Exercise 7.1: Statistics

Q.1: Calculate the mean for the following distribution:

x:	5	6	7	8	9
f:	4	8	14	11	3

Sol:

X	f	fx
5	4	20
6	8	48
7	14	98
8	11	88
9	3	27
	N = 40	281

Mean = 281/4 =7.025

2. Find the mean of the following data:

x:	19	21	23	25	27	29	31
f:	13	15	16	18	16	15	13

Soln:

X	f	fx
18	13	247
21	15	315
23	16	368
25	18	450
27	16	432
29	15	435
31	13	403
	N = 106	Sum = 2620

Mean (x) = 2680/106 = 25

3. If the mean of the following data is 20.6. Find the value of p.

x:	10	15	p	25	35
f:	3	10	25	7	5

Soln:

X	f	fx
10	3	30
5	10	150
P	25	25p
25	7	175
35	5	175
	N = 106	Sum = 2620

Given

Mean = 20.6

(530+25p)/50 = 20.6

25p = 20.6

P = 20

4. If the mean of the following data is 15, find p

x:	**5**	**10**	**15**	**20**	**25**
f:	**6**	**p**	**6**	**10**	**5**

Soln:

X	f	fx
5	6	30
10	P	10p
15	6	90
20	10	200
25	5	125
	N = p127	Sum = 10p + 445

Given

Mean =15

(10p + 445)/(p+27) = 15

10p + 445 = 15p +405

15p – 10p = 445 – 405

5p = 40

P = 8

5.Find the value of p for the following distribution whose mean is 16.6

X:	**8**	**12**	**15**	**p**	**20**	**25**	**30**
F:	**12**	**16**	**20**	**24**	**16**	**8**	**4**

Soln:

X	f	fx
8	12	96
12	12	192
15	20	300
P	24	24p
20	16	320
25	8	200
30	4	120
	N = 100	Sum = 24p + 1228

Given

Mean = 16.6

(24p+1228)/100 = 16.6

24p + 1228 = 1660

24p = 1660 – 1228

P = 432/24

P = 18

6. Find the missing value of p for the following distribution whose mean is 12.58

x:	**5**	**8**	**10**	**12**	**p**	**20**	**25**
f:	**2**	**5**	**8**	**22**	**7**	**4**	**2**

Soln:

x	f	fx
5	2	10
8	5	40
10	8	80
12	22	264
P	7	7p
20	24	480
25	2	50
	N = 50	Sum = 524 + 7p

Given mean = 12.58

Sum/N = 12.58

(524 +7p)/50 = 12.58

524 + 7p = 629

7p = 105

P = 15

7.Find the missing frequency (p) for the following distribution whose mean is 7.68.

x:	**3**	**5**	**7**	**9**	**11**	**13**
f:	**6**	**8**	**15**	**p**	**8**	**4**

Soln:

X	f	fx
3	6	18
5	8	40
7	15	105
9	p	9p
11	8	88
13	4	52
	N = P + 41	Sum 9p = 303

Given

Mean = 7.68

(7p+303)/p+41 =7.68

9p + 303 = p(7.68) + 314.88

9p – p(7.68) = 314.88 – 303

1.32p = 11.88

P = (11.88)/1.32

P = 9

8.The following table gives the number of boys of a particular age in a class of 40 students. Calculate the mean age of the students.

Ages (in years):	**15**	**16**	**17**	**18**	**19**	**20**
No of students:	**3**	**8**	**10**	**10**	**5**	**4**

Soln:

x	f	fx
15	3	45
16	8	128
17	10	170
18	10	180
19	5	95
20	4	80
	N = 40	Sum = 698

Mean age = sum/ N

= 698/ 40

= 17.45 years

9.Candidates of four schools appear in a mathematics test. The data were as follows:

Schools	No of candidates	Average score
I	60	75
II	48	80
III	P	55
IV	40	50

If the average score of the candidates of all the four schools is 66, find the number of candidates that appeared from school III.

