Chapter : 9. MEAN, MEDIAN, MODE OF GROUPED DATA, CUMULATIVE FREQUENCY GRAPH AND OGIVE

Exercise : 9A

Question: 1

If the mean of 5

Solution:

Mean of the observation is given by –

$$\text{Mean} = \frac{\text{Sum of the given observations}}{\text{Total number of observations}}$$

So, adding the given observations, we get

Sum of the given observations = x + (x + 2) + (x + 4) + (x + 6) + (x + 8)

= x + x + 2 + x + 4 + x + 6 + x + 8

= 5x + 20

Total number of observations = 5

Mean = 11 (Given)

$$\text{Mean} = \frac{5x + 20}{5}$$

$$\Rightarrow 11 = \frac{5x+20}{5}$$

⇒ 55 = 5x + 20

⇒ 5x = 55 – 20 = 35

⇒ x = 7

Thus, x = 7

Question: 2

If the mean of 25

Solution:

Mean of the observation is given by –

$$\text{Mean} = \frac{\text{Sum of the given observations}}{\text{Total number of observations}}$$

Total number of observations = 25

Mean of 25 observation = 27 (Given)

We get

$$27 = \frac{\text{Sum of 25 observations}}{25}$$

⇒ Sum of 25 observations = 27 × 25 = 675

If each observation is decreased by 7, the Sum gets affected.

New Sum = 675 – (25 × 7) = 675 – 175 = 500

$$\text{New mean} = \frac{500}{25} = 20$$

Thus, new mean = 20

Question: 3

Compute the mean

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
1 - 3	2	12	24
3 - 5	4	22	88
5 - 7	6	27	162
7 - 9	8	19	152
TOTAL		80	426

We have got

$\Sigma f_i = 20$ & $\Sigma f_i x_i = 426$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{426}{80}$$

$$\Rightarrow \bar{x} = 5.325$$

Thus, mean is 5.325

Question: 4

Find the mean, us

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
0 - 10	5	7	35
10 - 20	15	5	75
20 - 30	25	6	150
30 - 40	35	12	420
40 - 50	45	8	360
50 - 60	55	2	110
TOTAL		40	1150

We have got

$\Sigma f_i = 40$ & $\Sigma f_i x_i = 1150$

∵ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{1150}{40}$$

$$\Rightarrow \bar{x} = 28.75$$

Thus, mean is 28.75

Question: 5

Calculate the mea

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
25 - 35	30	6	180
35 - 45	40	10	400
45 - 55	50	8	400
55 - 65	60	12	720
65 - 75	70	4	280
TOTAL		40	1980

We have got

$\Sigma f_i = 40$ & $\Sigma f_i x_i = 1980$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{1980}{40}$$

$$\Rightarrow \bar{x} = 49.5$$

Thus, mean is 49.5

Question: 6

Compute the mean

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
0 - 100	50	6	300
100 - 200	150	9	1350
200 - 300	250	15	3750
300 - 400	350	12	4200
400 - 500	450	8	3600
TOTAL		50	13200

We have got

$\Sigma f_i = 50$ & $\Sigma f_i x_i = 13200$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{13200}{50}$$

$$\Rightarrow \bar{x} = 264$$

Thus, mean is 264

Question: 7

Using an appropri

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
84 - 90	87	8	696
90 - 96	93	10	930
96 - 102	99	16	1584
102 - 108	105	23	2415
108 - 114	111	12	1332
114 - 120	117	11	1287
TOTAL		80	8244

We have got

$\Sigma f_i = 80$ & $\Sigma f_i x_i = 8244$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{8244}{80}$$

$$\Rightarrow \bar{x} = 103.05$$

Thus, mean is 103.05

Here, the method being used is direct method as it is easy to calculate the mid - points of the class intervals and the rest calculations were simple and easy.

Question: 8

If the mean of th

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
0 - 10	5	3	15
10 - 20	15	4	60
20 - 30	25	p	25p
30 - 40	35	3	105
40 - 50	45	2	90
TOTAL		12 + p	270 + 25p

We have got

$\Sigma f_i = 12 + p$ & $\Sigma f_i x_i = 270 + 25p$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow 24 = \frac{270 + 25p}{12 + p}$$

$\Rightarrow 288 + 24p = 270 + 25p$

$\Rightarrow 25p - 24p = 288 - 270$

$\Rightarrow p = 18$

Thus, p is 18

Question: 9

The following dis

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

DAILY POCKET ALLOWANCE (Rs.)	MID - POINT(x_i)	NUMBER OF CHILDREN (f_i)	f_ix_i
11 - 13	12	7	84
13 - 15	14	6	84
15 - 17	16	9	144
17 - 19	18	13	234
19 - 21	20	f	20f
21 - 23	22	5	110
23 - 25	24	4	96
TOTAL		44 + f	752 + 20f

We have got

$\Sigma f_i = 44 + f$ and $\Sigma f_i x_i = 752 + 20f$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$\Rightarrow 18 = \frac{752 + 20f}{44 + f}$ ($\because$ given: mean of pocket allowance is 18)

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

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

$\Rightarrow 2f = 40$

$\Rightarrow f = 20$

Thus, f is 20.

Question: 10

If the mean of th

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
0 - 20	10	7	70
20 - 40	30	p	30p
40 - 60	50	10	500
60 - 80	70	9	630
80 - 100	90	13	1170
TOTAL		39 + p	2370 + 30p

We have got

$\Sigma f_i = 39 + p$ and $\Sigma f_ix_i = 2370 + 30p$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_ix_i}{\sum_i f_i}$$

$\Rightarrow 54 = \frac{2370 + 30p}{39 + p}$ ($\because$ given: mean of pocket allowance is 54)

$\Rightarrow 2106 + 54p = 2370 + 30p$

$\Rightarrow 54p - 30p = 2370 - 2106$

$\Rightarrow 24p = 264$

$\Rightarrow p = 11$

Thus, p is 11.

Question: 11

The mean of the f

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
0 - 10	5	7	35
10 - 20	15	10	150
20 - 30	25	x	25x
30 - 40	35	13	455
40 - 50	45	y	45y
50 - 60	55	10	550
60 - 70	65	14	910
70 - 80	75	9	675
TOTAL		63 + x + y	2775 + 25x + 45y

We have got

$\Sigma f_i = 63 + x + y$ and $\Sigma f_ix_i = 2775 + 25x + 45y$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$\Rightarrow 42 = \frac{2775 + 25x + 45y}{63 + x + y}$ ($\because$ given: mean of pocket allowance is 42)

$\Rightarrow 2646 + 42x + 42y = 2775 + 25x + 45y$

$\Rightarrow 42x - 25x + 42y - 45y = 2775 - 2646$

$\Rightarrow 17x - 3y = 129$ ...(i)

As given in the question, frequency(Σf_i) = 100

And as calculated by us, frequency (Σf_i) = 63 + x + y

Equalizing them, we get

63 + x + y = 100

⇒ x + y = 37 …(ii)

We will now solve equations (i) and (ii), multiply eq.(ii) by 3 and then add it to eq.(i), we get

(17x – 3y) + [3(x + y)] = 129 + 111

⇒ 17x – 3y + 3x + 3y = 240

⇒ 20x = 240

⇒ x = 12

Substitute x = 12 in equation (ii),

12 + y = 37

⇒ y = 37 – 12

⇒ y = 25

Thus, x = 12 and y = 25.

Question: 12

The daily expendi

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

EXPENDITURE (Rs.)	MID - POINT(x_i)	NUMBER OF FAMILIES(f_i)	f_ix_i
140 - 160	150	5	750
160 - 180	170	25	4250
180 - 200	190	f_1	$190f_1$
200 - 220	210	f_2	$210f_2$
220 - 240	230	5	1150
TOTAL		$35 + f_1 + f_2$	$6150 + 190f_1 + 210f_2$

We have got

$\Sigma f_i = 35 + f_1 + f_2$ and $\Sigma f_ix_i = 6150 + 190f_1 + 210f_2$

∵ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$\Rightarrow 188 = \frac{6150 + 190f_1 + 210f_2}{35 + f_1 + f_2}$ (∵ given: mean of pocket allowance is 188)

$\Rightarrow 6580 + 188f_1 + 188f_2 = 6150 + 190f_1 + 210f_2$

$\Rightarrow 190f_1 - 188f_1 + 210f_2 - 188f_2 = 6580 - 6150$

$\Rightarrow 2f_1 + 22f_2 = 430$ ...(i)

As given in the question, frequency(Σf_i) = 100

And as calculated by us, frequency (Σf_i) = $35 + f_1 + f_2$

Comparing them, we get

$35 + f_1 + f_2 = 100$

$\Rightarrow f_1 + f_2 = 65$ ...(ii)

We will now solve equations (i) and (ii), multiply eq.(ii) by 2 and then subtracting it from eq.(i), we get

$(2f_1 + 22f_2) - [2(f_1 + f_2)] = 430 - 130$

$\Rightarrow 2f_1 + 22f_2 - 2f_1 - 2f_2 = 300$

$\Rightarrow 20\ f_2 = 300$

$\Rightarrow f_2 = 15$

Substitute $f_2 = 15$ in equation (ii),

$f_1 + 15 = 65$

$\Rightarrow f_1 = 65 - 15$

$\Rightarrow f_1 = 50$

Thus, $f_1 = 50$ and $f_2 = 15$.

Question: 13

The mean of the f

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
0 - 20	10	7	70
20 - 40	30	f_1	$30f_1$
40 - 60	50	12	600
60 - 80	70	f_2	$70f_2$
80 - 100	90	8	720
100 - 120	110	5	550
TOTAL		$32 + f_1 + f_2$	$1940 + 30f_1 + 70f_2$

We have got

$\Sigma f_i = 32 + f_1 + f_2$ and $\Sigma f_i x_i = 1940 + 30f_1 + 70f_2$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$\Rightarrow 57.6 = \frac{1940 + 30f_1 + 70f_2}{32 + f_1 + f_2}$ ($\because$ given: mean of pocket allowance is 57.6)

$\Rightarrow 1843.2 + 57.6f_1 + 57.6f_2 = 1940 + 30f_1 + 70f_2$

$\Rightarrow 57.6f_1 - 30f_1 + 57.6f_2 - 70f_2 = 1940 - 1843.2$

$\Rightarrow 27.6f_1 - 12.4f_2 = 96.8$

$\Rightarrow 69f_1 - 31f_2 = 242$ ...(i)

As given in the question, frequency(Σf_i) = 50

And as calculated by us, frequency (Σf_i) = $32 + f_1 + f_2$

Comparing them, we get

$32 + f_1 + f_2 = 50$

$\Rightarrow f_1 + f_2 = 18$ ...(ii)

We will now solve equations (i) and (ii), multiply eq.(ii) by 31 and then adding to eq.(i), we get

$(69f_1 - 31f_2) + [31(f_1 + f_2)] = 242 + 558$

$\Rightarrow 69f_1 - 31f_2 + 31f_1 + 31f_2 = 800$

$\Rightarrow 100f_1 = 800$

$\Rightarrow f_1 = 8$

Substitute $f_1 = 8$ in equation (ii),

$8 + f_2 = 18$

$\Rightarrow f_2 = 18 - 8$

$\Rightarrow f_2 = 10$

Thus, $f_1 = 8$ and $f_2 = 10$.

Question: 14

During a medical

Solution:

We will find the mean heartbeats per minute by direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
65 - 68	66.5	2	133
68 - 71	69.5	4	278
71 - 74	72.5	3	217.5
74 - 77	75.5	8	604
77 - 80	78.5	7	549.5
80 - 83	81.5	4	326
83 - 86	84.5	2	169
TOTAL		30	2277

We have got

$\Sigma f_i = 30$ & $\Sigma f_i x_i = 2277$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{2277}{30}$$

$$\Rightarrow \bar{x} = 75.9$$

Thus, mean is 75.9 heartbeats per minute.

Question: 15

Find the mean mar

Solution:

We will find the mean marks per student using Assumed - mean method, where A = Assumed

mean.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	DEVIATION(d_i) $d_i = x_i - 25$	$f_i d_i$
0 - 10	5	12	- 20	- 240
10 - 20	15	18	- 10	- 180
20 - 30	25 = A	27	0	0
30 - 40	35	20	10	200
40 - 50	45	17	20	340
50 - 60	55	6	30	180
TOTAL		100		300

We have got

A = 25, $\Sigma f_i = 100$ & $\Sigma f_i d_i = 300$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i d_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = 25 + \frac{300}{100}$$

$$\Rightarrow \bar{x} = 28$$

Thus, mean is 28.

Question: 16

Find the mean of

Solution:

We will find the mean of the frequency distribution using Assumed - mean method, where A = Assumed mean.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	DEVIATION(d_i) $d_i = x_i - 150$	$f_i d_i$
100 - 120	110	10	- 40	- 400
120 - 140	130	20	- 20	- 400
140 - 160	150 = A	30	0	0
160 - 180	170	15	20	300
180 - 200	190	5	40	200
TOTAL		80		- 300

We have got

A = 150, $\Sigma f_i = 80$ & $\Sigma f_i d_i = - 300$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i d_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = 150 - \frac{300}{80}$$

$$\Rightarrow \bar{x} = 146.25$$

Thus, mean is 146.25.

Question: 17

Find the mean of

Solution:

We will find the mean of the data using Assumed - mean method, where A = Assumed mean.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	DEVIATION(d_i) $d_i = x_i - 50$	$f_i d_i$
0 - 20	10	20	- 40	- 800
20 - 40	30	35	- 20	- 700
40 - 60	50 = A	52	0	0
60 - 80	70	44	20	880
80 - 100	90	38	40	1520
100 - 120	110	31	60	1860
TOTAL		220		2760

We have got

A = 50, $\Sigma f_i = 220$ & $\Sigma f_i d_i = 2760$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i d_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = 50 + \frac{2760}{220}$$

$$\Rightarrow \bar{x} = 62.55$$

Thus, mean is 62.55.

Question: 18

The following tab

Solution:

We will solve this using direct method.

LITERACY RATE(%)	MID - POINT(x_i)	NUMBER OF CITIES(f_i)	f_ix_i
45 - 55	50	4	200
55 - 65	60	11	660
65 - 75	70	12	840
75 - 85	80	9	720
85 - 95	90	4	360
TOTAL		40	2780

We have got

$\Sigma f_i = 40$ and $\Sigma f_i x_i = 2780$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{2780}{40}$$

$$\Rightarrow \bar{x} = 69.5$$

Thus, mean is 69.5%.

Question: 19

Find the mean of

Solution:

We will find the mean of the frequency distribution using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 25 and h = 10

CLASS	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 25$	FREQUENCY(f_i)	$u_i = d_i/h$	f_iu_i
0 - 10	5	- 20	7	- 2	- 14
10 - 20	15	- 10	10	- 1	- 10
20 - 30	25 = A	0	15	0	0
30 - 40	35	10	8	1	8
40 - 50	45	20	10	2	20
TOTAL			50		4

We have got

A = 25, h = 10, $\Sigma f_i = 50$ & $\Sigma f_i u_i = 4$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i u_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 25 + \frac{4}{50} \times 10$$

$$\Rightarrow \bar{x} = 25.8$$

Thus, mean is 25.8

Question: 20

Find the mean of

Solution:

We will find the mean of the data using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 40 and h = 10

CLASS	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 40$	FREQUENCY(f_i)	$u_i = d_i/h$	f_iu_i
5 - 15	10	- 30	6	- 3	- 18
15 - 25	20	- 20	10	- 2	- 20
25 - 35	30	- 10	16	- 1	- 16
35 - 45	40 = A	0	15	0	0
45 - 55	50	10	24	1	24
55 - 65	60	20	8	2	16
65 - 75	70	30	7	3	21
TOTAL			86		7

We have got

A = 40, h = 10, $\Sigma f_i = 86$ & $\Sigma f_iu_i = 7$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i u_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 40 + \frac{7}{86} \times 10$$

$$\Rightarrow \bar{x} = 40.81$$

Thus, mean is 40.81

Question: 21

The weights of te

Solution:

We will find the mean weight of packet using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 202.5 and h = 1

WEIGHT(g)	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 202.5$	NUMBER OF PACKETS(f_i)	$u_i = d_i/h$	f_iu_i
200 - 201	200.5	- 2	13	- 2	- 26
201 - 202	201.5	- 1	27	- 1	- 27
202 - 203	202.5 = A	0	18	0	0
203 - 204	203.5	1	10	1	10
204 - 205	204.5	2	1	2	2
205 - 206	205.5	3	1	3	3
TOTAL			70		- 38

We have got

A = 202.5, h = 1, $\Sigma f_i = 70$ & $\Sigma f_iu_i = - 38$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i u_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 202.5 - \frac{38}{70} \times 1$$

$$\Rightarrow \bar{x} = 201.96$$

Thus, mean is 201.96 g.

Question: 22

Find the mean of

Solution:

We will find the mean of the frequency distribution using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 45 and h = 10

CLASS	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 45$	FREQUENCY(f_i)	$u_i = d_i/h$	f_iu_i
20 - 30	25	- 20	25	- 2	- 50
30 - 40	35	- 10	40	- 1	- 40
40 - 50	45 = A	0	42	0	0
50 - 60	55	10	33	1	33
60 - 70	65	20	10	2	20
TOTAL			150		- 37

We have got

A = 45, h = 10, $\Sigma f_i = 150$ & $\Sigma f_iu_i = - 37$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_iu_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 45 - \frac{37}{150} \times 10$$

$$\Rightarrow \bar{x} = 42.53$$

Thus, mean is 42.53.

Question: 23

In an annual exam

Solution:

We will find the mean marks using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 37.5 and h = 15

MARKS OBTAINED	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 37.5$	NUMBER OF STUDENTS(f_i)	$u_i = d_i/h$	f_iu_i
0 - 15	7.5	- 30	2	- 2	- 4
15 - 30	22.5	- 15	4	- 1	- 4
30 - 45	37.5 = A	0	5	0	0
45 - 60	52.5	15	20	1	20
60 - 75	67.5	30	9	2	18
75 - 90	82.5	45	10	3	30
TOTAL			50		60

We have got

A = 37.5, h = 15, $\Sigma f_i = 50$ & $\Sigma f_iu_i = 60$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i u_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 37.5 + \frac{60}{50} \times 15$$

$$\Rightarrow \bar{x} = 55.5$$

Thus, mean marks are 55.5.

