

Exercise 15.3

Q.1

Expenditure

f_i

x_i

$d_i = x_i - a$

$f_i d_i$

100 - 150

24

125

- 150

- 3600

150 - 200

40

175

- 100

- 4000

200 - 250

33

225

- 50

- 1650

250 - 300

28

275 = a

0

0

300 - 350	30	325	50	1500
350 - 400	22	375	100	2200
400 - 450	16	425	150	2400
450 - 500	7	475	200	1400
	$\Sigma f_i = 200$			$\Sigma f_i d_i = -1750$

$$\begin{aligned} \text{Mean} &= a + \frac{\Sigma f_i d_i}{\Sigma f_i} \\ &= 275 + \frac{(-1750)}{200} \\ &= 275 - 8.75 = \boxed{266.25} \end{aligned}$$

Q. 3

Wages	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
100 - 120	110	4	-40	-480
120 - 140	130	14	-20	-280
140 - 160	150 = a	8	0	0
160 - 180	170	6	20	120
180 - 200	190	10	40	400
		$\Sigma f_i = 50$		$\Sigma f_i d_i = -240$

$$\begin{aligned} \text{Mean} &= a + \frac{\Sigma f_i d_i}{\Sigma f_i} \\ &= 150 + \frac{(-240)}{50} \\ &= 150 - 4.80 = \boxed{145.20} \end{aligned}$$

Q. 5

Class Interval	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
0 - 6	3	6	-12	-72
6 - 12	9	8	-6	-48
12 - 18	15 = a	10	0	0
18 - 24	21	9	6	54

24-30	27	7	12	84
		$\sum f_i = 40$		$\sum f_i d_i = 18$

$$\begin{aligned} \text{Mean} &= a + \frac{\sum f_i d_i}{\sum f_i} \\ &= 15 + \frac{18}{40} = 15 + 0.45 \\ &= \boxed{15.45} \end{aligned}$$

Q.6

Class Interval	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
50-70	60	18	-40	-720
70-90	80	12	-20	-240
90-110	100 = a	13	0	0
110-130	120	27	20	540
130-150	140	8	40	320
150-170	160	22	60	1320
		$\sum f_i = 100$		$\sum f_i d_i = 1220$

$$\begin{aligned} \text{Mean} &= a + \frac{\sum f_i d_i}{\sum f_i} \\ &= 100 + \frac{1220}{100} \\ &= 100 + 12.20 = \boxed{112.20} \end{aligned}$$

Q.7

Class Interval	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
0-8	4	8	-16	-96
8-16	12	7	-8	-56
16-24	20 = a	10	0	0
24-32	28	8	8	64
32-40	36	9	16	144
		$\sum f_i = 40$		$\sum = 56$

$$\text{Mean} = a + \frac{\sum fidi}{\sum fi}$$

$$= 20 + \frac{56.7}{40.5} = 20 + 1.4$$

$$= \boxed{21.4}$$

Class	$a - ix = ib$	ix	ix	Frequency	$f \cdot x$
0-10	0	0	0	8	0
10-20	0	0	0	5	0
20-30	0	0	0	2	0
30-40	0	0	0	7	0
40-50	0	0	0	8	0
50-60	0	0	0	10	0
60-70	0	0	0	10	0
70-80	0	0	0	10	0
80-90	0	0	0	10	0
90-100	0	0	0	10	0
Total				40	56.7

$$\text{Mean} = 21.4$$

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Class	$a - ix = ib$	ix	ix	Frequency	$f \cdot x$
0-10	0	0	0	8	0
10-20	0	0	0	5	0
20-30	0	0	0	2	0
30-40	0	0	0	7	0
40-50	0	0	0	8	0
50-60	0	0	0	10	0
60-70	0	0	0	10	0
70-80	0	0	0	10	0
80-90	0	0	0	10	0
90-100	0	0	0	10	0
Total				40	56.7

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Q. 8

Class Interval	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
0-6	3	7	-12	-84
6-12	9	5	-6	-30
12-18	15 = a	10	0	0
18-24	21	12	6	72
24-30	27	6	12	72
		$\Sigma f_i = 40$		$\Sigma f_i d_i = 30$

$$\begin{aligned}\text{Mean} &= a + \frac{\Sigma f_i d_i}{\Sigma f_i} \\ &= 15 + \frac{30}{40} = 15 + 0.75 \\ &= \boxed{15.75}\end{aligned}$$

Q. 9

Class Interval	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
0-10	5	9	-20	-180
10-20	15	12	-10	-120
20-30	25 = a	15	0	0
30-40	35	10	10	100
40-50	45	14	20	280
		$\Sigma f_i = 60$		$\Sigma f_i d_i = 80$

$$\begin{aligned}\text{Mean} &= a + \frac{\Sigma f_i d_i}{\Sigma f_i} \\ &= 25 + \frac{80}{60} = 25 + 1.333 \\ &= \boxed{26.333}\end{aligned}$$

