = 10$$

$$\begin{aligned} \text{Mean} &= A + h \times (\sum f_i u_i / N) \\ &= 50 + 10 \times (-2/40) \\ &= 50 - 0.5 \\ &= 49.5 \end{aligned}$$

14.

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

**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

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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,

$$A = 42 \text{ and } h = 5$$

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

$$= 42 + 5 \times (-79/70)$$

$$= 42 - 79/14$$

$$= 42 - 5.643$$

$$= 36.357$$



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