Question: 24

Find the arithmet

Solution:

We will find the mean of the frequency distribution using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 33 and h = 6

AGE(years)	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 33$	NUMBER OF WORKERS(f_i)	$u_i = d_i/h$	f_iu_i
18 - 24	21	- 12	6	- 2	- 12
24 - 30	27	- 6	8	- 1	- 8
30 - 36	33 = A	0	12	0	0
36 - 42	39	6	8	1	8
42 - 48	45	12	4	2	8
48 - 54	51	18	2	3	6
TOTAL			40		2

We have got

A = 33, h = 6, $\Sigma f_i = 40$ & $\Sigma f_i u_i = 2$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i u_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 33 + \frac{2}{40} \times 6$$

$$\Rightarrow \bar{x} = 33.3$$

Thus, mean age is 33.3 years.

Question: 25

Find the mean of

Solution:

We will find the mean of the frequency distribution using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 550 and h = 20

CLASS	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 550$	FREQUENCY(f_i)	$u_i = d_i/h$	f_iu_i
500 - 520	510	- 40	14	- 2	- 28
520 - 540	530	- 20	9	- 1	- 9
540 - 560	550 = A	0	5	0	0
560 - 580	570	20	4	1	4
580 - 600	590	40	3	2	6
600 - 620	610	60	5	3	15
TOTAL			40		- 12

We have got

A = 550, h = 20, $\Sigma f_i = 40$ & $\Sigma f_i u_i = -12$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i u_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 550 - \frac{12}{40} \times 20$$

$$\Rightarrow \bar{x} = 544$$

Thus, mean is 544.

Question: 26

Find the mean age

Solution:

We will find the mean age using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 42 and h = 5

Since, the class intervals are inclusive type, we'll first convert it into exclusive type by extending the class interval from both the ends.

AGE(years)	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 550$	NUMBER OF PERSONS(f_i)	$u_i = d_i/h$	f_iu_i
24.5 - 29.5	27	- 15	4	- 3	- 12
29.5 - 34.5	32	- 10	14	- 2	- 28
34.5 - 39.5	37	- 5	22	- 1	- 22
39.5 - 44.5	42 = A	0	16	0	0
44.5 - 49.5	47	5	6	1	6
49.5 - 54.5	52	10	5	2	10
54.5 - 59.5	57	15	3	3	9
TOTAL			70		- 37

We have got

A = 42, h = 5, $\Sigma f_i = 70$ & $\Sigma f_i u_i = -37$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i u_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 42 - \frac{37}{70} \times 5$$

$$\Rightarrow \bar{x} = 39.36$$

Thus, mean age is 544 years.

Question: 27

The following tab

Solution:

We will find the average age using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 29.5 and h = 10

Since, the class intervals are inclusive type, we'll first convert it into exclusive type by extending the class interval from both the ends.

AGE(years)	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 29.5$	NUMBER OF CASES(f_i)	$u_i = d_i/h$	f_iu_i
4.5 - 14.5	9.5	- 20	6	- 2	- 12
14.5 - 24.5	19.5	- 10	11	- 1	- 11
24.5 - 34.5	29.5 = A	0	21	0	0
34.5 - 44.5	39.5	10	23	1	23
44.5 - 54.5	49.5	20	14	2	28
54.5 - 64.5	59.5	30	5	3	15
TOTAL			80		43

We have got

A = 29.5, h = 10, $\Sigma f_i = 80$ & $\Sigma f_i u_i = 43$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i u_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 29.5 + \frac{43}{80} \times 10$$

$$\Rightarrow \bar{x} = 34.88$$

Thus, mean age is 34.88 years.

Question: 28

Weight of 60 eggs

Solution:

We will find the mean weight using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 92 and h = 5

Since, the class intervals are inclusive type, we'll first convert it into exclusive type by extending the class interval from both the ends.

WEIGHT(G)	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 92$	NUMBER OF EGGS(f_i)	$u_i = d_i/h$	f_iu_i
74.5 - 79.5	77	- 15	4	- 3	- 12
79.5 - 84.5	82	- 10	9	- 2	- 18
84.5 - 89.5	87	- 5	13	- 1	- 13
89.5 - 94.5	92 = A	0	17	0	0
94.5 - 99.5	97	5	12	1	12
99.5 - 104.5	102	10	3	2	6
104.5 - 109.5	107	15	2	3	6
TOTAL			60		- 19

We have got

A = 92, h = 5, $\Sigma f_i = 60$ & $\Sigma f_iu_i = - 19$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i u_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 92 - \frac{19}{60} \times 5$$

$$\Rightarrow \bar{x} = 90.42$$

Thus, mean weight is 90 g.

Question: 29

The following tab

Solution:

We will find the mean marks using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 17.5 and h = 5

Since, the class intervals are less - than type, we'll first convert it into exclusive type.

WEIGHT(G)	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 17.5$	NUMBER OF EGGS(f_i)	$u_i = d_i/h$	f_iu_i
0 - 5	2.5	- 15	3	- 3	- 9
5 - 10	7.5	- 10	7	- 2	- 14
10 - 15	12.5	- 5	15	- 1	- 15
15 - 20	17.5 = A	0	24	0	0
20 - 25	22.5	5	16	1	16
25 - 30	27.5	10	8	2	16
30 - 35	32.5	15	5	3	15
35 - 40	37.5	20	2	4	8
TOTAL			80		17

We have got

A = 17.5, h = 5, $\Sigma f_i = 80$ & $\Sigma f_i u_i = 17$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i u_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 17.5 + \frac{17}{80} \times 5$$

$$\Rightarrow \bar{x} = 18.5625$$

Thus, mean marks correct to 2 decimal places are 18.56.

Exercise : 9B

Question: 1

In a hospital, th

Solution:

To find median,

Assume Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

AGE(years)	NUMBER OF PATIENTS(f_i)	C_f
0 - 15	5	5
15 - 30	20	5 + 20 = 25
30 - 45	40	25 + 40 = 65
45 - 60	50	65 + 50 = 115
60 - 75	25	115 + 25 = 140
TOTAL	140	

So, N = 140

⇒ N/2 = 140/2 = 70

The cumulative frequency just greater than (N/2 =) 70 is 115, so the corresponding median class is 45 - 60 and accordingly we get C_f = 65(cumulative frequency before the median class).

Now, since median class is 45 - 60.

∴ l = 45, h = 15, f = 50, N/2 = 70 and C_f = 65

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 45 + \left(\frac{70-65}{50}\right) \times 15$$

= 45 + 1.5

= 46.5

Thus, median age is 46.5 years.

Question: 2

Compute the media

Solution:

To find median,

Assume Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

MARKS	NUMBER OF STUDENTS(f_i)	C_f
0 - 7	3	3
7 - 14	4	3 + 4 = 7
14 - 21	7	7 + 7 = 14
21 - 28	11	14 + 11 = 25
28 - 35	0	25 + 0 = 25
35 - 42	16	25 + 16 = 41
42 - 49	9	41 + 9 = 50
TOTAL	50	

So, N = 50

⇒ N/2 = 50/2 = 25

The cumulative frequency just greater than (N/2 =) 25 is 41, so the corresponding median class is 35 - 42 and accordingly we get C_f = 25(cumulative frequency before the median class).

Now, since median class is 35 - 42.

∴ l = 35, h = 7, f = 16, N/2 = 25 and C_f = 25

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 35 + \left(\frac{25-25}{16}\right) \times 7$$

= 35 + 0

= 35

Thus, median marks are 35.

Question: 3

The following tab

Solution:

To find median,

Assume Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

DAILY WAGES(Rs.)	NUMBER OF WORKERS(f_i)	C_f
0 - 100	40	40
100 - 200	32	40 + 32 = 72
200 - 300	48	72 + 48 = 120
300 - 400	22	120 + 22 = 142
400 - 500	8	142 + 8 = 150
TOTAL	150	

So, N = 150

⇒ N/2 = 150/2 = 75

The cumulative frequency just greater than (N/2 =) 75 is 120, so the corresponding median class is 200 - 300 and accordingly we get C_f = 72(cumulative frequency before the median class).

Now, since median class is 200 - 300.

∴ l = 200, h = 100, f = 48, N/2 = 75 and C_f = 72

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 200 + \left(\frac{75-72}{48}\right) \times 100$$

= 200 + 6.25

= 206.25

Thus, median wage is Rs. 206.25.

Question: 4

Calculate the med

Solution:

To find median, Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

CLASS	FREQUENCY(f_i)	C_f
5 - 10	5	5
10 - 15	6	5 + 6 = 11
15 - 20	15	11 + 15 = 26
20 - 25	10	26 + 10 = 36
25 - 30	5	36 + 5 = 41
30 - 35	4	41 + 4 = 45
35 - 40	2	45 + 2 = 47
40 - 45	2	47 + 2 = 49
TOTAL	49	

So, N = 49

⇒ N/2 = 49/2 = 24.5

The cumulative frequency just greater than (N/2 =) 24.5 is 25, so the corresponding median class is 15 - 20 and accordingly we get C_f = 11(cumulative frequency before the median class).

Now, since median class is 15 - 20.

∴ l = 15, h = 5, f = 15, N/2 = 24.5 and C_f = 11

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 15 + \left(\frac{24.5-11}{15}\right) \times 5$$

= 15 + 4.5

= 19.5

Thus, median is 19.5.

Question: 5

Given below is th

Solution:

To find median, Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

CONSUMPTION (unit)	NUMBER OF CONSUMERS(f_i)	C_f
65 - 85	4	4
85 - 105	5	4 + 5 = 9
105 - 125	13	9 + 13 = 22
125 - 145	20	22 + 20 = 42
145 - 165	14	42 + 14 = 56
165 - 185	7	56 + 7 = 63
185 - 205	4	63 + 4 = 67
TOTAL	67	

So, N = 67

⇒ N/2 = 67/2 = 33.5

The cumulative frequency just greater than (N/2 =) 33.5 is 42, so the corresponding median class is 125 - 145 and accordingly we get C_f = 22(cumulative frequency before the median class).

Now, since median class is 125 - 145.

$\therefore$ l = 125, h = 20, f = 20, N/2 = 33.5 and C_f = 22

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 125 + \left(\frac{33.5-22}{20}\right) \times 20$$

= 125 + 11.5

= 136.5

Thus, median is 136.5.

Question: 6

Calculate the med

Solution:

To find median, Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

HEIGHT(cm)	NUMBER OF BOYS(f_i)	C_f
135 - 140	6	6
140 - 145	10	6 + 10 = 16
145 - 150	18	16 + 18 = 34
150 - 155	22	34 + 22 = 56
155 - 160	20	56 + 20 = 76
160 - 165	15	76 + 15 = 91
165 - 170	6	91 + 6 = 97
170 - 175	3	97 + 3 = 100
TOTAL	100	

So, N = 100

⇒ N/2 = 100/2 = 50

The cumulative frequency just greater than (N/2 =) 50 is 56, so the corresponding median class is 150 - 155 and accordingly we get C_f = 34(cumulative frequency before the median class).

Now, since median class is 150 - 155.

∴ l = 150, h = 5, f = 22, N/2 = 50 and C_f = 34

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 150 + \left(\frac{50-34}{22}\right) \times 5$$

= 150 + 3.636

= 153.64

Thus, median is 153.64 cm.

Question: 7

Calculate the mis

Solution:

Median(given) = 24, Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table, where x is the unknown frequency.

CLASS	FREQUENCY(f_i)	C_f
0 - 10	5	5
10 - 20	25	5 + 25 = 30
20 - 30	x	30 + x
30 - 40	18	30 + x + 18 = 48 + x
40 - 50	7	48 + x + 7 = 55 + x
TOTAL	55 + x	

Median = 24 (as already mentioned in the question)

24 lies between 20 - 30 ⇒ Median class = 20 - 30

∴ l = 20, h = 10, f = x, N/2 = (55 + x)/2 and C_f = 30

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow 24 = 20 + \left(\frac{\frac{55+x}{2} - 30}{x}\right) \times 10$$

$\Rightarrow 24 = 20 + \left(\frac{55 + x - 60}{2x}\right) \times 10$

$\Rightarrow 24 - 20 = (10x - 50)/2x$

$\Rightarrow (4)(2x) = 10x - 50$

$\Rightarrow 8x = 10x - 50$

$\Rightarrow 10x - 8x = 50$

$\Rightarrow 2x = 50$

$\Rightarrow x = 25$

Thus, the unknown frequency is 25.

Question: 8

The median of the

Solution:

Given: Median = 16 & N = 70

Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table, where x is the unknown frequency.

CLASS	FREQUENCY(f_i)	C_f
0 - 5	12	12
5 - 10	a	12 + a
10 - 15	12	12 + a + 12 = 24 + a
15 - 20	15	24 + a + 15 = 39 + a
20 - 25	b	39 + a + b
25 - 30	6	39 + a + b + 6 = 45 + a + b
30 - 35	6	45 + a + b + 6 = 51 + a + b
35 - 40	4	51 + a + b + 4 = 55 + a + b
TOTAL	55 + a + b	

Median = 16 (as already mentioned in the question)

16 lies between 15 - 20 ⇒ Median class = 15 - 20

∴ l = 15, h = 5, f = 15, N/2 = (55 + a + b)/2 and C_f = 24 + a

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow 16 = 15 + \left(\frac{\frac{55+a+b}{2} - (24+a)}{15}\right) \times 5$$

$$\Rightarrow 16 = 15 + \left(\frac{55+a+b-48-2a}{30}\right) \times 5$$

⇒ 16 – 15 = (7 – a + b)/6

⇒ 6 = 7 – a + b

⇒ a – b = 1 ...(i)

And given that N = 70

⇒ 55 + a + b = 70

⇒ a + b = 15 ...(ii)

Solving equations (i) & (ii), we get

(a – b) + (a + b) = 1 + 15

⇒ 2a = 16

⇒ a = 8

Substituting a = 8 in eq.(i),

8 – b = 1

⇒ b = 7

Thus, the unknown frequencies are a = 8 and b = 7.

Question: 9

In the following

Solution:

Given: Median = 5000 & N = 60

Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table, where x is the unknown frequency.

RUNS SCORED	NUMBER OF BATSMEN(f_i)	C_f
2500 - 3500	5	5
3500 - 4500	x	5 + x
4500 - 5500	y	5 + x + y
5500 - 6500	12	5 + x + y + 12 = 17 + x + y
6500 - 7500	6	17 + x + y + 6 = 23 + x + y
7500 - 8500	2	23 + x + y + 2 = 25 + x + y
TOTAL	25 + x + y	

Given,Median = 5000 (as already mentioned in the question)

Sum of frequencies, N = x + y + 25 = 60 [Total No of players]

5000 lies between 4500 - 5500 ⇒ Median class = 4500 - 5500

∴ l = 4500, h = 1000, f = y, N/2 = 60/2=30 and C_f = 5 + x

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow 5000 = 4500 + \left(\frac{\frac{60}{2} - (5+x)}{y}\right) \times 1000$$

$$\Rightarrow 5000 = 4500 + \left(\frac{30-5-x}{y}\right) \times 1000$$

⇒ 5000 – 4500 = (25000 – 1000x)/y

⇒ 500y = 25000 – 1000x

⇒ 2x + y = 50 ...(i)

And given that N = 60

⇒ 25 + x + y = 60

⇒ x + y = 35 ...(ii)

Solving equations (i) & (ii), we get

(2x + y) – (x + y) = 50 – 35

⇒ x = 15

Substituting x = 15 in eq.(ii),

15 + y = 35

⇒ y = 20

Thus, the unknown frequencies are x = 15 and y = 20.

Question: 10

If the median of

Solution:

Given: Median = 32.5 & N = 40

Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table, where x is the unknown frequency.

CLASS	NUMBER OF BATSMEN(f_i)	C_f
0 - 10	f_1	f_1
10 - 20	5	$5 + f_1$
20 - 30	9	$5 + f_1 + 9 = 14 + f_1$
30 - 40	12	$14 + f_1 + 12 = 26 + f_1$
40 - 50	f_2	$26 + f_1 + f_2$
50 - 60	3	$26 + f_1 + f_2 + 3 = 29 + f_1 + f_2$
60 - 70	2	$29 + f_1 + f_2 + 2 = 31 + f_1 + f_2$
TOTAL	$31 + f_1 + f_2$	

Median = 32.5 (as already mentioned in the question)

32.5 lies between 30 - 40 ⇒ Median class = 30 - 40

∴ l = 30, h = 10, f = 12, N/2 = $(31 + f_1 + f_2)/2 = 40/2$ and $C_f = 14 + f_1$

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow 32.5 = 30 + \left(\frac{\frac{40}{2} - (14 + f_1)}{12}\right) \times 10$$

$$\Rightarrow 32.5 = 30 + \left(\frac{20 - 14 - f_1}{12}\right) \times 10$$

⇒ $32.5 - 30 = (60 - 10f_1)/12$

⇒ $(2.5)(12) = 60 - 10f_1$

⇒ $30 = 60 - 10f_1$

⇒ $f_1 = 3$ ...(i)

And given that N = 40

$\Rightarrow 31 + f_1 + f_2 = 40$

$\Rightarrow f_1 + f_2 = 9$ ...(ii)

Substituting $f_1 = 3$ in eq.(ii),

$3 + f_2 = 9$

$\Rightarrow f_2 = 6$

Thus, the unknown frequencies are $f_1 = 3$ and $f_2 = 6$.

Question: 11

Calculate the med

Solution:

To find median, Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table and convert it into exclusive - type by adjusting from both ends of a class.