Soln: Let the number candidates from school III = P

Schools	No of candidates N_i	Average scores (x_i)
I	60	75
II	48	80
III	P	55
IV	40	50

Given

Average score or all schools = 66

$N_1\overline{x}_1+N_2\overline{x}_2+N_3\overline{x}_3+N_4\overline{x}_4 N_1+N_2+N_3+N_4 \frac{N_1\overline{x_1}+N_2\overline{x_2}+N_3\overline{x_3}+N_4\overline{x_4}}{N_1+N_2+N_3+N_4}$

$4500+3340+55p+200060+48+p+40 \frac{4500+3340+55p+2000}{60+48+p+40}$

10340 + 55p = 66p + 9768

10340 – 9768 = (66 – 55)p

P = 572/11

10.Five coins were simultaneously tossed 1000 times and at each toss, the number of heads was observed. The number of tosses during which 0, 1, 2, 3, 4 and 5 heads were obtained are shown in the table below. Find the mean number of heads per toss.

No of heads per toss	**No of tosses**
0	**38**
1	**144**
2	**342**
3	**287**
4	**164**
5	**25**
Total	**1000**

Soln:

No of heads per toss	No of tosses
0	38
1	144
2	342
3	287
4	164
5	25

No of heads per toss	No of tosses	fx
0	38	0
1	144	144

2	342	684
3	287	861
4	164	656
5	25	125

Mean number of heads per toss = 2470/1000 = 2.47

Mean = 2.47

12.The arithmetic mean of the following data is 25. Find the value of k.

X_i:	**5**	**15**	**25**	**35**	**45**
f_i:	**3**	**k**	**3**	**6**	**2**

Sol:

X	f	fx
5	3	15
15	k	15k
25	3	75
35	6	210
45	2	90
	N = k + 120	Sum = 15k + 390

Given mean = 25

Sum/ N = 25

15k + 390 = 25k + 350

25k – 15k = 40

10k = 40

k = 4

13. If the mean of the following data is 18.75. Find the value of p.

X_i:	**10**	**15**	**p**	**25**	**30**
F_i:	**5**	**10**	**7**	**8**	**2**

Soln:

X	f	fx
10	5	50
15	10	150
P	7	7p
25	8	200
30	2	60
	N = k + 120	Sum = 1p + 460

Given mean = 18.75

Sum/ N = 1.75

7p + 460 = 600

7p = 140

P = 20

14.Find the value of p. If the mean of the following distribution is 20.

x:	**15**	**17**	**19**	**20 + p**	**23**

f:	**2**	**3**	**4**	**5p**	**6**

Soln:

X	f	fx
15	2	30
17	3	51
19	4	76
20 + p	5p	$100p+5p^2$
23	6	138
	N = 5p +15`	Sum = 295 +100p +$5p^2$

Given Mean= 2n

Sum/ N = 20

$(295 + 100p – 5p^2) / (5 + 15) = 20$

$295 + 100p + 5p^2=100p + 300$

$5p^2 – 5 = 0$

$5(p^2 – 1) = 0$

$P^2 – 1 = 0$

P = (+1 , -1)

If p + 1 = 0

P = -1

Or p -1 = 0

P = 1

15.Find the missing frequencies in the following frequency distribution if it is known that the mean of the distribution is 50.

X:	**10**	**30**	**50**	**70**	**90**
f:	**17**	**f_1**	**32**	**f_2**	**19**

Soln:

x	f	fx
10	17	170
30	f_1	$30f_1$
50	32	1600
70	f_2	$70f_2$
90	19	1710
	N = 120	Sum = $30f_1+70f_2+3480$

Given mean

Sum/ N = 50

$30f_1+70f_2+3480/ 120 = 50$

$30f_1+70f_2+3480 = 6000$ —- (1)

Also, sum of f = 120

$17 + f_1 + 32 + f_2 + 19 = 120$

$f_1 + f_2 = 52$

$f_1 = 52 – f_2$

Substituting the value of f_1 in (1)

$30 (52 – f_2) +70f_2 + 3480 = 6000$

$f_2 = 24$

Hence $f_1 = 52 - 24 = 28$

$f_1 = 28$; $f_2 = 24$

Exercise 7.2: Statistics

1. The number of telephone calls received at an exchange per interval for 250 successive one- minute intervals are given in the following frequency table:

No. of calls(x):	**0**	**1**	**2**	**3**	**4**	**5**	**6**
No. of intervals (f):	**15**	**24**	**29**	**46**	**54**	**43**	**39**

Compute the mean number of calls per interval.