Q.10

Class interval	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
0-8	4	5	-16	-80
8-16	12	9	-8	-72
16-24	20 = a	10	0	0
24-32	28	8	8	64
32-40	36	8	16	128
		$\Sigma f_i = 40$		$\Sigma f_i d_i = 40$

$$\begin{aligned} \text{Mean} &= a + \frac{\Sigma f_i d_i}{\Sigma f_i} \\ &= 20 + \frac{40}{40} \\ &= 21 \end{aligned}$$

Q.11

Class Interval	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
0-8	4	5	-16	-80
8-16	12	6	-8	-48
16-24	20 = a	4	0	0
24-32	28	3	8	24
32-40	36	2	16	32
		$\Sigma f_i = 20$		$\Sigma f_i d_i = -72$

$$\begin{aligned} \text{Mean} &= a + \frac{\Sigma f_i d_i}{\Sigma f_i} \\ &= 20 + \frac{-72}{20} \\ &= 20 - 3.6 = 16.4 \end{aligned}$$

Q.12

Class Interval	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
10-30	20	5	-40	-200
30-50	40	5	-20	-100

50-70	60=a	12	0	0
70-90	80	20	20	400
90-110	100	3	40	120
110-130	120	2	60	120
		$\sum f_i = 50$		$\sum f_i d_i = 280$

$$\begin{aligned} \text{Mean} &= a + \frac{\sum f_i d_i}{\sum f_i} \\ &= 60 + \frac{280}{50} = 60 + 5.6 \\ &= \boxed{65.6} \end{aligned}$$

Q. 13

Class Interval	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
25-35	30	6	-20	-120
35-45	40	10	-10	-100
45-55	50=a	8	0	0
55-65	60	12	10	120
65-75	70	4	20	80
		$\sum f_i = 40$		$\sum f_i d_i = -20$

$$\begin{aligned} \text{Mean} &= a + \frac{\sum f_i d_i}{\sum f_i} \\ &= 50 + \frac{(-20)}{40} = 50 - 0.5 \\ &= \boxed{49.5} \end{aligned}$$

Q. 14

Class Interval	Continuous	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
25-29	24.5-29.5	27	4	-15	-210
30-34	29.5-34.5	32	22	-10	-220
35-39	34.5-39.5	37	16	-5	-80
40-44	39.5-44.5	42=a	6	0	0

45-49	44.5 - 49.5	5	5	25
50-54	49.5 - 54.5	3	10	30
55-59	54.5 - 59.5	4	15	60
		$\Sigma f_i = 70$		$\Sigma fidi = -395$

$$\text{Mean} = a + \frac{\Sigma fidi}{\Sigma f_i}$$

$$= 42 + \frac{-395}{70}$$

$$= 42 - 5.643 = \boxed{36.357}$$

Q.15

Class Interval	x_i	f_i	$d_i = x_i - a$	$fidi$
1-4	2.5	6	-10	-60
4-9	6.5	12	-6	-72
9-16	12.5 = a	26	0	0
16-27	21.5	20	9	180
		$\Sigma f_i = 64$		$\Sigma fidi = 48$

$$\text{Mean} = a + \frac{\Sigma fidi}{\Sigma f_i}$$

$$= 12.5 + \frac{48}{64}$$

$$= 12.5 + 0.75$$

$$= 13.25$$

Q.16

Class Interval	x_i	f_i	$d_i = x_i - a$	$fidi$
1400-1500	1450	5	-200	-1000
1500-1600	1550	10	-100	-1000
1600-1700	1650 = a	20	0	0
1700-1800	1750	9	100	900
1800-1900	1850	6	200	1200
1900-2000	1950	2	300	600
		$\Sigma f_i = 52$		$\Sigma fidi = 700$

$$\text{Mean} = a + \frac{\sum f_i d_i}{\sum f_i}$$

$$= 1650 + \frac{700}{52} = 1650 + 13.46$$

$$= \boxed{1663.46}$$

Q.17

Marks	x_i	f_i	fix_i
0-10	5	20	100
10-20	15	24	360
20-30	25	40	1000
30-40	35	36	1260
40-50	45	20	900
		$\sum f_i = 140$	$\sum fix_i = 3620$