AGE(years)	FREQUENCY(f_i)	C_f
18.5 - 25.5	35	35
25.5 - 32.5	96	35 + 96 = 131
32.5 - 39.5	68	131 + 68 = 199
39.5 - 46.5	102	199 + 102 = 301
46.5 - 53.5	35	301 + 35 = 336
53.5 - 60.5	4	336 + 4 = 340
TOTAL	340	

So, N = 340

⇒ N/2 = 340/2 = 170

The cumulative frequency just greater than (N/2 =) 170 is 199, so the corresponding median class is 32.5 - 39.5 and accordingly we get C_f = 131(cumulative frequency before the median class).

Now, since median class is 32.5 - 39.5.

∴ l = 32.5, h = 7, f = 68, N/2 = 170 and C_f = 131

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 32.5 + \left(\frac{170-131}{68}\right) \times 7$$

= 32.5 + 4.014

= 36.51

Thus, median is 36.51 years.

Question: 12

Find the median w

Solution:

To find median, Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table and convert it into exclusive - type by adjusting from both ends of a class.

WAGES PER DAY(Rs.)	NUMBER OF WOMEN WOKERS(f_i)	C_f
60.5 - 70.5	5	5
70.5 - 80.5	15	5 + 15 = 20
80.5 - 90.5	20	20 + 20 = 40
90.5 - 100.5	30	40 + 30 = 70
100.5 - 110.5	20	70 + 20 = 90
110.5 - 120.5	8	90 + 8 = 98
TOTAL	98	

So, N = 98

⇒ N/2 = 98/2 = 49

The cumulative frequency just greater than (N/2 =)49 is 70, so the corresponding median class is 90.5 - 100.5 and accordingly we get C_f = 40(cumulative frequency before the median class).

Now, since median class is 90.5 - 100.5.

∴ l = 90.5, h = 10, f = 30, N/2 = 49 and C_f = 40

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 90.5 + \left(\frac{49-40}{30}\right) \times 10$$

= 90.5 + 3

= 93.5

Thus, median is Rs. 93.5.

Question: 13

Find the median f

Solution:

To find median, Assume

$\Sigma f_i = N$ = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table and convert it into exclusive - type by adjusting from both ends of a class.

CLASS	FREQUENCY(f_i)	C_f
0.5 - 5.5	7	7
5.5 - 10.5	10	7 + 10 = 17
10.5 - 15.5	16	17 + 16 = 33
15.5 - 20.5	32	33 + 32 = 65
20.5 - 25.5	24	65 + 24 = 89
25.5 - 30.5	16	89 + 16 = 105
30.5 - 35.5	11	105 + 11 = 116
35.5 - 40.5	5	116 + 5 = 121
40.5 - 45.5	2	121 + 2 = 123
TOTAL	123	

So, N = 123

$\Rightarrow N/2 = 123/2 = 61.5$

The cumulative frequency just greater than (N/2 =)61.5 is 65, so the corresponding median class is 15.5 - 20.5 and accordingly we get C_f = 33(cumulative frequency before the median class).

Now, since median class is 15.5 - 20.5.

$\therefore$ l = 15.5, h = 5, f = 32, N/2 = 61.5 and C_f = 33

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 15.5 + \left(\frac{61.5-33}{32}\right) \times 5$$

= 15.5 + 4.45

= 19.95

Thus, median is 19.95.

Question: 14

Find the median f

Solution:

To find median, Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table and convert it into exclusive - type.

MARKS	C_f	NUMBER OF STUDENTS(f_i)
0 - 10	12	12
10 - 20	32	32 - 12 = 20
20 - 30	57	57 - 32 = 25
30 - 40	80	80 - 57 = 23
40 - 50	92	92 - 80 = 12
50 - 60	116	116 - 92 = 24
60 - 70	164	164 - 116 = 48
70 - 80	200	200 - 164 = 36
TOTAL		200

So, N = 200

⇒ N/2 = 200/2 = 100

The cumulative frequency just greater than (N/2 =)100 is 116, so the corresponding median class is 50 - 60 and accordingly we get C_f = 92(cumulative frequency before the median class).

Now, since median class is 50 - 60.

∴ l = 50, h = 10, f = 24, N/2 = 100 and C_f = 92

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 50 + \left(\frac{100-92}{24}\right) \times 10$$

= 50 + 3.33

= 53.33

Thus, median is 53.33.

Exercise : 9C

Question: 1

Find the mode of

Solution:

Here, the maximum class frequency is 45.

The class corresponding to this frequency is the modal class. ⇒ modal class = 30 - 40

∴ lower limit of the modal class (l) = 30

Modal class size (h) = 10

Frequency of the modal class (f_1) = 45

Frequency of class preceding the modal class (f_0) = 35

Frequency of class succeeding the modal (f_2) = 25

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \text{Mode} = 30 + \left(\frac{45-35}{2(45)-35-25}\right) \times 10$$

$$\Rightarrow \text{Mode} = 30 + \left(\frac{10}{30}\right) \times 10$$

⇒ Mode = 30 + 3.33 = 33.33

Hence, the mode is 33.33

Question: 2

Compute the mode

Solution:

Here, the maximum class frequency is 28.

The class corresponding to this frequency is the modal class. ⇒ modal class = 40 - 60

∴ lower limit of the modal class (l) = 40

Modal class size (h) = 20

Frequency of the modal class (f_1) = 28

Frequency of class preceding the modal class (f_0) = 16

Frequency of class succeeding the modal (f_2) = 20

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \text{Mode} = 40 + \left(\frac{28-16}{2(28)-16-20}\right) \times 20$$

$$\Rightarrow \text{Mode} = 40 + \left(\frac{12}{20}\right) \times 20$$

⇒ Mode = 40 + 12 = 52

Hence, the mode is 52.

Question: 3

Heights of studen

Solution:

Here, the maximum class frequency is 20.

The class corresponding to this frequency is the modal class. ⇒ modal class = 160 - 165

∴ lower limit of the modal class (l) = 160

Modal class size (h) = 5

Frequency of the modal class (f_1) = 20

Frequency of class preceding the modal class (f_0) = 8

Frequency of class succeeding the modal (f_2) = 12

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \text{Mode} = 160 + \left(\frac{20-8}{2(20)-8-12}\right) \times 5$$

$$\Rightarrow \text{Mode} = 160 + \left(\frac{12}{20}\right) \times 5$$

⇒ Mode = 160 + 3 = 163

Hence, the mode is 163 cm.

Mode represents frequency, hence 163 cm is the height of maximum number of students.

To find the mean, we will solve by using direct method.

HEIGHT (cm)	MID - POINT(x_i)	NUMBER OF STUDENTS(f_i)	f_ix_i
150 - 155	152.5	15	2287.5
155 - 160	157.5	8	1260
160 - 165	162.5	20	3250
165 - 170	167.5	12	2010
170 - 175	172.5	5	862.5
TOTAL		60	9670

We have got

$\Sigma f_i = 60$ & $\Sigma f_i x_i = 9670$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{9670}{60}$$

$$\Rightarrow \bar{x} = 161.17$$

Thus, mean is 161.17

Mean represents average, thus 161.7 cm is the average height of all the students.

Question: 4

Find the mode of

Solution:

Here, the maximum class frequency is 25.

The class corresponding to this frequency is the modal class. ⇒ modal class = 26 - 30

$\therefore$ lower limit of the modal class (l) = 26

Modal class size (h) = 4

Frequency of the modal class (f_1) = 25

Frequency of class preceding the modal class (f_0) = 20

Frequency of class succeeding the modal (f_2) = 22

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \text{Mode} = 26 + \left(\frac{25-20}{2(25)-20-22}\right) \times 4$$

$$\Rightarrow \text{Mode} = 26 + \left(\frac{5}{8}\right) \times 4$$

⇒ Mode = 26 + 2.5 = 28.5

Hence, the mode is 28.5.

Question: 5

Given below is th

Solution:

Expenditure done by maximum number of manual workers is estimated by finding mode.

So here, the maximum class frequency is 40.

The class corresponding to this frequency is the modal class. ⇒ modal class = 1500 - 2000

$\therefore$ lower limit of the modal class (l) = 1500

Modal class size (h) = 500

Frequency of the modal class (f_1) = 40

Frequency of class preceding the modal class (f_0) = 24

Frequency of class succeeding the modal (f_2) = 31

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \text{Mode} = 1500 + \left(\frac{40-24}{2(40)-24-31}\right) \times 500$$

$$\Rightarrow \text{Mode} = 1500 + \left(\frac{16}{25}\right) \times 500$$

⇒ Mode = 1500 + 320 = 1820

Hence, the mode is Rs.1820.

Question: 6

Calculate the mod

Solution:

Here, the maximum class frequency is 150.

The class corresponding to this frequency is the modal class. ⇒ modal class = 5000 - 10000

∴ lower limit of the modal class (l) = 5000

Modal class size (h) = 5000

Frequency of the modal class (f_1) = 150

Frequency of class preceding the modal class (f_0) = 90

Frequency of class succeeding the modal (f_2) = 100

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \text{Mode} = 5000 + \left(\frac{150-90}{2(150)-90-100}\right) \times 5000$$

$$\Rightarrow \text{Mode} = 5000 + \left(\frac{60}{110}\right) \times 5000$$

⇒ Mode = 5000 + 2727.27 = 7727.27

Hence, the mode is Rs.7727.27.

Question: 7

Compute the mode

Solution:

Here, the maximum class frequency is 24.

The class corresponding to this frequency is the modal class. ⇒ modal class = 15 - 20

∴ lower limit of the modal class (l) = 15

Modal class size (h) = 5

Frequency of the modal class (f_1) = 24

Frequency of class preceding the modal class (f_0) = 18

Frequency of class succeeding the modal (f_2) = 17

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$\Rightarrow \text{Mode} = 15 + \left(\frac{24-18}{2(24)-18-17}\right) \times 5$

$\Rightarrow \text{Mode} = 15 + \left(\frac{6}{13}\right) \times 5$

⇒ Mode = 15 + 2.30 = 17.30

Hence, the mode is 17.30 years.

Question: 8

Compute the mode

Solution:

Here, the maximum class frequency is 32.

The class corresponding to this frequency is the modal class. ⇒ modal class = 85 - 95

∴ lower limit of the modal class (l) = 85

Modal class size (h) = 10

Frequency of the modal class (f_1) = 32

Frequency of class preceding the modal class (f_0) = 30

Frequency of class succeeding the modal (f_2) = 6

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$\Rightarrow \text{Mode} = 85 + \left(\frac{32-30}{2(32)-30-6}\right) \times 10$

$\Rightarrow \text{Mode} = 85 + \left(\frac{2}{28}\right) \times 10$

⇒ Mode = 85 + 0.71 = 85.71

Hence, the mode is 85.71.

Question: 9

Compute the mode

Solution:

Since, the given data is in inclusive series, it needs to get converted in exclusive series.

CLASS INTERVAL	0.5 - 5.5	5.5 - 10.5	10.5 - 15.5	15.5 - 20.5	20.5 - 25.5	25.5 - 30.5	30.5 - 35.5	35.5 - 40.5	40.5 - 45.5	45.5 - 50.5
FREQUENCY	3	8	13	18	28	20	13	8	6	4

Here, the maximum class frequency is 28.

The class corresponding to this frequency is the modal class. ⇒ modal class = 15.5 - 20.5

∴ lower limit of the modal class (l) = 15.5

Modal class size (h) = 5

Frequency of the modal class (f_1) = 28

Frequency of class preceding the modal class (f_0) = 18

Frequency of class succeeding the modal (f_2) = 20

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \text{Mode} = 15.5 + \left(\frac{28-18}{2(28)-18-20}\right) \times 5$$

$$\Rightarrow \text{Mode} = 15.5 + \left(\frac{10}{18}\right) \times 5$$

⇒ Mode = 15.5 + 2.78 = 23.28

Hence, the mode is 23.28.

Question: 10

The agewise parti

Solution:

To find frequencies, we have Sum of frequencies that is, 181.

Using Sum of frequencies = 181,

x + 15 + 18 + 30 + 50 + 48 + x = 181

⇒ 2x + 161 = 181

⇒ 2x = 181 – 161 = 20

⇒ x = 10

Thus we have,

Age (in years)	5 - 7	7 - 9	9 - 11	11 - 13	13 - 15	15 - 17	17 - 19
Number of students	10	15	18	30	50	48	10

Here, the maximum class frequency is 50.

The class corresponding to this frequency is the modal class. ⇒ modal class = 13 - 15

∴ lower limit of the modal class (l) = 13

Modal class size (h) = 2

Frequency of the modal class (f_1) = 50

Frequency of class preceding the modal class (f_0) = 30

Frequency of class succeeding the modal (f_2) = 48

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \text{Mode} = 13 + \left(\frac{50-30}{2(50)-30-48}\right) \times 2$$

$$\Rightarrow \text{Mode} = 13 + \left(\frac{20}{22}\right) \times 2$$

⇒ Mode = 13 + 1.82 = 14.82

Hence, the mode is 14.82.

Exercise : 9D

Question: 1

Find the mean, mo

Solution:

To find mean, we will solve by direct method:

CLASS INTERVAL	MID - POINT(x_i)	NUMBER OF BATSMEN(f_i)	f_ix_i
0 - 10	5	4	20
10 - 20	15	4	60
20 - 30	25	7	175
30 - 40	35	10	350
40 - 50	45	12	540
50 - 60	55	8	440
60 - 70	65	5	325
TOTAL		50	1910

We have got

$\Sigma f_i = 50$ & $\Sigma f_i x_i = 1910$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{1910}{50}$$

$$\Rightarrow \bar{x} = 38.2$$

To find median,

Assume $\Sigma f_i = N$ = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

CLASS INTERVAL	NUMBER OF WORKERS(f_i)	C_f
0 - 10	4	4
10 - 20	4	4 + 4 = 8
20 - 30	7	8 + 7 = 15
30 - 40	10	15 + 10 = 25
40 - 50	12	25 + 12 = 37
50 - 60	8	37 + 8 = 45
60 - 70	5	45 + 5 = 50
TOTAL	50	

So, N = 50

⇒ N/2 = 50/2 = 25

The cumulative frequency just greater than (N/2 =) 25 is 37, so the corresponding median class is 40 - 50 and accordingly we get C_f = 25(cumulative frequency before the median class).

Now, since median class is 40 - 50.

∴ l = 40, h = 10, f = 16, N/2 = 25 and C_f = 25

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 40 + \left(\frac{25 - 25}{16}\right)10$$

= 40 + 0

= 40

And we know that,

Mode = 3(Median) – 2(Mean)

= 3(40) – 2(38.2)

= 120 – 76.4

= 43.6

Hence, mean is 38.2, median is 40 and mode is 43.6.

Question: 2

Find the mean, me

Solution:

To find mean, we will solve by direct method:

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
0 - 20	10	6	60
20 - 40	30	8	240
40 - 60	50	10	500
60 - 80	70	12	840
80 - 100	90	6	540
100 - 120	110	5	550
120 - 140	130	3	390
TOTAL		50	3120

We have got

$\Sigma f_i = 50$ & $\Sigma f_i x_i = 3120$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{3120}{50}$$

$$\Rightarrow \bar{x} = 62.4$$

To find median,

Assume $\Sigma f_i = N$ = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

CLASS	FREQUENCY(f_i)	C_f
0 - 20	6	6
20 - 40	8	6 + 8 = 14
40 - 60	10	14 + 10 = 24
60 - 80	12	24 + 12 = 36
80 - 100	6	36 + 6 = 42
100 - 120	5	42 + 5 = 47
120 - 140	3	47 + 3 = 50
TOTAL	50	

So, N = 50

⇒ N/2 = 50/2 = 25

The cumulative frequency just greater than (N/2 =) 25 is 36, so the corresponding median class is 60 - 80 and accordingly we get C_f = 24(cumulative frequency before the median class).

Now, since median class is 60 - 80.

∴ l = 60, h = 20, f = 12, N/2 = 25 and C_f = 24

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 60 + \left(\frac{25-24}{12}\right) \times 20$$

= 60 + 1.67

= 61.67

And we know that,

Mode = 3(Median) – 2(Mean)

= 3(61.67) – 2(62.4)

= 185.01 – 124.8

= 60.21

Hence, mean is 62.4, median is 61.67 and mode is 60.21.

Question: 3

Find the mean, me

Solution:

To find mean, we will solve by direct method:

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
0 - 50	25	2	50
50 - 100	75	3	225
100 - 150	125	5	625
150 - 200	175	6	1050
200 - 250	225	5	1125
250 - 300	275	3	825
300 - 350	325	1	325
TOTAL		25	4225

We have got

$\Sigma f_i = 25$ & $\Sigma f_ix_i = 4171$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{4225}{25}$$

$$\Rightarrow \bar{x} = 169$$

To find median,

Assume Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

CLASS	FREQUENCY(f_i)	C_f
0 - 50	2	2
50 - 100	3	2 + 3 = 5
100 - 150	5	5 + 5 = 10
150 - 200	6	10 + 6 = 16
200 - 250	5	16 + 5 = 21
250 - 300	3	21 + 3 = 24
300 - 350	1	24 + 1 = 25
TOTAL	25	

So, N = 25

⇒ N/2 = 25/2 = 12.5

The cumulative frequency just greater than (N/2 =) 12.5 is 16, so the corresponding median class is 150 - 200 and accordingly we get C_f = 10(cumulative frequency before the median class).

Now, since median class is 150 - 200.

∴ l = 150, h = 50, f = 6, N/2 = 12.5 and C_f = 10

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 150 + \left(\frac{12.5-10}{6}\right) \times 50$$

= 150 + 20.83

= 170.83

And we know that,

Mode = 3(Median) – 2(Mean)

= 3(170.83) – 2(169)

= 512.49 – 338

= 174.49

Hence, mean is 169, median is 170.83 and mode is 174.49.