Soln: Let be assumed mean (A) = 3

No. of calls x_i	No. of intervals f_i	$u_1=x_i-A=x_i=3u_1 = x_i - A = x_i = 3$	$f_iu_i f_i u_i$
0	15	-3	-45

1	24	-2	-47
2	29	-1	-39
3	46	0	0
4	54		54
5	43	2	43(2) = 86
6	39	3	47
	N= 250		Sum = 135

Mean number of cells = 3+frac1352503 + $frac135250$ = frac885250$frac885250$ = 3.54

2. Five coins were simultaneously tossed 1000 times, and at each toss the number of heads was observed. The number of tosses during which 0, 1, 2, 3, 4 and 5 heads were obtained are shown in the table below. Find the mean number of heads per toss.

No of heads per toss (x):	**0**	**1**	**2**	**3**	**4**	**5**
No of tosses (f):	**38**	**144**	**342**	**287**	**164**	**25**

Soln: Let the assumed mean (A) = 2

No. of heads per toss x_i	No of intervals f_i	$u_i=A_i-x=A_i-2$ $u_i = A_i - x = A_i - 2$	f_iu_i $f_i u_i$
0	38	-2	-7
1	144	-1	-144
2	342	0	0
3	287	1	287

4	164	2	328
5	25	3	75
	N= 1000		Sum = 470

Mean number of per toss = 2 +470/1000 = 2 + 0.47 =2.47

3. The following table gives the number of branches and number of plants in the garden of a school.

No of branches (x):	**2**	**3**	**4**	**5**	**6**
No of plants (f):	**49**	**43**	**57**	**38**	**13**

Calculate the average number of branches per plant.

Soln:

Let the assumed mean (A) = 4

No of branches x_i	No of plants f_i	$u_i=x_i-A=x_i-4$ $u_i = x_i - A = x_i - 4$	f_iu_i $f_i u_i$
2	49	-2	-98
3	43	-1	-43
4	57	0	0
5	38	1	38
6	13	2	26
	N = 200		Sum = -77

Average number of branches per plant = 4 + (-77/200) = 4 -77/200 = (800 -77)/200 = 3.615

4. The following table gives the number of children of 150 families in a village

No of children (x):	**0**	**1**	**2**	**3**	**4**	**5**
No of families (f):	**10**	**21**	**55**	**42**	**15**	**7**

Find the average number of children per family.

Soln: Let the assumed mean (A) = 2

No of children x_i	No of families f_i	$u_i=x_i-A=x_i-2$	f_iu_i
0	10	-2	-20
1	21	-1	-21
3	42	1	42
4	15	2	30
5	7	5	35
	N = 20		Sum = 52

Average number of children for family = 2 + 52/150 = (300 +52)/150 = 352/150 = 2.35 (approx)

5. The marks obtained out of 50, by 102 students in a physics test are given in the frequency table below:

Marks (x):	15	20	22	24	25	30	33	38	45
Frequency (f):	5	8	11	20	23	18	13	3	1

Find the average number of marks.

Soln: Let the assumed mean (A) = 25

Marks x_i	Frequency f_i	$u_i=x_i-A=x_i-2$ $u_i = x_i - A = x_i - 2$	f_iu_i $f_i u_i$
15	5	-10	-50
20	8	-5	-40
22	8	-3	-24
24	20	-1	-20
25	23	0	0
30	18	5	90
33	13	8	104
38	3	12	36
45	3	20	60
	N = 122		Sum = 110

Average number of marks = 25 + 110/102

= (2550 + 110)/102

= 2660/102

= 26.08 (Approx)

6.The number of students absent in a class was recorded every day for 120 days and the information is given in the following

No of students absent (x):	0	1	2	3	4	5	6	7
No of days (f):	12	4	10	50	34	15	4	

Find the mean number of students absent per day.