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{3620}{140} = 25.857$$

$$= \boxed{25.857}$$

Q.18

Class	x_i	f_i	fix_i
0-20	10	5	50
20-40	30	f_1	$30f_1$
40-60	50	10	500
60-80	70	f_2	$70f_2$
80-100	90	7	630
100-120	110	8	880
		$\sum f_i = 30 + f_1 + f_2$	$\sum fix_i = 2060 + 30f_1 + 70f_2$

$$\text{Mean} = 62.8 \quad \left. \begin{array}{l} \sum f_i = 50 \end{array} \right\} \text{given}$$

$$\therefore 30 + f_1 + f_2 = 50$$

$$f_1 + f_2 = 50 - 30$$

$$f_2 = 20 - f_1$$

$$f_1 + f_2 = 20 \quad \text{--- (1)}$$

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{2060 + 30f_1 + 70f_2}{50}$$

$$62.8 = \frac{2060 + 30f_1 + 70(20 - f_1)}{50} \quad (\text{from (1)})$$

$$62.8 \times 50 = 2060 + 30f_1 + 1400 - 70f_1$$

$$3140 = 3460 - 40f_1$$

$$40f_1 = 3460 - 3140$$

$$f_1 = \frac{320}{40}$$

$$f_1 = 8$$

Putting value of f_1 in (1)

$$f_2 = 20 - f_1$$

$$f_2 = 20 - 8$$

$$f_2 = 12$$

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Q.20 Mean = 27

class	x_i	f_i	$f_i x_i$
0-10	5	8	40
10-20	15	p	$15p$
20-30	25	12	300
30-40	35	13	455
40-50	45	10	450
		$\Sigma f_i = 43 + p$	$\Sigma f_i x_i = 1245 + 15p$

$$\text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

$$27 = \frac{1245 + 15p}{43 + p}$$

$$1161 + 27p = 1245 + 15p$$

$$27p - 15p = 1245 - 1161$$

$$12p = 84$$

$$p = \frac{84}{12}$$

$$\boxed{p = 7}$$

Q.26

Class	f_i	x_i	$d_i = x_i - a$	$f_i d_i$
20-30	400	25	-20	-2000
30-40	120	35	-10	-1200
40-50	130	45 = a	0	0
50-60	400	55	10	4000
60-70	200	65	20	4000
70-80	50	75	30	1500
	$\Sigma f_i = 1000$			$\Sigma f_i d_i = 6300$

$$\text{Mean} = a + \frac{\sum fidi}{\sum fi}$$

$$= 45 + \frac{6300}{1000}$$

$$= 45 + 6.3 = \boxed{51.3}$$

Q.27

Class	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
11-13	12	3	-6	-18
13-15	14	6	-4	-24
15-17	16	9	-2	-18
17-19	18=a	13	0	0
19-21	20	4	2	8
21-23	22	5	4	20
23-25	24	4	6	24
		$\sum f_i = 40 + f$		$\sum f_i d_i = -16 + 2f$

$$\text{Mean} = 18 \text{ (given)}$$

$$\text{Mean} = \frac{\sum fidi}{\sum fi} + a$$

$$18 = 18 + \frac{(-16 + 2f)}{40 + f}$$

$$18 = \frac{18(40 + f) - 16 + 2f}{40 + f}$$

$$720 + 18f = 720 + 18f - 16 + 2f$$

$$16 = 2f$$

$$f = \frac{16}{2} = 8$$

$$\boxed{f = 8}$$

Q. 28

class	f_i	x_i	$d_i = x_i - a$	$f_i d_i$
0-20	17	10	-40	-680
20-40	f_1	30	-20	$-20f_1$
40-60	32	50 = a	0	0
60-80	f_2	70	20	$20f_2$
80-100	19	90	40	760
$\Sigma f_i = 68 + f_1 + f_2$				$\Sigma f_i d_i = 80 - 20f_1 + 20f_2$

Mean = 50 } given
 $\Sigma f_i = 120$

ATQ,

$$68 + f_1 + f_2 = 120$$

$$f_1 + f_2 = 120 - 68$$

$$f_2 = 52 - f_1 \quad \text{--- (1)}$$

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

$$50 = 50 + \frac{80 - 20f_1 + 20f_2}{120}$$

$$50 \times 120 = 6000 + 80 - 20f_1 + 20(52 - f_1)$$

$$6000 = 6000 + 80 - 20f_1 + 1040 - 20f_1$$

$$-40f_1 = 1120$$

$$f_1 = \frac{1120}{-40} = -28$$

$$\boxed{f_1 = 28}$$

Putting value of f_1 in (1)

$$f_2 = 52 - f_1$$

$$f_2 = 52 - 28$$

$$f_2 = 24$$

Q. 29.

Income	Continuous	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
1-200	0.5-200.5	100.5	14	-200	-2800
201-400	200.5-400.5	300.5 = a	15	0	0
401-600	400.5-600.5	500.5	14	200	2800
601-800	600.5-800.5	700.5	7	400	2800
			$\Sigma f_i = 50$		$\Sigma f_i d_i = 2800$

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

$$= 300.5 + \frac{2800}{50}$$

$$= \boxed{356.5}$$

Q. 30. If the mean is 356.5, find the value of x.