Question: 4

Find the mode, me

Solution:

To find mean, we will solve by direct method:

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
25 - 35	30	7	210
35 - 45	40	31	1240
45 - 55	50	33	1650
55 - 65	60	17	1020
65 - 75	70	11	770
75 - 85	80	1	80
TOTAL		100	4970

We have got

$\Sigma f_i = 100$ & $\Sigma f_ix_i = 4970$

∵ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{4970}{100}$$

$$\Rightarrow \bar{x} = 49.7$$

To find median,

Assume Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

CLASS	FREQUENCY(f_i)	C_f
25 - 35	7	7
35 - 45	31	7 + 31 = 38
45 - 55	33	38 + 33 = 71
55 - 65	17	71 + 17 = 88
65 - 75	11	88 + 11 = 99
75 - 85	1	99 + 1 = 100
TOTAL	100	

So, N = 100

⇒ N/2 = 100/2 = 50

The cumulative frequency just greater than (N/2 =) 50 is 71, so the corresponding median class is 45 - 55 and accordingly we get C_f = 38(cumulative frequency before the median class).

Now, since median class is 45 - 55.

$\therefore$ l = 45, h = 10, f = 33, N/2 = 50 and C_f = 38

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 45 + \left(\frac{50-38}{33}\right) \times 10$$

= 45 + 3.64

= 48.64

And we know that,

Mode = 3(Median) – 2(Mean)

= 3(48.64) – 2(49.7)

= 145.92 – 99.4

= 46.52

Hence, mean is 49.7, median is 48.64 and mode is 46.52.

Question: 5

A survey regardin

Solution:

To find mean, we will solve by direct method:

HEIGHT (cm.)	MID - POINT(x_i)	TOTAL NUMBER OF GIRLS(f_i)	f_ix_i
120 - 130	125	2	250
130 - 140	135	8	1080
140 - 150	145	12	1740
150 - 160	155	20	3100
160 - 170	165	8	1320
TOTAL		50	7490

We have got

Σf_i = 50 & Σf_ix_i = 7490

∵ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{7490}{50}$$

$$\Rightarrow \bar{x} = 149.8$$

To find median,

Assume Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

HEIGHT (cm.)	TOTAL NUMBER OF GIRLS(f_i)	C_f
120 - 130	2	2
130 - 140	8	2 + 8 = 10
140 - 150	12	10 + 12 = 22
150 - 160	20	22 + 20 = 42
160 - 170	8	42 + 8 = 50
TOTAL	50	

So, N = 50

⇒ N/2 = 50/2 = 25

The cumulative frequency just greater than (N/2 =) 25 is 42, so the corresponding median class is 150 - 160 and accordingly we get C_f = 22(cumulative frequency before the median class).

Now, since median class is 150 - 160.

∴ l = 150, h = 10, f = 20, N/2 = 25 and C_f = 22

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 150 + \left(\frac{25-22}{20}\right) \times 10$$

= 150 + 1.5

= 151.5

And we know that,

Mode = 3(Median) – 2(Mean)

= 3(151.5) – 2(149.8)

= 454.5 – 299.6

= 154.9

Hence, mean is 149.8, median is 151.5 and mode is 154.9.

Question: 6

The following tab

Solution:

To find mean, we will solve by direct method:

DAILY INCOME (Rs.)	MID - POINT(x_i)	NUMBER OF WORKERS(f_i)	f_ix_i
100 - 120	110	12	1320
120 - 140	130	14	1820
140 - 160	150	8	1200
160 - 180	170	6	1020
180 - 200	190	10	1900
TOTAL		50	7260

We have got

$\Sigma f_i = 50$ & $\Sigma f_ix_i = 7260$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$\Rightarrow \bar{x} = \frac{7260}{50}$

$\Rightarrow \bar{x} = 145.2$

To find median,

Assume Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

DAILY INCOME (Rs.)	NUMBER OF WORKERS(f_i)	C_f
100 - 120	12	12
120 - 140	14	12 + 14 = 26
140 - 160	8	26 + 8 = 34
160 - 180	6	34 + 6 = 40
180 - 200	10	40 + 10 = 50
TOTAL	50	

So, N = 50

$\Rightarrow$ N/2 = 50/2 = 25

The cumulative frequency just greater than (N/2 =) 25 is 26, so the corresponding median class is 120 - 140 and accordingly we get C_f = 12(cumulative frequency before the median class).

Now, since median class is 120 - 140.

$\therefore$ l = 120, h = 20, f = 14, N/2 = 25 and C_f = 12

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$\Rightarrow \text{Median} = 120 + \left(\frac{25-12}{14}\right) \times 20$

= 120 + 18.57

= 138.57

And we know that,

Mode = 3(Median) – 2(Mean)

= 3(138.57) – 2(145.2)

= 415.71 – 290.4

= 125.31

Hence, mean is 145.2, median is 138.57 and mode is 125.31.

Question: 7

The table below s

Solution:

To find mean, we will solve by direct method:

DAILY EXPENDITURE (Rs.)	MID - POINT(x_i)	NUMBER OF HOUSEHOLDS(f_i)	f_ix_i
100 - 150	125	6	750
150 - 200	175	7	1225
200 - 250	225	12	2700
250 - 300	275	3	825
300 - 350	325	2	650
TOTAL		30	6150

We have got

$\Sigma f_i = 30$ & $\Sigma f_ix_i = 6150$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{6150}{30}$$

$\Rightarrow \bar{x} = 205$

To find median,

Assume Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

DAILY EXPENDITURE (Rs.)	NUMBER OF HOUSEHOLDS(f_i)	C_f
100 - 150	6	6
150 - 200	7	6 + 7 = 13
200 - 250	12	13 + 12 = 25
250 - 300	3	25 + 3 = 28
300 - 350	2	28 + 2 = 30
TOTAL	30	

So, N = 30

$\Rightarrow$ N/2 = 30/2 = 15

The cumulative frequency just greater than (N/2 =) 15 is 25, so the corresponding median class is 200 - 250 and accordingly we get C_f = 13(cumulative frequency before the median class).

Now, since median class is 200 - 250.

$\therefore$ l = 200, h = 50, f = 12, N/2 = 15 and C_f = 13

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 200 + \left(\frac{15-13}{12}\right) \times 50$$

= 200 + 8.33

= 208.33

Hence, mean is 205 and median is 208.33

Exercise : 9E

Question: 1

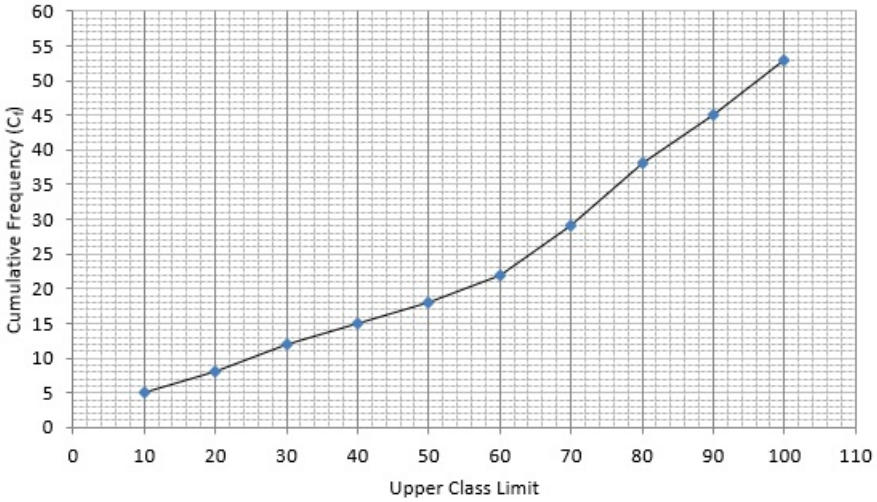
Find the median o

Solution:

The frequency distribution table for ‘less than’ type is:

MARKS	CUMULATIVE FREQUENCY (C_f)
Less than 10	5
Less than 20	5 + 3 = 8
Less than 30	8 + 4 = 12
Less than 40	12 + 3 = 15
Less than 50	15 + 3 = 18
Less than 60	18 + 4 = 22
Less than 70	22 + 7 = 29
Less than 80	29 + 9 = 38
Less than 90	38 + 7 = 45
Less than 100	45 + 8 = 53

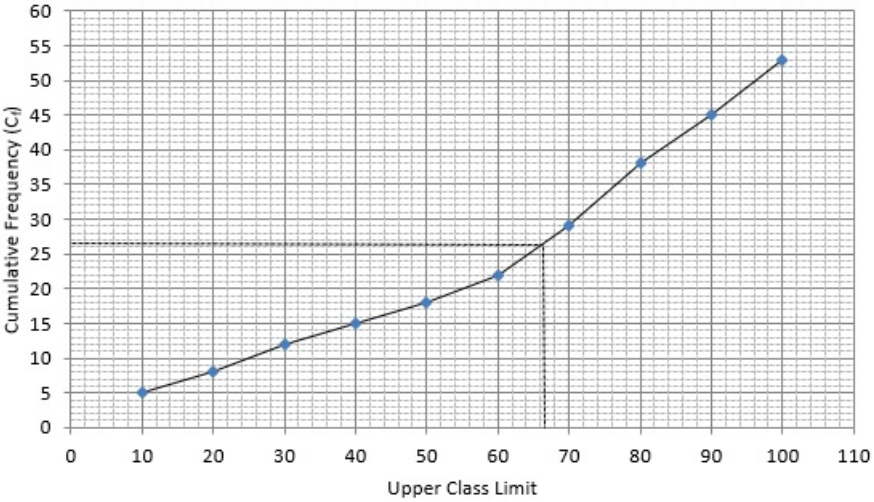
Lets plot a graph of ‘less than ogive’, taking upper limits of the class intervals on x - axis and cumulative frequencies on y - axis.



As we have N = 53 by the frequency table.

N/2 = 53/2 = 26.5

Mark 26.5 on y - axis and the corresponding point on x - axis would be the median.



The corresponding point on x - axis is 66.4.

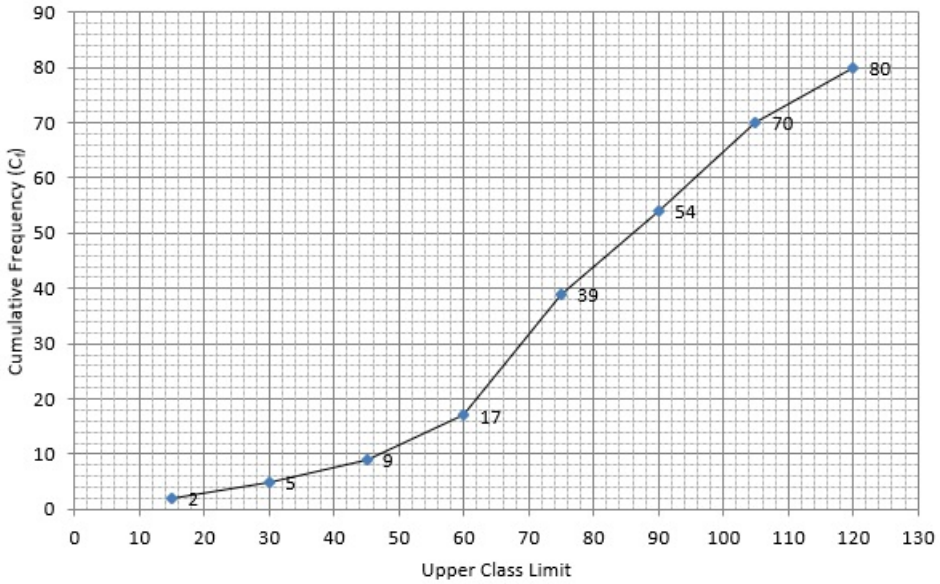
Hence, median is 66.4

Question: 2

The given distrib

Solution:

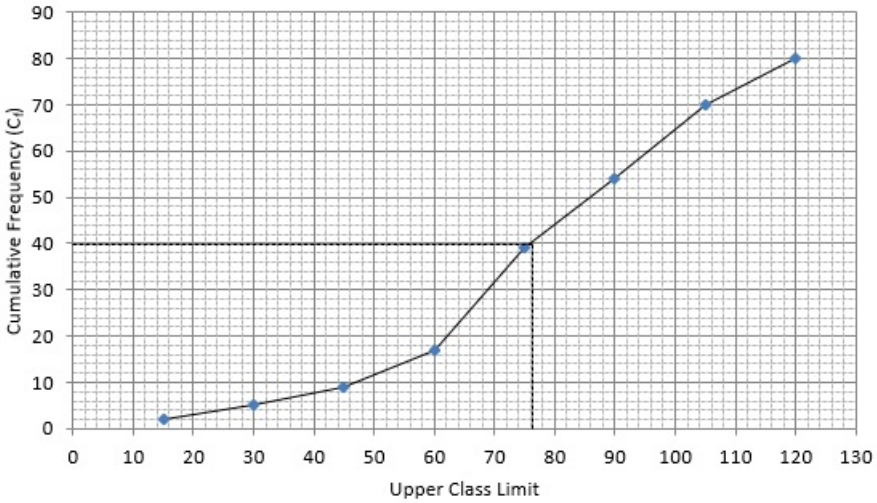
Lets plot a graph of ‘less than ogive’, taking upper limits of the class intervals on x - axis and cumulative frequencies on y - axis.



As we have N = 80 by the frequency table.

N/2 = 80/2 = 40

Mark 40 on y - axis and the corresponding point on x - axis would be the median.



The corresponding point on x - axis is 76.

Hence, median is 76.

Question: 3

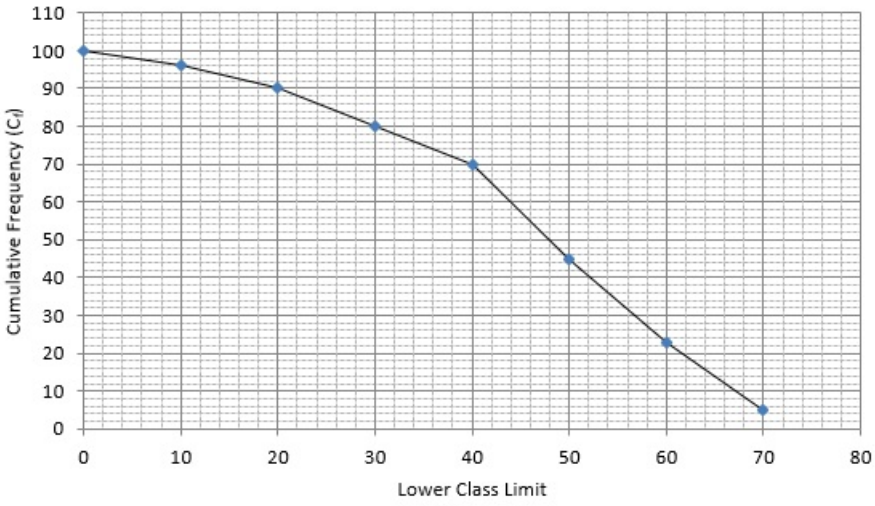
Draw a 'more than

Solution:

The frequency distribution table for ‘more than’ type is:

MARKS	CUMULATIVE FREQUENCY (C_f)
more than 0	96 + 4 = 100
more than 10	90 + 6 = 96
more than 20	80 + 10 = 90
more than 30	70 + 10 = 80
more than 40	45 + 25 = 70
more than 50	23 + 22 = 45
more than 60	5 + 18 = 23
more than 70	5

Lets plot a graph of ‘more than’ ogive, taking lower limits of the class intervals on x - axis and cumulative frequencies on y - axis.



Question: 4

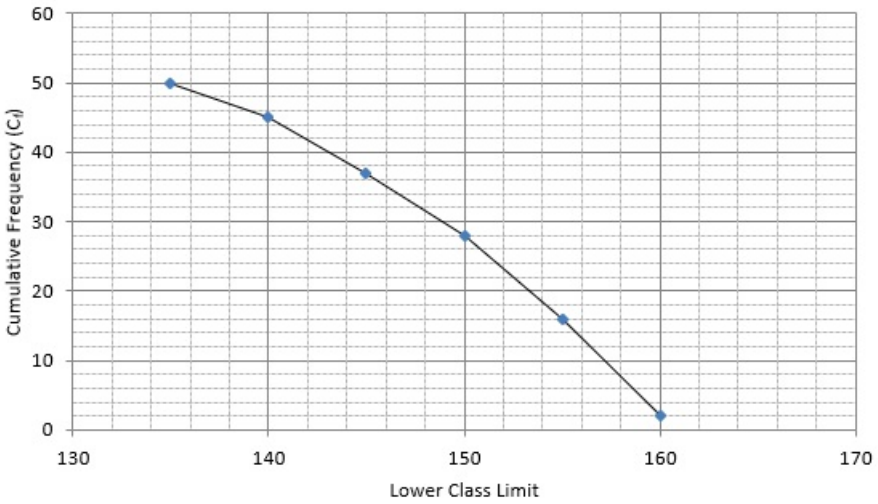
The heights of 50

Solution:

The frequency distribution table for ‘more than’ type is:

HEIGHT(cm)	CUMULATIVE FREQUENCY (C_f)
more than 135	45 + 5 = 50
more than 140	37 + 8 = 45
more than 145	28 + 9 = 37
more than 150	16 + 12 = 28
more than 155	2 + 14 = 16
more than 160	2

Lets plot a graph of ‘more than’ ogive, taking lower limits of the class intervals on x - axis and cumulative frequencies on y - axis.