Soln:Let mean assumed mean (A) = 3

No of students absent x_i	No of days f_i	$u_i = x_i - A = x_i - 3$ $u_i=x_i-A=x_i-3$	f_iu_i
3	1	-3	-3
1	4	-2	-8
2	10	-1	-10
3	50	0	0
4	34	1	24
5	15	2	30
6	4	3	12
7	2	4	8
	N = 120		Sum =63

Mean number of students absent per day = 3 + 63/120

= (360 + 63)/120

= 423/120

= 3.53

7. In the first proof of reading of a book containing 300 pages the following distribution of misprints was obtained:

No of misprints per page (x):	0	1	2	3	4	5
No of pages (f):	154	96	36	9	5	1

Find the average number of misprints per page.

Soln: Let the assumed mean (A) = 2

No of misprints per page x_i	No of days f_i	$u_i = x_i - A = x_i - 3$	$f_i u_i$
0	154	-2	-308
1	95	-1	-95
2	36	0	0
3	9	1	9
4	5	2	1
5	1	3	3
	N = 300		Sum = 381

Average number of misprints per day = 2 + (-381/300)

= 2 – 381/300

= (600-381)/300

= 219/300

= 0.73

8. The following distribution gives the number of accidents met by 160 workers in a factory during a month.

No of accidents (x):	0	1	2	3	4
No of workers (f):	70	52	34	3	1

Find the average number of accidents per worker.

Soln: Let the assumed mean (A) = 2

No of accidents	No of workers f_i	$u_i=x_i-A=x_i-3$	f_iu_i
0	70	-2	-140
1	52	-1	-52
2	34	0	0
3	3	1	3
4	1	2	2
	N = 100		Sum = -187

Average no of accidents per day workers

=> x + (-187/160)

= 133/160

= 0.83

9. Find the mean from the following frequency distribution of marks at a test in statistics:

Marks (x):	5	10	15	20	25	30	35	40	45	50
No of students (f):	15	50	80	76	72	45	39	9	8	6

Soln: Let the assumed mean (A) = 25

Marks x_i	No of students f_i	$u_i=x_i-A=x_i-3$	f_iu_i
5	15	-20	-300
10	50	-15	-750
15	80	-10	-800
20	76	-5	-380
25	72	0	0

30	45	5	225
35	39	10	390
40	9	15	135
45	8	20	160
50	6	25	150
	N = 400		Sum = -1170

Mean = 25 + (-1170)/400 = 22.075

Exercise 7.3: Statistics

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

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

Find the average expenditure (in rupees) per household

Soln: Let the assumed mean (A) = 275

Class interval	Mid value (x_i)	$d_i = x_i - 275$	$u_i = (x_i - 275)/50$	Frequency f_i	$f_i u_i$

100 – 150	125	-150	-3	24	-12
150 – 200	175	-100	-2	40	-80
200 – 250	225	-50	-1	33	-33
250 – 300	275	0	0	28	0
300 – 350	325	50	1	30	30
350 – 400	375	100	2	22	44
400 – 450	425	150	3	16	48
450 – 500	475	200	4	7	28
				N = 200	Sum = -35

We have

A = 275, h = 50

Mean = A + h * sum/N = 275 + 50 * -35/200 = 275 – 8.75 = 266.25

2. A survey was conducted by a group of students as a part of their environmental awareness program, in which they collected the following data regarding the number of plants in 200 houses in a locality. Find the mean number of plants per house.

Number of plants:	**0-2**	**2-4**	**4-6**	**6-B**	**8-10**	**10-12**	**12-14**
Number of houses:	**1**	**2**	**1**	**5**	**6**	**2**	**3**

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

Soln:

Let us find class marks (x_i) = (upper class limit + lower class limit)/2

Now we may compute x_i and f_ix_i as following.