Question: 5

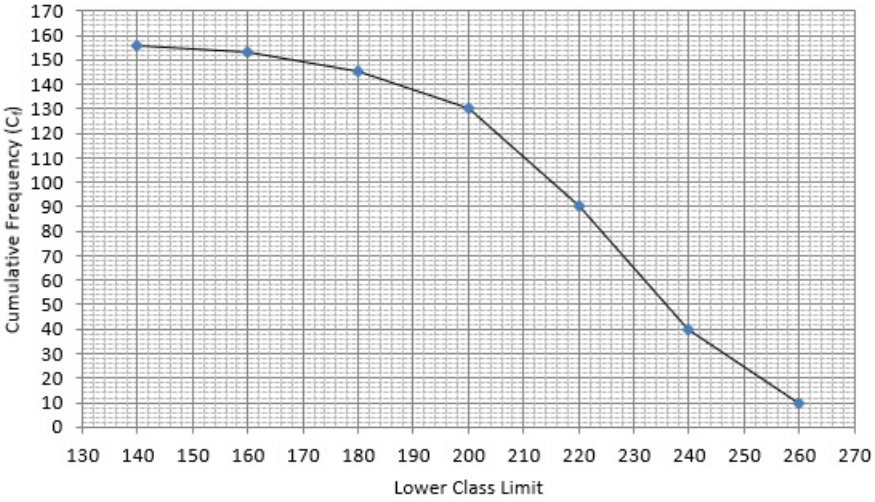
The monthly consu

Solution:

The frequency distribution table for ‘more than’ type is:

HEIGHT(cm)	CUMULATIVE FREQUENCY (C_f)
more than 140	153 + 3 = 156
more than 160	145 + 8 = 153
more than 180	130 + 15 = 145
more than 200	90 + 40 = 130
more than 220	40 + 50 = 90
more than 240	10 + 30 = 40
more than 260	10

Lets plot a graph of ‘more than’ ogive, taking lower limits of the class intervals on x - axis and cumulative frequencies on y - axis.



Question: 6

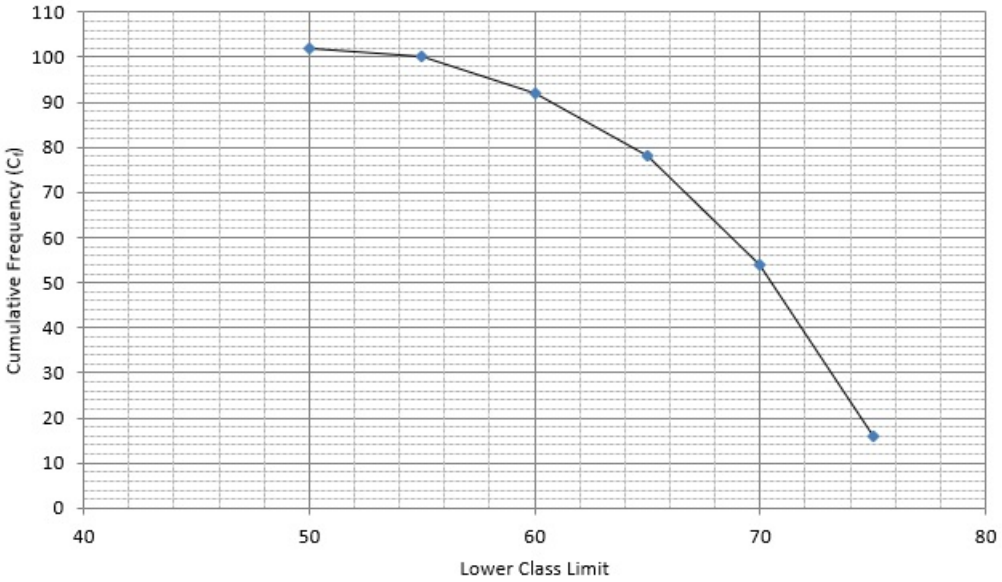
The following tab

Solution:

The frequency distribution table for ‘more than’ type is:

HEIGHT(cm)	CUMULATIVE FREQUENCY (C_f)
more than 50	100 + 2 = 102
more than 55	92 + 8 = 100
more than 60	78 + 14 = 92
more than 65	54 + 24 = 78
more than 70	16 + 38 = 54
more than 75	16

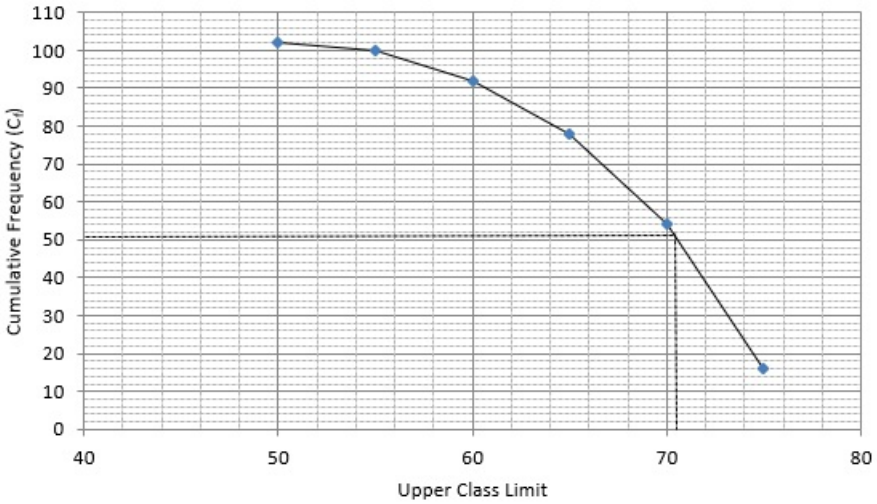
Lets plot a graph of ‘more than’ ogive, taking lower limits of the class intervals on x - axis and cumulative frequencies on y - axis.



As we have N = 102 by the frequency table.

N/2 = 102/2 = 51

Mark 51 on y - axis and the corresponding point on x - axis would be the median.



The corresponding point on x - axis is 70.5.

Hence, median is 70.5.

Question: 7

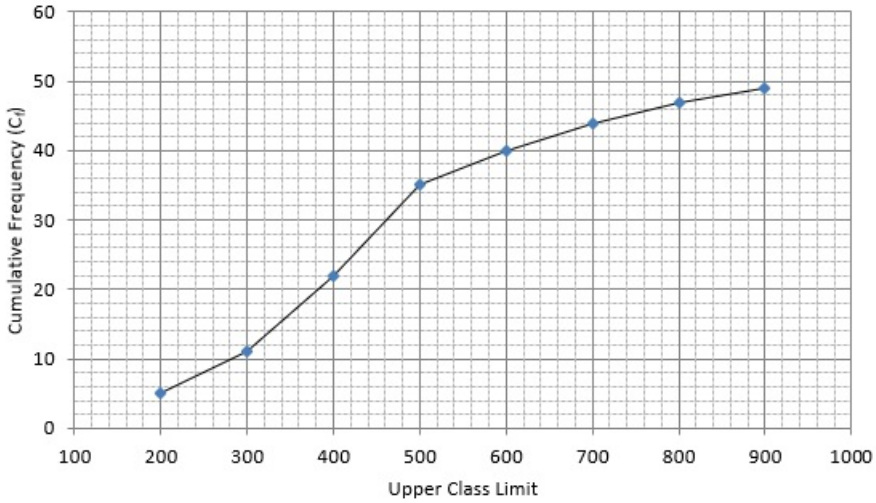
The table given b

Solution:

The frequency distribution table for ‘less than’ type is:

MARKS	CUMULATIVE FREQUENCY (C_f)
Less than 200	5
Less than 300	5 + 6 = 11
Less than 400	11 + 11 = 22
Less than 500	22 + 13 = 35
Less than 600	35 + 5 = 40
Less than 700	40 + 4 = 44
Less than 800	44 + 3 = 47
Less than 900	47 + 2 = 49

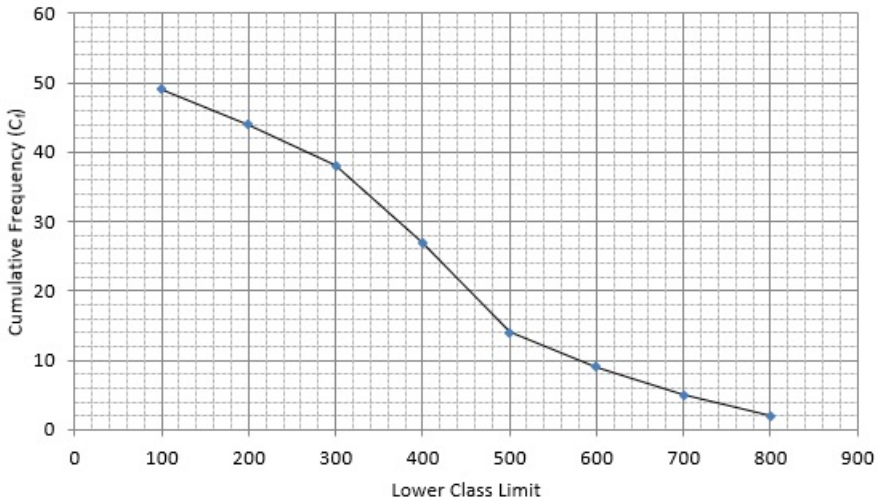
Lets plot the graph of ‘less than ogive’, taking upper limits of the class intervals on x - axis and cumulative frequencies on y - axis.



The frequency distribution table for ‘more than’ type is:

MARKS	CUMULATIVE FREQUENCY (C_f)
more than 100	44 + 5 = 49
more than 200	38 + 6 = 44
more than 300	27 + 11 = 38
more than 400	14 + 13 = 27
more than 500	9 + 5 = 14
more than 600	5 + 4 = 9
more than 700	2 + 3 = 5
more than 800	2

Lets plot a graph of ‘more than’ ogive, taking lower limits of the class intervals on x - axis and cumulative frequencies on y - axis.



Question: 8

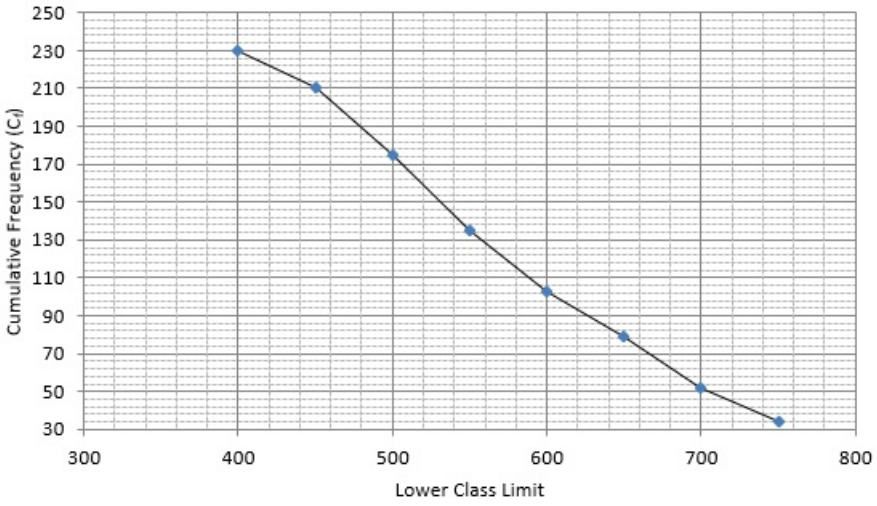
From the followin

Solution:

The frequency distribution table for ‘more than’ type is:

HEIGHT(cm)	CUMULATIVE FREQUENCY (C_f)
more than 400	210 + 20 = 230
more than 450	175 + 35 = 210
more than 500	135 + 40 = 175
more than 550	103 + 32 = 135
more than 600	79 + 24 = 103
more than 650	52 + 27 = 79
more than 700	34 + 18 = 52
More than 750	34

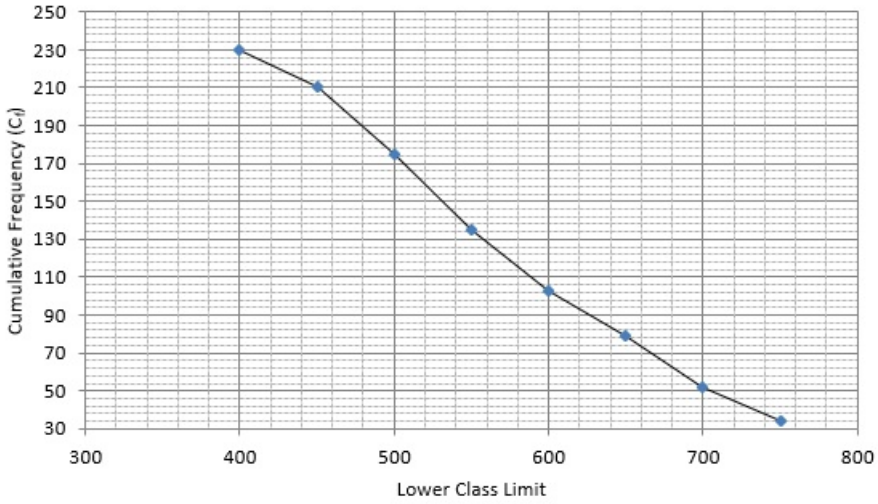
Lets plot a graph of ‘more than’ ogive, taking lower limits of the class intervals on x - axis and cumulative frequencies on y - axis.



As we have N = 230 by the frequency table.

N/2 = 230/2 = 115

Mark 115 on y - axis and the corresponding point on x - axis would be the median.



----------The corresponding point on x - axis is 590.

Hence, median is 590.

Question: 9

The marks obtaine

Solution:

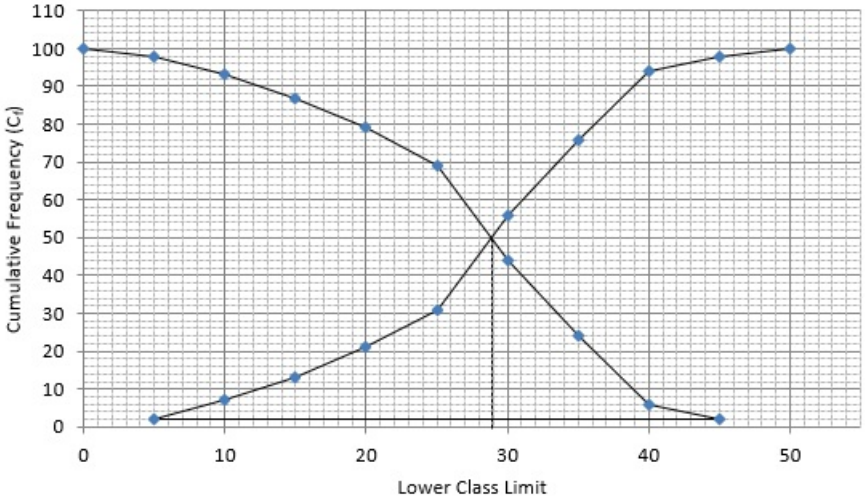
(i) The frequency distribution table for ‘less than’ type is:

MARKS	CUMULATIVE FREQUENCY (C_f)
Less than 5	2
Less than 10	2 + 5 = 7
Less than 15	7 + 6 = 13
Less than 20	13 + 8 = 21
Less than 25	21 + 10 = 31
Less than 30	31 + 25 = 56
Less than 35	56 + 20 = 76
Less than 40	76 + 18 = 94
Less than 45	94 + 4 = 98
Less than 50	98 + 2 = 100

(ii) The frequency distribution table for ‘more than’ type is:

MARKS	CUMULATIVE FREQUENCY (C_f)
More than 0	98 + 2 = 100
More than 5	93 + 5 = 98
More than 10	87 + 6 = 93
More than 15	79 + 8 = 87
More than 20	69 + 10 = 79
More than 25	44 + 25 = 69
More than 30	24 + 20 = 44
More than 35	6 + 18 = 24
More than 40	2 + 4 = 6
More than 45	2

Plotting points for ‘less - than ogive’ and ‘more - than ogive’ on the graph,



In this type of graph where ‘less than ogive’ and more than ogive’ are plotted in the same graph, median is found on x - axis by the intersection of these two ogives.

Here, median = 29.5

Question: 10

From the followin

Solution:

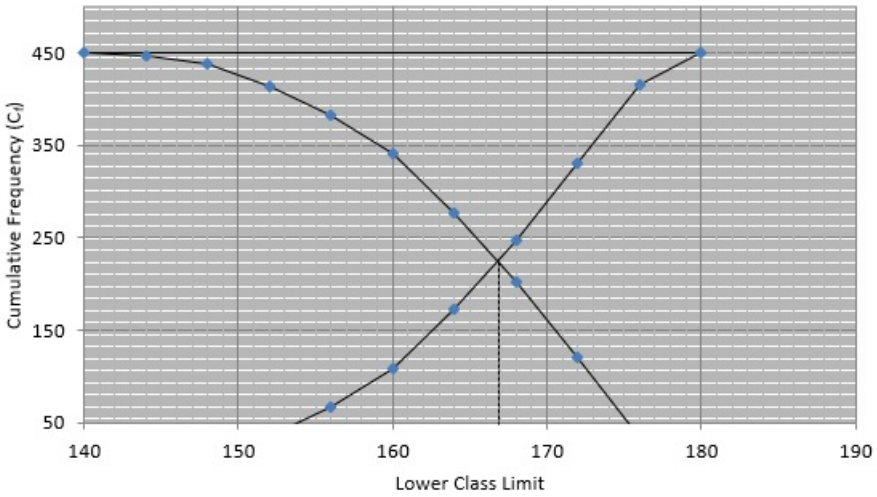
(i) The frequency distribution table for ‘less than’ type is:

MARKS	CUMULATIVE FREQUENCY (C_f)
Less than 144	3
Less than 148	3 + 9 = 12
Less than 152	12 + 24 = 36
Less than 156	36 + 31 = 67
Less than 160	67 + 42 = 109
Less than 164	109 + 64 = 173
Less than 168	173 + 75 = 248
Less than 172	248 + 82 = 330
Less than 176	330 + 86 = 416
Less than 180	416 + 34 = 450

(ii) The frequency distribution table for ‘more than’ type is:

MARKS	CUMULATIVE FREQUENCY (C_f)
More than 140	447 + 3 = 450
More than 144	438 + 9 = 447
More than 148	414 + 24 = 438
More than 152	383 + 31 = 414
More than 156	341 + 42 = 383
More than 160	277 + 64 = 341
More than 164	202 + 75 = 277
More than 168	120 + 82 = 202
More than 172	34 + 86 = 120
More than 176	34

Plotting points for ‘less - than ogive’ and ‘more - than ogive’ on the graph,



In this type of graph where ‘less than ogive’ and more than ogive’ are plotted in the same graph, median is found on x - axis by the intersection of these two ogives.

Here, median = 166

Exercise : 9F

Question: 1

Write the median

Solution:

To find median class,

Assume Σf_i = N = Sum of frequencies,

f_i = frequency

and C_f = cumulative frequency

Lets form a table.

AGE(years)	NUMBER OF PATIENTS(f_i)	C_f
0 - 10	4	4
10 - 20	4	4 + 4 = 8
20 - 30	8	8 + 8 = 16
30 - 40	10	16 + 10 = 26
40 - 50	12	26 + 12 = 38
50 - 60	8	38 + 8 = 46
60 - 70	4	46 + 4 = 50
TOTAL	50	

So, N = 50

⇒ N/2 = 50/2 = 25

The cumulative frequency just greater than (N/2 =) 25 is 26, so the corresponding median class is 30 - 40.

Hence, median class = 30 - 40

Question: 2

What is the lower

Solution:

Here, the maximum class frequency is 27.

The class corresponding to this frequency is the modal class. ⇒ modal class = 40 - 50

∴ lower limit of the modal class (l) = 40

Question: 3

The monthly pocke

Solution:

Here, the maximum class frequency is 30.

The class corresponding to this frequency is the modal class. ⇒ modal class = 150 - 200

∴ lower limit of the modal class (l) = 150

The class mark is found by,

$$\frac{150 + 200}{2} = \frac{350}{2} = 175$$

∴ Class mark is 175.

Question: 4

A data has 25 obs

Solution:

Since we have 25 observations, that is odd number of observations, median is found at $\left(\frac{n+1}{2}\right)^{th}$ position.

So since, n = 25

⇒ Median will be found at $\left(\frac{25+1}{2}\right)^{th}$ position. ⇒ Median = 13^{th} observation

Question: 5

For a certain dis

Solution:

Given: mode = 1000 and median = 1250

The empirical relationship between mean, median and mode is,

Mode = 3(Median) – 2(Mean)

⇒ 2(Mean) = 3(Median) – Mode

⇒ Mean = [3(Median) – Mode]/2

⇒ Mean = [3(1250) – 1000]/2

⇒ Mean = [3750 – 1000]/2 = 2750/2 = 1375

∴ mean = 1375

Question: 6

In a class test,

Solution:

Here, the maximum class frequency is 25.

The class corresponding to this frequency is the modal class. ⇒ modal class = 40 - 60

To find median class,

Assume Σf_i = N = Sum of frequencies,

f_i = frequency

and C_f = cumulative frequency

Lets form a table.

MARKS OBTAINED	NUMBER OF STUDENTS(f_i)	C_f
0 - 20	4	4
20 - 40	6	4 + 6 = 10
40 - 60	25	10 + 25 = 35
60 - 80	10	35 + 10 = 45
80 - 100	5	45 + 5 = 50
TOTAL	50	

So, N = 50

⇒ N/2 = 50/2 = 25

The cumulative frequency just greater than (N/2 =) 25 is 35, so the corresponding median class is 40 - 60.

∴ modal class = 40 - 60 and median class = 40 - 60

Question: 7

Find the class ma

Solution:

Class mark is given by $\frac{\text{Upper limit + Lower limit}}{2}$

Class mark of class 10 - 25 = $\frac{10+25}{2} = \frac{35}{2} = 17.5$

Class mark of class 35 - 55 = $\frac{35+55}{2} = \frac{90}{2} = 45$

∴ Class mark of class 10 - 25 is 17.5 and 35 - 55 is 45.

Question: 8

While calculating

Solution:

We have got

A = 25, $\Sigma f_i = 50$ & $\Sigma f_i d_i = 110$

∵ By Assumed - mean method, mean is given by

$$\bar{x} = A + \frac{\sum_i f_i d}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = 25 + \frac{110}{50}$$

$$\Rightarrow \bar{x} = 27.2$$

Thus, mean is 27.2

Question: 9

The distributions

Solution:

According to the question,

$$4 = \frac{X}{36} \text{ and } 3 = \frac{Y}{64}$$

⇒ X = 36 × 4 = 144 and Y = 64 × 3 = 192

We have, X = 144 and Y = 192

Mean of distribution (X + Y = 144 + 192 =) 336 is,

Mean = 336/(36 + 64) = 336/100 = 3.36

Hence, mean = 3.36

Question: 10

In a frequency di

Solution:

Given: number of classes = 12,

Class width = 2.5, and

Lowest class boundary = 8.1

Upper class is given by,

Upper class boundary = Lower class boundary + (width × number of classes)

Substituting values,

⇒ Upper class boundary = 8.1 + (2.5 × 12)

⇒ Upper class boundary = 8.1 + 30 = 38.1

Hence, upper class boundary is 38.1

Question: 11

The observations

Solution:

Since there are 10 observations, that is, even number of observations, median is found by taking average of $\left(\frac{n}{2}\right)^{th}$ and $\left(\frac{n}{2} + 1\right)^{th}$ observations.

So, median is found at average of $\left(\frac{10}{2}\right)^{th} = (5)^{th}$ and $\left(\frac{10}{2} + 1\right)^{th} = (6)^{th}$ observations.

$(5)^{th}$ observation = x and $(6)^{th}$ observation = x + 2

Taking average,

Median = (x + x + 2)/2

⇒ 63 = (2x + 2)/2 [∵ given is median = 63]

⇒ 126 = 2x + 2

⇒ 2x = 126 – 2

⇒ 2x = 124

⇒ x = 124/2 = 62

∴ x = 62

Question: 12

The median of 19

Solution:

As median is the “middle” number of the sorted list of numbers, and given is median of 19 observations observed to be 30.

⇒ 30 is the middle most value amongst 19 observations.

If two more observations (8 and 32) are added, where 8 is less than 30 and 32 is more than 30. 30 is still the middlemost value as the two values are added on either side of 30.

Hence, median of 21 observations are 30.

Question: 13

If the median of

Solution:

Arranging the values x/5, x/4, x/2, x and x/3 in ascending order, we get

x/5, x/4, x/3, x/2 and x

Here, median is x/3 as it is the middle value amongst all values.

Given: median = 8

⇒ x/3 = 8

⇒ x = 24

Hence, x = 24

Question: 14

What is the cumul

Solution:

Here, the maximum class frequency is 23.

The class corresponding to this frequency is the modal class. ⇒ modal class = 12 - 15

Lets form a table.

CLASS	FREQUENCY(f_i)	C_f
3 - 6	7	7
6 - 9	13	7 + 13 = 20
9 - 12	10	20 + 10 = 30
12 - 15	23	30 + 23 = 53
15 - 18	4	53 + 4 = 57
18 - 21	21	57 + 21 = 78
21 - 24	16	78 + 16 = 94
TOTAL	94	

Since, modal class = 12 - 15, the corresponding cumulative frequency is 53.

Question: 15

Find the mode of

Solution:

Here, the maximum class frequency is 18.

The class corresponding to this frequency is the modal class. ⇒ modal class = 40 - 60

∴ lower limit of the modal class (l) = 40

Modal class size (h) = 20

Frequency of the modal class (f_1) = 18

Frequency of class preceding the modal class (f_0) = 6

Frequency of class succeeding the modal (f_2) = 10

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$\Rightarrow \text{Mode} = 40 + \left(\frac{18-6}{2(18)-6-10}\right) \times 20$

$\Rightarrow \text{Mode} = 40 + \left(\frac{12}{20}\right) \times 20$

⇒ Mode = 40 + 12 = 52

Hence, the mode is 52.

Question: 16

The following are

Solution:

In a ‘less than type’ cumulative frequency distribution, upper limit of the classes are considered.

It is given by,

AGE(in years)	CUMULATIVE FREQUENCY(C_f)
Less than 20	60
Less than 30	102
Less than 40	157
Less than 50	227
Less than 60	280
Less than 70	300

Question: 17

In the following

Solution:

To find p and q, solve by finding cumulative frequency,

CLASS	FREQUENCY (f)	CUMULATIVE FREQUENCY (C_f)
100 - 200	11	11
200 - 300	12	p = 11 + 12 = 23
300 - 400	10	33
400 - 500	q	46 = 33 + q ⇒ q = 13
500 - 600	20	66
600 - 700	14	80

⇒ p = 11 + 12 = 23

And 46 = 33 + q ⇒ q = 46 – 33 = 13

∴ p = 23 and q = 13

Lets form the table again,

CLASS	FREQUENCY (f_i)	CUMULATIVE FREQUENCY (C_f)
100 - 200	11	11
200 - 300	12	23
300 - 400	10	33
400 - 500	13	46
500 - 600	20	66
600 - 700	14	80
TOTAL	80	

For modal class,

Here, the maximum class frequency is 20.

The class corresponding to this frequency is the modal class. ⇒ modal class = 500 - 600

To find median class,

Assume Σf_i = N = Sum of frequencies,

f_i = frequency

and C_f = cumulative frequency

So, N = 80

⇒ N/2 = 80/2 = 40

The cumulative frequency just greater than (N/2 =) 40 is 46, so the corresponding median class is 400 - 500.

∴ modal class = 500 - 600 and median class = 400 - 500

Question: 18

The following fre

Solution:

In a ‘less than type’ cumulative frequency distribution, lower limits of the classes are considered.

It is given by,

MONTHLY CONSUMPTION (in units)	CUMULATIVE FREQUENCY(C_f)
More than 65	60 + 4 = 64
More than 85	55 + 5 = 60
More than 105	42 + 13 = 55
More than 125	22 + 20 = 42
More than 145	8 + 14 = 22
More than 165	8

Question: 19

The following tab

Solution:

The frequency distribution table is:

LIFE TIME (in days)	NUMBER OF BULBS
0 - 50	7
50 - 100	21 - 7 = 14
100 - 150	52 - 21 = 31
150 - 200	79 - 52 = 27
200 - 250	91 - 79 = 12
250 - 300	100 - 91 = 9

Question: 20

The following tab

Solution:

(a) To convert the given frequency distribution into continuous form, adjust the end - limits of each class.

MARKS OBTAINED (in percent)	NUMBER OF STUDENTS (f_i)
10.5 - 20.5	141
20.5 - 30.5	221
30.5 - 40.5	439
40.5 - 50.5	529
50.5 - 60.5	495
60.5 - 70.5	322
70.5 - 80.5	153

(b) To find median class,

Assume $\Sigma f_i = N$ = Sum of frequencies,

f_i = frequency

and C_f = cumulative frequency

MARKS OBTAINED (in percent)	NUMBER OF STUDENTS (f_i)	C_f
10.5 - 20.5	141	141
20.5 - 30.5	221	141 + 221 = 362
30.5 - 40.5	439	362 + 439 = 801
40.5 - 50.5	529	801 + 529 = 1330
50.5 - 60.5	495	1330 + 495 = 1825
60.5 - 70.5	322	1825 + 322 = 2147
70.5 - 80.5	153	2147 + 153 = 2300
TOTAL	2300	

So, N = 2300

⇒ N/2 = 2300/2 = 1150

The cumulative frequency just greater than (N/2 =) 1150 is 1825, so the corresponding median class is 50.5 - 60.5.

∴ median class = 50.5 - 60.5

The class mark of 50.5 - 60.5 is $\frac{50.5+60.5}{2} = \frac{111}{2} = 55.5$

(c) For modal class,

Here, the maximum class frequency is 529.

The class corresponding to this frequency is the modal class. ⇒ modal class = 40.5 - 50.5

The cumulative frequency corresponding to the modal class is 1330

Question: 21

If the mean of th

Solution:

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_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
TOTAL		43 + p	1245 + 15p

We have got

$\Sigma f_i = 43 + p$ and $\Sigma f_i x_i = 1245 + 15p$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$\Rightarrow 27 = \frac{1245 + 15p}{43 + p}$ ($\because$ given: mean of pocket allowance is 27)

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

$\Rightarrow$ 27p – 15p = 1245 – 1161

$\Rightarrow$ 12p = 84

$\Rightarrow$ p = 84/12

$\Rightarrow$ p = 7

Thus, p = 7

Question: 22

Calculate the mis

Solution:

Given: Median = 24

Let the unknown frequency be x.

Assume

$\Sigma f_i = N$ = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table, where x is the unknown frequency.

AGE (in years)	NUMBER OF PERSONS(f_i)	C_f
0 - 10	5	5
10 - 20	25	5 + 25 = 30
20 - 30	x	30 + x
30 - 40	18	30 + x + 18 = 48 + x
40 - 50	7	48 + x + 7 = 55 + x
TOTAL	55 + x	

Median = 24 (as already mentioned in the question)

24 lies between 20 - 30 ⇒ Median class = 20 - 30

∴ l = 20, h = 10, f = x, N/2 = (55 + x)/2 and C_f = 30

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow 24 = 20 + \left(\frac{\frac{55+x}{2} - 30}{x}\right) \times 10$$

$$\Rightarrow 24 = 20 + \left(\frac{55 + x - 60}{2x}\right) \times 10$$

⇒ 24 – 20 = (5x – 25)/x

⇒ 4x = 5x – 25

⇒ 5x – 4x = 25

⇒ x = 25

Exercise : MULTIPLE CHOICE QUESTIONS (MCQ)

Question: 1

Which of the foll

Solution:

Mean, median and mode are a measure of central tendency but range of a set of data is the difference between the largest and smallest values.

Question: 2

Which of the foll

Solution:

Mean is just the average of some observations. It cannot be determined graphically as the values cannot be Summed up.

Question: 3

Which of the foll

Solution:

Mean is influenced by extreme values in class intervals, while median and mode is not influenced by extreme values as median is the mid value among observations and mode is the value that is come often in a set of data values and they are independent of extreme values.

Question: 4

The mode of a fre

Solution:

A histogram shows frequencies of value and mode of frequency distribution can be obtained from a histogram.

Question: 5

The median of a f

Solution:

An ogive is a type of frequency polygon that shows cumulative frequencies and median is the mid - value among given values. Graphically, median can be found by ogive as corresponding to one axis, we get the value on the other axis in an ogive.

Question: 6

The cumulative fr

Solution:

Cumulative frequency table is useful in determining the median in the case of class intervals.

Question: 7

The abscissa of t

Solution:

The abscissa of the point of intersection of the ‘less than type’ and ‘more than type’ cumulative frequency curves of the grouped data gives its median as it gives accurate mid - point among all values.

Question: 8

If x_i'

Solution:

If mean = 7, x_i’s = midpoints of the class intervals and f_i = corresponding frequencies

Mean is given by,

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

$$\Rightarrow \bar{x} \sum f_i = \sum f_i x_i$$

Or $$\sum f_i \bar{x} = \sum f_i x_i$$

Or $$\sum f_i \bar{x} - \sum f_i x_i = 0$$

Or $$\sum f_i (x_i - \bar{x}) = 0$$

Question: 9

For finding the m

Solution:

Since, $d_i = x_i - A$,

where d_i = deviation and A = Assumed mean

And $u_i = d_i/h = (x_i - A)/h$,

where h = class width

Question: 10

In the formula, <

Solution:

For finding the mean of the grouped data, d_i's are deviations from A(Assumed mean) of the midpoints of the classes. It is necessary to find midpoints of the class intervals to find mean of the grouped data.

Question: 11

While computing t

Solution:

Class marks are the aggregates value of the classes and is given by:

Class mark = (lower limit + upper limit)/2

And the frequencies are Assumed to be centered at the class marks of the classes.

Question: 12

The relation betw

Solution:

This relationship between mean, median and mode is also called empirical relationship and is given by,

mode = (3 × median) – (2 × mean)

Question: 13

If the 'less than

Solution:

If 'less than type' ogive and 'more than type' ogive intersect each other at (20.5,15.5), then median of the given data is 20.5 as median in this kind of graph is found on x - axis, which represents class intervals (upper limit/lower limit).

Question: 14

Consider the freq

Solution:

To find median class,

Assume Σf_i = N = Sum of frequencies,

f_i = frequency

and C_f = cumulative frequency

HEIGHT (in cm)	NUMBER OF STUDENTS	CUMULATIVE FREQUENCY (C_f)
150 - 155	16	16
155 - 160	12	28
160 - 165	9	37
165 - 170	7	44
170 - 175	10	54
175 - 180	6	60
TOTAL	60	

So, N = 60

⇒ N/2 = 60/2 = 30

The cumulative frequency just greater than (N/2 =) 30 is 37, so the corresponding median class is 160 - 165.

∴ upper limit of median class = 165

For modal class,

Here, the maximum class frequency is 16.

The class corresponding to this frequency is the modal class. ⇒ modal class = 150 - 155

∴ lower limit of the modal class = 150

Hence, Sum of lower limit of the modal class and upper limit of the median class = 165 + 150 = 315

Question: 15

Consider the foll

Solution:

For modal class,

Here, the maximum class frequency is 30.

The class corresponding to this frequency is the modal class. ⇒ modal class = 30 - 40

∴ modal class = 30 - 40

Question: 16

Mode = ?

Solution:

Mode is given by,

$$\text{Mode} = x_k + h\left(\frac{f_k - f_{k-1}}{2f_k - f_{k-1} - f_{k+1}}\right)$$

where,

x_k = lower limit of the modal class,

h = class width,

f_k = frequency of the modal class,

f_{k-1} = frequency of class preceding the modal class

and f_{k+1} = frequency of class succeeding the modal class

Question: 17

Median = ?

Solution:

Medium is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

Where

N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Question: 18

If the mean and m

Solution:

Given: mean = 8.9 and median = 9

By empirical formula,

mode = (3 × median) – (2 × mean)

⇒ mode = (3 × 9) – (2 × 8.9)

⇒ mode = 27 – 17.8 = 9.2

Question: 19

Look at the frequ

Solution:

To find median,

Assume Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

CLASS INTERVAL	FREQUENCY(f_i)	C_f
35 - 45	8	8
45 - 55	12	8 + 12 = 20
55 - 65	20	20 + 20 = 40
65 - 75	10	40 + 10 = 50
TOTAL	50	

So, N = 50

⇒ N/2 = 50/2 = 25

The cumulative frequency just greater than (N/2 =) 25 is 40, so the corresponding median class is 55 - 65 and accordingly we get C_f = 20(cumulative frequency before the median class).

Now, since median class is 55 - 65.

∴ l = 55, h = 10, f = 20, N/2 = 25 and C_f = 20

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 55 + \left(\frac{25-20}{20}\right) \times 10$$

= 55 + 2.5

= 57.5

Thus, median age is 57.5.

Question: 20

Consider the foll

Solution:

Here, the maximum class frequency is 25.

The class corresponding to this frequency is the modal class. ⇒ modal class = 22 - 26

∴ lower limit of the modal class (l) = 22

Modal class size (h) = 4

Frequency of the modal class (f_1) = 25

Frequency of class preceding the modal class (f_0) = 16

Frequency of class succeeding the modal (f_2) = 19

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \text{Mode} = 22 + \left(\frac{25-16}{2(25)-16-19}\right) \times 4$$

$$\Rightarrow \text{Mode} = 22 + \left(\frac{9}{15}\right) \times 4$$

⇒ Mode = 22 + 2.4 = 24.4

Hence, the mode is 24.4.

Question: 21

The mean and mode

Solution:

Given: mean = 28 and mode = 16

By empirical formula,

mode = (3 × median) – (2 × mean)

⇒ 3 × median = mode + (2 × mean)

⇒ 3 × median = 16 + (2 × 28)

⇒ 3 × median = 16 + 56

⇒ 3 × median = 72

⇒ median = 72/3 = 24

Question: 22

The median and mo

Solution:

Given: median = 26 and mode = 29

By empirical formula,

mode = (3 × median) – (2 × mean)

⇒ 2 × mean = (3 × median) – mode

⇒ 2 × mean = (3 × 26) – 29

⇒ 2 × mean = 78 – 29

⇒ 2 × mean = 49

⇒ mean = 49/2 = 24.5

Question: 23

For a symmetrical

Solution:

As in a symmetrical frequency distribution, the left and right hand side of the distribution is roughly equally balanced around the mean of the distribution.

Question: 24

Look at the cumul

Solution:

MONTHLY INCOME	NUMBER OF FAMILIES	FREQUENCY (f_i)
10000 - 14000	100	100 - 85 = 15
14000 - 18000	85	85 - 69 = 16
18000 - 20000	69	69 - 50 = 19
20000 - 25000	50	50 - 37 = 13
25000 - 30000	37	37 - 15 = 22
30000 and above	15	15

From the above table, number of families having income range 20000 - 25000 is 13. (Observe the frequency values corresponding to the monthly income)

Question: 25

The median of fir

Solution:

Listing out all first 8 prime numbers, we have

2, 3, 5, 7, 11, 13, 17, 19

Since, the median will be at the aggregate of the (8/2 =) 4^{th} position and (8/2 + 1 =) 5^{th} position.

We have, (7 + 11)/2 = 18/2 = 9

Thus, median is 9.

Question: 26

The mean of 20 nu

Solution:

It’s given that mean of 20 numbers is 0, which implies that average of 20 numbers is 0.

This means that Sum of 20 numbers is 0.

If Sum of 19 numbers out of 20 is x(say), then the 20^{th} number will be absolutely 0 for the average to be 0.

⇒ At the most, 19 numbers will be positive.

Question: 27

If the median of

Solution:

Since there are 6 number of observation in all, which is an even number of observation.

Median will be found at the aggregate of (6/2 =) 3^{rd} and (6/2 + 1 =) 4^{th} position.

3^{rd} value = x – 1 and 4^{th} value = x – 3

Taking their aggregate, we get

Median = (x – 1 + x – 3)/2

⇒ 13 = (2x – 4)/2 [∵ median = 13]

⇒ 26 = 2x – 4

⇒ 2x = 26 + 4

⇒ 2x = 30

⇒ x = 15

Thus, median is 15.

Question: 28

The mean of 2, 7,

Solution:

Given: mean of 2, 7, 6 and x is 15

Mean = $\frac{\text{sum of observations}}{\text{number of observation}}$

⇒ 15 = $\frac{2+7+6+x}{4}$

⇒ 60 = 15 + x

⇒ x = 60 – 15 = 45 ...(i)

Also, given that mean of 18, 1, 6, x and y is 10

10 = $\frac{18+1+6+x+y}{5}$ [∵ mean = 10]

⇒ 50 = 25 + 45 + y = 70 + y [from equation (i)]

⇒ y = 50 – 70 = - 20

Thus, y = - 20

Question: 29

Match the followi

Solution:

The correct answer is:

Column I	Column II	Explanation
(a) The most frequent value in a data is known as …….	(s) mode	The most frequent value in the data is known as mode, as mode is the value that occurs most often (as per its definition).
(b) Which of the following cannot be determined graphically out of mean, mode and median?	(r) mean	Mean cannot be determined graphically, as mean is the average value from the set of given observations. Also, it doesn’t find the average of qualitative data, so it cannot be found by graph.
(c) An ogive is used to determine …….	(q) median	An ogive is used to determine median, as median is just the middle most value in the given set of observation which can be obtained by ‘less than type’ or ‘more than type’ ogives.
(d) Out of mean, mode, median and standard deviation, which is not a measure of central tendency?	(p) standard deviation	Standard deviation is not a measure of central tendency, as standard deviation is the deviation from the mean value for a group of observation. It doesn’t represent central tendency.

Question: 30

Each question con

Solution:

According to Reason(R),

Relationship between mean, median and mode is,

Mode = 3(Median) – 2(Mean)

If we substitute the values given in the above relationship,

Median = 150 and Mean = 148 (given)

Mode = 3(150) – 2(148)

⇒ Mode = 450 – 296 = 154

We get mode = 154, which satisfies the assertion.

Thus, Assertion(A) and Reason(R) are true and Reason(R) is the correct explanation of the Assertion(A).

Question: 31

Each question con

Solution:

Here, the maximum class frequency is 23.

The class corresponding to this frequency is the modal class. ⇒ modal class = 12 - 15

∴ lower limit of the modal class (l) = 12

Modal class size (h) = 3

Frequency of the modal class (f_1) = 23

Frequency of class preceding the modal class (f_0) = 21

Frequency of class succeeding the modal (f_2) = 10

Mode is given by,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \text{Mode} = 12 + \left(\frac{23-21}{2(23)-21-10}\right) \times 3$$

$$\Rightarrow \text{Mode} = 12 + \left(\frac{2}{15}\right) \times 3$$

⇒ Mode = 12 + 0.4 = 12.4

∴ Assertion (A) is true and Reason (R) is true obviously.

But Reason (R) is not the correct explanation of Assertion (A).

Thus, Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

Exercise : FORMATIVE ASSESSMENT (UNIT TEST)

Question: 1

Which one of the

Solution:

Mean and mode does not require construction of cumulative frequency, but median necessarily requires construction of cumulative frequency, unless it is raw data (in which median is the $(n/2)^{th}$ value, when there are n number of observations; and the average of $(n/2)^{th}$ and $(n/2 + 1)^{th}$ values, when there are n observations).

Question: 2

If the mean of a

Solution:

Given: mean = 27 and median = 33

We have to find the value of mode.

Empirical relationship is given by,

Mode = 3(Median) – 2(Mean)

⇒ Mode = 3(33) – 2(27)

⇒ Mode = 99 – 54 = 45

Question: 3

Consider the foll

Solution:

We need to find – (1) Median class

(2) Modal class

First we'll find (1) Median class.

To find median class,

Assume Σf_i = N = Sum of frequencies,

f_i = frequency of class intervals

and C_f = cumulative frequency

Lets form a table.

CLASS INTERVAL	FREQUENCY(f_i)	C_f
0 - 5	10	10
5 - 10	15	10 + 15 = 25
10 - 15	12	25 + 12 = 37
15 - 20	20	37 + 20 = 57
20 - 25	9	57 + 9 = 66
TOTAL	66	

So, N = 66

⇒ N/2 = 66/2 = 33

The cumulative frequency just greater than (N/2 =) 33 is 37, so the corresponding median class is 10 - 15.

∴ median class is 10 - 15.

To find (2) Modal class,

Here, the maximum class frequency is 20.

The class corresponding to this frequency is the modal class. ⇒ modal class = 15 - 20

Lower limit of median = 10 and lower limit of mode = 15

Sum = 10 + 15 = 25

Question: 4

Consider the foll

Solution:

To find median class,

Assume Σf_i = N = Sum of frequencies,

f_i = frequency of class intervals

and C_f = cumulative frequency

Lets convert this data into exclusive type of data.

CLASS INTERVAL	FREQUENCY(f_i)	C_f
- 0.5 - 5.5	13	13
5.5 - 11.5	10	13 + 10 = 23
11.5 - 17.5	15	23 + 15 = 38
17.5 - 23.5	8	38 + 8 = 46
23.5 - 29.5	11	46 + 11 = 57
TOTAL	57	

So, N = 57

⇒ N/2 = 57/2 = 28.5

The cumulative frequency just greater than (N/2 =) 28.5 is 38, so the corresponding median class is 11.5 - 17.5.

∴ Upper limit of this median class = 17.5

Question: 5

If the mean and m

Solution:

Given: mean = 53.4 and mode = 55.2

We have to find the median.

By empirical formula,

Mode = 3(Median) – 2(Mean)

⇒ 3(Median) = Mode + 2(Mean)

⇒ Median = [Mode + 2(Mean)]/3

⇒ Median = [55.2 + 2(53.4)]/3

⇒ Median = [55.2 + 106.8]/3

⇒ Median = 162/3 = 54

∴ Median = 54

Question: 6

In the table give

Solution:

We need to form a ‘less than type’ table to solve this.

CLASS	FREQUENCY	CUMULATIVE FREQUENCY (C_f)
Less than 14	2	2
Less than 14.2	4	2 + 4 = 6
Less than 14.4	15	6 + 15 = 21
Less than 14.6	54	21 + 54 = 75
Less than 14.8	25	75 + 25 = 100
Less than 15	20	100 + 20 = 120

Here, cumulative frequency shows number of athletes taking different time intervals to run a 100 - m - hurdle race.

So by the table, there are 75 athletes who completed the race in less than 14.6 seconds.

Question: 7

Consider the foll

Solution:

To find median class,

Assume Σf_i = N = Sum of frequencies,

f_i = frequency of class intervals

and C_f = cumulative frequency

Lets convert this data into exclusive type of data.

CLASS INTERVAL	FREQUENCY(f_i)	C_f
- 0.5 - 5.5	13	13
5.5 - 11.5	10	13 + 10 = 23
11.5 - 17.5	15	23 + 15 = 38
17.5 - 23.5	8	38 + 8 = 46
23.5 - 29.5	11	46 + 11 = 57
TOTAL	57	

So, N = 57

⇒ N/2 = 57/2 = 28.5

The cumulative frequency just greater than (N/2 =) 28.5 is 38, so the corresponding median class is 11.5 - 17.5.

∴ Upper limit of this median class = 17.5

Question: 8

The annual profit

Solution:

To find frequency corresponding to 20 - 25 class, we need to convert ‘more than or equal to’ type

data into class intervals.

PROFIT (in lakhs)	FREQUENCY
5 - 10	30 - 28 = 2
10 - 15	28 - 16 = 12
15 - 20	16 - 14 = 2
20 - 25	14 - 10 = 4
25 - 30	10 - 7 = 3
30 - 35	7 - 3 = 4
35 - 40	3

Observe in the table above, frequency corresponding to the class 20 - 25 is 4.

Question: 9

Find the mean of

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
1 - 3	2	9	18
3 - 5	4	22	88
5 - 7	6	27	162
7 - 9	8	18	144
TOTAL		76	412

We have got

$\Sigma f_i = 76$ & $\Sigma f_i x_i = 412$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{412}{76}$$

$$\Rightarrow \bar{x} = 5.421$$

Thus, mean is 5.421

Question: 10

The maximum bowli

Solution:

To find median, Assume

$\Sigma f_i = N$ = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

SPEED(in km/hr)	NUMBER OF PLAYERS(f_i)	C_f
85 - 100	10	10
100 - 115	4	10 + 4 = 14
115 - 130	7	14 + 7 = 21
130 - 145	9	21 + 9 = 30
TOTAL	30	

So, N = 30

⇒ N/2 = 30/2 = 15

The cumulative frequency just greater than (N/2 =) 15 is 21, so the corresponding median class is 115 - 130 and accordingly we get C_f = 14(cumulative frequency before the median class).

Now, since median class is 115 - 130.

∴ l = 115, h = 15, f = 7, N/2 = 15 and C_f = 14

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 115 + \left(\frac{15-14}{7}\right) \times 15$$

= 115 + 2.14

= 117.14

Thus, median is 117.14 km/hr.

Question: 11

The arithmetic me

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
0 - 10	5	16	80
10 - 20	15	p	15p
20 - 30	25	30	750
30 - 40	35	32	1120
40 - 50	45	14	630
TOTAL		92 + p	2580 + 15p

We have got

$\Sigma f_i = 92 + p$ and $\Sigma f_i x_i = 2580 + 15p$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$\Rightarrow 50 = \frac{2580 + 15p}{92 + p}$ ($\because$ given: arithmetic mean is 50)

$\Rightarrow$ 4600 + 50p = 2580 + 15p

$\Rightarrow$ 50p – 15p = 2580 – 4600

$\Rightarrow$ 35p = 2020

$\Rightarrow$ p = 11

Thus, p is 11.

Question: 12

Find the median o

Solution:

To find median, Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

MARKS	NUMBER OF STUDENTS(f_i)	C_f
0 - 10	6	6
10 - 20	16	6 + 16 = 22
20 - 30	30	22 + 30 = 52
30 - 40	9	52 + 9 = 61
40 - 50	4	61 + 4 = 65
TOTAL	65	

So, N = 65

⇒ N/2 = 65/2 = 32.5

The cumulative frequency just greater than (N/2 =) 32.5 is 52, so the corresponding median class is 20 - 30 and accordingly we get C_f = 22(cumulative frequency before the median class).

Now, since median class is 20 - 30.

∴ l = 20, h = 10, f = 30, N/2 = 32.5 and C_f = 22

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 20 + \left(\frac{32.5-22}{30}\right) \times 10$$

= 20 + 3.5

= 23.5

Thus, median is 23.5.

Question: 13

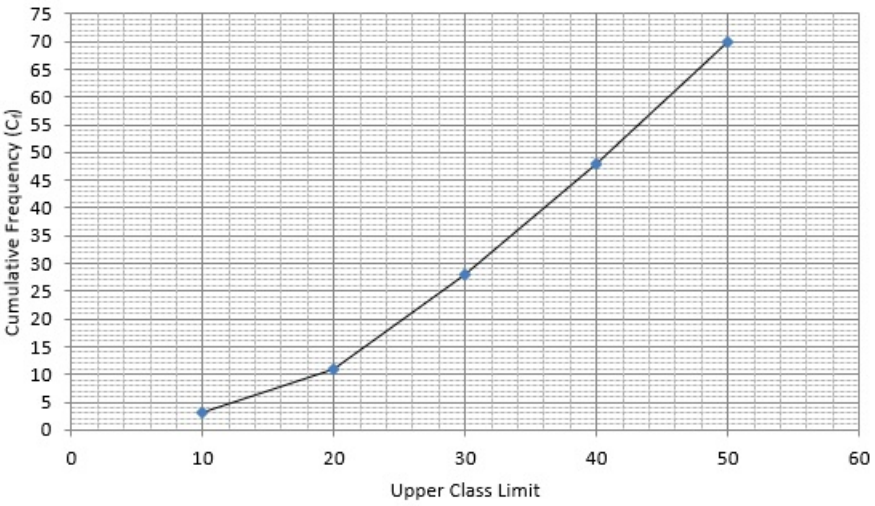
Following is the

Solution:

The frequency distribution table for ‘less than’ type is:

MARKS	CUMULATIVE FREQUENCY (C_f)
Less than 10	3
Less than 20	11
Less than 30	28
Less than 40	48
Less than 50	70

Lets plot a graph of ‘less than ogive’, taking upper limits of the class intervals on x - axis and cumulative frequencies on y - axis.



Question: 14

Find the median o

Solution:

To find median, Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table and convert it into exclusive - type by adjusting from both ends of a class.

MARKS	NUMBER OF STUDENTS(f_i)	C_f
0 - 10	8	8
10 - 20	16	8 + 16 = 24
20 - 30	36	24 + 36 = 60
30 - 40	34	60 + 34 = 94
40 - 50	6	94 + 6 = 100
TOTAL	100	

So, N = 100

⇒ N/2 = 100/2 = 50

The cumulative frequency just greater than (N/2 =) 50 is 60, so the corresponding median class is 20 - 30 and accordingly we get C_f = 24(cumulative frequency before the median class).

Now, since median class is 20 - 30.

∴ l = 20, h = 10, f = 36, N/2 = 50 and C_f = 24

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 20 + \left(\frac{50-24}{36}\right) \times 10$$

= 20 + 7.22

= 27.22

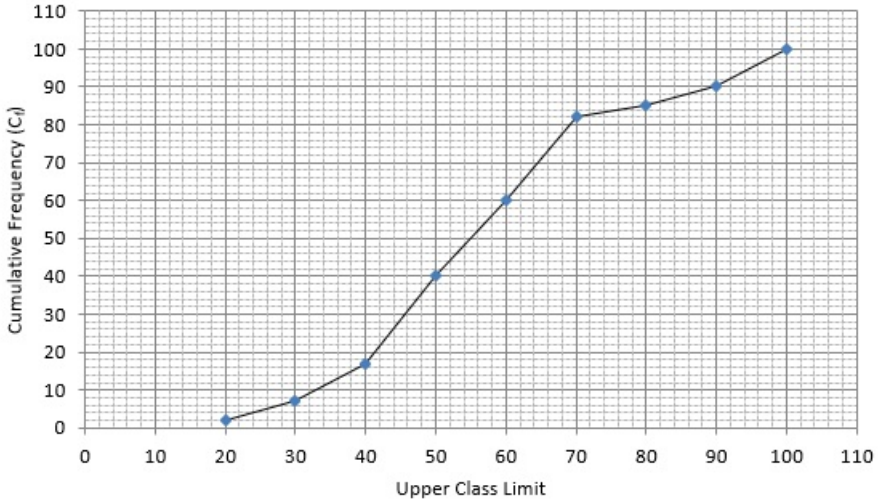
Thus, median is 27.22.

Question: 15

For the following

Solution:

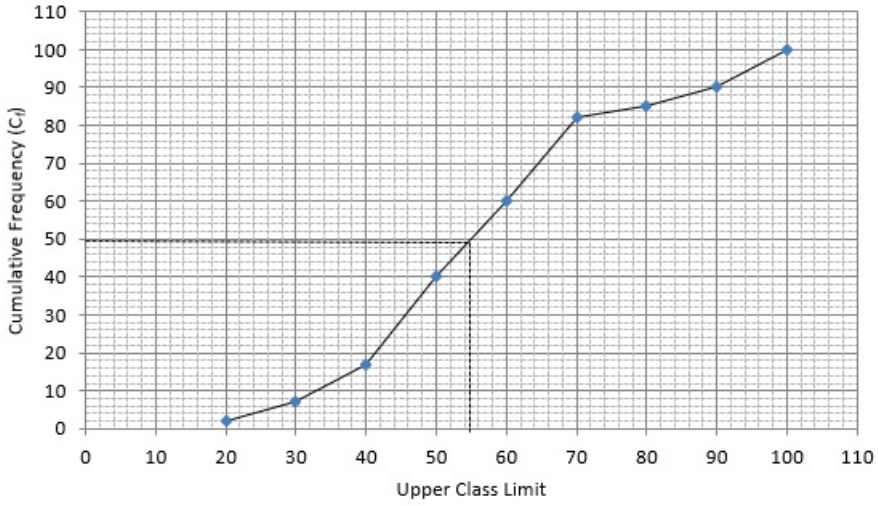
Lets plot a graph of ‘less than ogive’, taking upper limits of the class intervals on x - axis and cumulative frequencies on y - axis.



As we have N = 100 by the frequency table.

N/2 = 100/2 = 50

Mark 50 on y - axis and the corresponding point on x - axis would be the median.



The corresponding point on x - axis is 55.

Hence, median is 55.

Question: 16

The median value

Solution:

Given: Median = 35 & N = 170

Assume

Σf_i = N = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table, where x and y are the unknown frequencies.

CLASS	FREQUENCY(f_i)	C_f
0 - 10	10	10
10 - 20	20	10 + 20 = 30
20 - 30	x	30 + x
30 - 40	40	30 + x + 40 = 70 + x
40 - 50	y	70 + x + y
50 - 60	25	70 + x + y + 25 = 95 + x + y
60 - 70	15	95 + x + y + 15 = 110 + x + y
TOTAL	110 + x + y	

Median = 35 (as already mentioned in the question)

35 lies between 30 - 40 ⇒ Median class = 30 - 40

∴ l = 30, h = 10, f = 40, N/2 = (110 + x + y)/2 = 170/2 = 85 and C_f = 30 + x

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow 35 = 30 + \left(\frac{85-(30+x)}{40}\right) \times 10$$

$$\Rightarrow 35 = 30 + \left(\frac{85-30-x}{40}\right) \times 10$$

⇒ 35 – 30 = (55 – x)/4

⇒ 5 × 4 = 55 – x

⇒ 20 = 55 – x

⇒ x = 55 – 20 = 35 …(i)

And given that N = 170

⇒ 110 + x + y = 170

⇒ x + y = 170 – 110

⇒ x + y = 60 …(ii)

Substituting x = 35 in eq.(ii),

35 + y = 60

⇒ y = 60 – 35 = 25

Thus, the unknown frequencies are x = 35 and y = 25.

Question: 17

Find the missing

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	TOTAL FREQUENCY(f_i)	f_ix_i
0 - 20	10	17	170
20 - 40	30	f_1	$30f_1$
40 - 60	50	32	1600
60 - 80	70	f_2	$70f_2$
80 - 100	90	19	1710
TOTAL		$68 + f_1 + f_2$	$3480 + 30f_1 + 70f_2$

We have got

Mean = 50 and N = 120 (as given in the question)

$\Sigma f_i = 68 + f_1 + f_2$ and $\Sigma f_ix_i = 3480 + 30f_1 + 70f_2$

∵ mean is given by

$$\bar{x} = \frac{\sum_i f_ix_i}{\sum_i f_i}$$

$\Rightarrow 50 = \frac{3480 + 30f_1 + 70f_2}{68 + f_1 + f_2}$ (∵ given: mean is 50)

$\Rightarrow 3400 + 50f_1 + 50f_2 = 3480 + 30f_1 + 70f_2$

$\Rightarrow 50f_1 - 30f_1 + 50f_2 - 70f_2 = 3480 - 3400$

$\Rightarrow 20f_1 - 20f_2 = 80$

$\Rightarrow f_1 - f_2 = 4$ ...(i)

As given in the question, frequency(Σf_i) = 120

And as calculated by us, frequency (Σf_i) = $68 + f_1 + f_2$

Equalizing them, we get

$68 + f_1 + f_2 = 120$

$\Rightarrow f_1 + f_2 = 120 - 68 = 52$

$\Rightarrow f_1 + f_2 = 52$ ...(ii)

We will now solve equations (i) and (ii), adding them we get

$(f_1 + f_2) + (f_1 - f_2) = 52 + 4$

$\Rightarrow 2f_1 = 56$

$\Rightarrow f_1 = 56/2$

$\Rightarrow f_1 = 28$

Substitute $f_1 = 28$ in equation (ii),

$28 + f_2 = 52$

$\Rightarrow f_2 = 52 - 28$

$\Rightarrow f_2 = 24$

Thus, $f_1 = 28$ and $f_2 = 24$.

Question: 18

Find the mean of

Solution:

We will find the mean using step - deviation method, where A = Assumed mean and h = length of class interval.

Here, let A = 99 and h = 6

Since, the class intervals are inclusive type, we'll first convert it into exclusive type by extending the class interval from both the ends.

CLASS	MID - POINT(x_i)	DEVIATION(d_i) $d_i = x_i - 99$	FREQUENCY(f_i)	$u_i = d_i/h$	f_iu_i
84 - 90	87	- 12	15	- 2	- 30
90 - 96	93	- 6	22	- 1	- 22
96 - 102	99 = A	0	20	0	0
102 - 108	105	6	18	1	18
108 - 114	111	12	20	2	40
114 - 120	117	18	25	3	75
TOTAL			120		81

We have got

A = 99, h = 6, $\Sigma f_i = 120$ & $\Sigma f_i u_i = 81$

$\because$ mean is given by

$$\bar{x} = A + \frac{\sum_i f_i u_i}{\sum_i f_i} \times h$$

$$\Rightarrow \bar{x} = 99 + \frac{81}{120} \times 6$$

$$\Rightarrow \bar{x} = 99 + 4.05 = 103.05$$

Thus, mean is 103.05.

Question: 19

Find the mean, me

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

CLASS	MID - POINT(x_i)	FREQUENCY(f_i)	f_ix_i
0 - 10	5	6	30
10 - 20	15	8	120
20 - 30	25	10	250
30 - 40	35	15	525
40 - 50	45	5	225
50 - 60	55	4	220
60 - 70	65	2	130
TOTAL		50	1500

We have got

$\Sigma f_i = 50$ and $\Sigma f_i x_i = 1500$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{1500}{50}$$

$$\Rightarrow \bar{x} = 30$$

Thus, mean is 30.

To find median, Assume

$\Sigma f_i = N$ = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

CLASS	FREQUENCY(f_i)	C_f
0 - 10	6	6
10 - 20	8	6 + 8 = 14
20 - 30	10	14 + 10 = 24
30 - 40	15	24 + 15 = 39
40 - 50	5	39 + 5 = 44
50 - 60	4	44 + 4 = 48
60 - 70	2	48 + 2 = 50
TOTAL	50	

We have got

So, N = 50

⇒ N/2 = 50/2 = 25

The cumulative frequency just greater than (N/2 =) 25 is 39, so the corresponding median class is 30 - 40 and accordingly we get C_f = 24(cumulative frequency before the median class).

Now, since median class is 30 - 40.

∴ l = 30, h = 10, f = 15, N/2 = 25 and C_f = 24

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 30 + \left(\frac{25-24}{15}\right) \times 10$$

= 30 + 0.67

= 30.67

Thus, median is 30.67.

Since, we have got mean = 30 and median = 30.67

Applying the empirical formula,

Mode = 3(Median) – 2(Mean)

⇒ Mode = 3(30.67) – 2(30)

⇒ Mode = 92.01 – 60 = 32.01

∴ Mean = 30, Median = 30.67 and Mode = 32.01

Question: 20

Draw 'less than o

Solution:

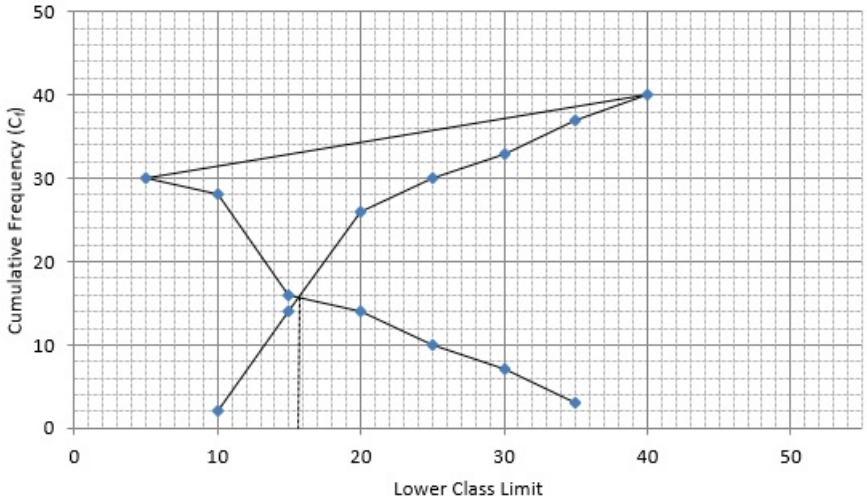
The frequency distribution table for ‘less than’ type is:

CLASS	CUMULATIVE FREQUENCY (C_f)
Less than 10	2
Less than 15	2 + 12 = 14
Less than 20	14 + 2 = 26
Less than 25	26 + 4 = 30
Less than 30	30 + 3 = 33
Less than 35	33 + 4 = 37
Less than 40	37 + 3 = 40

The frequency distribution table for ‘more than’ type is:

CLASS	CUMULATIVE FREQUENCY (C_f)
More than 5	28 + 2 = 30
More than 10	16 + 12 = 28
More than 15	14 + 2 = 16
More than 20	10 + 4 = 14
More than 25	7 + 3 = 10
More than 30	3 + 4 = 7
More than 35	3

Plotting points for ‘less - than ogive’ and ‘more - than ogive’ on the graph,



In this type of graph where ‘less than ogive’ and more than ogive’ are plotted in the same graph, median is found on x - axis by the intersection of these two ogives.

Here, median = 15.5

Question: 21

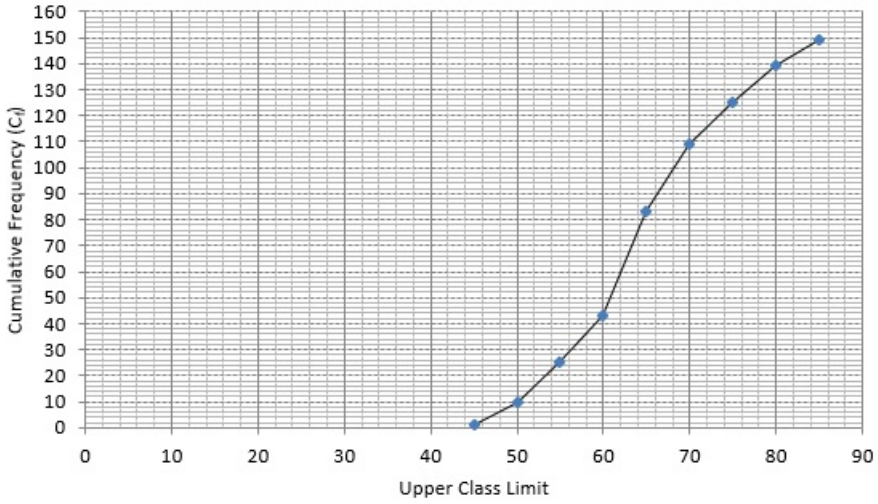
The production yi

Solution:

The frequency distribution table for ‘less than’ type is:

PRODUCTION YIELD (in kg/ha)	CUMULATIVE FREQUENCY (C_f)
Less than 45	1
Less than 50	1 + 9 = 10
Less than 55	10 + 15 = 25
Less than 60	25 + 18 = 43
Less than 65	43 + 40 = 83
Less than 70	83 + 26 = 109
Less than 75	109 + 16 = 125
Less than 80	125 + 14 = 139
Less than 85	139 + 10 = 149

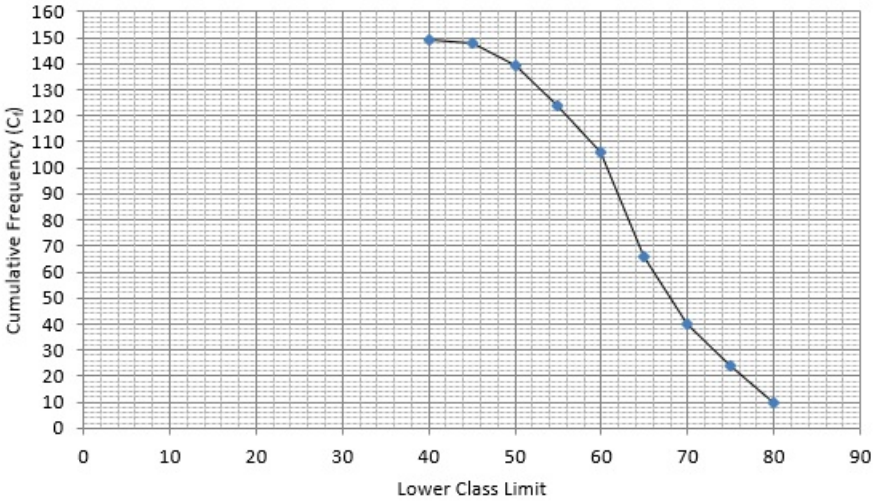
Lets plot the graph of ‘less than ogive’, taking upper limits of the class intervals on x - axis and cumulative frequencies on y - axis.



The frequency distribution table for ‘more than’ type is:

MARKS	CUMULATIVE FREQUENCY (C_f)
more than 40	148 + 1 = 149
more than 45	139 + 9 = 148
more than 50	124 + 15 = 139
more than 55	106 + 18 = 124
more than 60	66 + 40 = 106
more than 65	40 + 26 = 66
more than 70	24 + 16 = 40
more than 75	10 + 14 = 24
more than 80	10

Lets plot a graph of ‘more than’ ogive, taking lower limits of the class intervals on x - axis and cumulative frequencies on y - axis.



Question: 22

The following tab

Solution:

For equal class intervals, we will solve by finding mid points of these classes using direct method.

MARKS	MID - POINT(x_i)	NUMBER OF STUDENTS(f_i)	f_ix_i
10.5 - 15.5	13	2	26
15.5 - 20.5	18	3	54
20.5 - 25.5	23	6	138
25.5 - 30.5	28	4	112
30.5 - 35.5	33	14	462
35.5 - 40.5	38	12	456
40.5 - 45.5	43	4	172
45.5 - 50.5	48	2	96
TOTAL		47	1516

We have got

$\Sigma f_i = 47$ and $\Sigma f_i x_i = 1516$

$\because$ mean is given by

$$\bar{x} = \frac{\sum_i f_i x_i}{\sum_i f_i}$$

$$\Rightarrow \bar{x} = \frac{1516}{47}$$

$$\Rightarrow \bar{x} = 32.26$$

Thus, mean is 32.26.

To find median, Assume

$\Sigma f_i = N$ = Sum of frequencies,

h = length of median class,

l = lower boundary of the median class,

f = frequency of median class

and C_f = cumulative frequency

Lets form a table.

MARKS	NUMBER OF STUDENTS(f_i)	NUMBER OF STUDENTS(f_i)
10.5 - 15.5	2	2
15.5 - 20.5	3	2 + 3 = 5
20.5 - 25.5	6	5 + 6 = 11
25.5 - 30.5	4	11 + 4 = 15
30.5 - 35.5	14	15 + 14 = 29
35.5 - 40.5	12	29 + 12 = 41
40.5 - 45.5	4	41 + 4 = 45
45.5 - 50.5	2	45 + 2 = 47
TOTAL	47	

We have got

So, N = 47

⇒ N/2 = 47/2 = 23.5

The cumulative frequency just greater than (N/2 =) 23.5 is 29, so the corresponding median class is 30.5 - 35.5 and accordingly we get C_f = 15(cumulative frequency before the median class).

Now, since median class is 30.5 - 35.5.

∴ l = 30.5, h = 5, f = 14, N/2 = 23.5 and C_f = 15

Median is given by,

$$\text{Median} = l + \left(\frac{\frac{N}{2} - C_f}{f}\right) \times h$$

$$\Rightarrow \text{Median} = 30 + \left(\frac{23.5-15}{14}\right) \times 5$$

= 30 + 3.03

= 33.03

Thus, median is 33.03.

Since, we have got mean = 32.26 and median = 33.03

Applying the empirical formula,

Mode = 3(Median) – 2(Mean)

⇒ Mode = 3(33.03) – 2(32.26)

⇒ Mode = 99.09 – 64.52 = 34.57

∴ Mean = 32.26, Median = 33.03 and Mode = 34.57