Number of plants	Number of house (f_i)	x_i	F_ix_i
0 – 2	1	1	1
2 – 4	2	3	6
4 – 6	1	5	5
6 – 8	5	7	35
8 – 10	6	9	54
10 – 12	2	11	22
12 – 14	3	13	39
Total	N = 20		Sum = 162

From the table we may observe that

N = 20

Sum = 162

Mean $\bar{x}$ = Sum/N

162/20 = 8.1

So mean number of plants per house is 8.1

We have used for the direct method values X_i and f_i are very small

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

Daily wages (in Rs)	**100-120**	**120-140**	**140-160**	**160-180**	**180-200**
Number of workers:	**12**	**16**	**8**	**6**	**10**

Find the mean daily wages of the workers of the factory by using an appropriate method.

Soln: Let the assume mean (A) = 150

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

We have

N = 50, h = 20

Mean = A + h x sum/N

= 150 + 2 x (-15)/5

= 150 – 4.8

= 145.2

4.Thirty women were examined in a hospital by a doctor and the number of heart beats per minute recorded and summarized as follows. Find the mean heart beats per minute for these women, choosing a suitable method.

Number of heart

Beats Per minute:	**65 – 68**	**68 – 71**	**71 – 74**	**74 – 77**	**77 – 80**	**80 – 83**	**83 – 86**
Number of women:	**2**	**4**	**3**	**8**	**7**	**4**	**2**

Soln: we may find marks of each interval (x_i) by using the relation

(x_i) = (upper class limit + lower class limit)/2

Class size of this data = 3

Now talking 75.5 as assumed mean (a)

We may calculate d_i, u_i, f_iu_i as following

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

Now we may observe from table that N = 30, sum = 4

Mean $\bar{x}$ = 75.5 + (4/3)x3

= 75.5 + 0.4

= 75.9

So mean heart beats per minute for those women are 75.9 beats per minute

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

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

Soln:

Let us assume mean be 15

Class interval	Mid – value	$d_i = x_i - 15$	$u_i = (x_i - 15)/6$	f_i	f_iu_i
0 – 6	3	-12	-2	6	-12
6 – 12	9	-6	-1	8	-8
12 – 18	15	0	0	10	0

18 – 24	21	6	1	9	9
24 – 30	27	18	2	7	14
				N = 40	Sum = 3

A = 15, h = 6

Mean = A + h(sum/A)

= 15 + 6(3/40)

= 15 + 0.45

= 15.45

6.

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

Soln: Let us assumed mean be 100

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

A = 100, h = 20

Mean = 100 + 20 (61/100)

= 100 + 12.2

= 112.2

7.

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

Soln: Let the assumed mean (A) = 20

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

We have A = 20, h = 8

Mean= A + h (sum/N)

= 20 + 8 (7/40)

= 20 + 1.4

= 21.4

8.

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

Soln: Let the assumed mean be (A) = 15

Class interval	Mid – value	$d_i = x_i - 15$	$u_i = (x_i - 15)/6$	Frequency f_i	$f_i u_i$
0 – 6	3	-12	-2	-1	-14
6 – 12	9	-6	-1	5	-5

12 – 18	15	0	0	10	0
18 – 24	21	6	1	12	12
24 – 30	27	12	2	6	12
				N = 40	Sum = 5

We have

A = 15, h = 6

Mean = A + h(sum/N)

= 15 + 6 (5/40)

= 15 + 0.75

= 15.75

9.

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

Soln: Let the assumed mean (A) = 25

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

We have A = 25, h = 10

Mean = A + h(sum/N)

= 25 + 19 (8/60)

= 25 + (4/3)

= 26.333

10.

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

Soln: Let the assumed mean (A) = 20

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

We have,

A = 20, h = 8

Mean = A + h (sum/N)

= 20 + 8 (5/ 40)

= 20 + 1

= 21

11.

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

Soln: Let the assumed mean (A) = 20

Class	Mid value x_i	$d_i = x_i - 20$	$u_i = (x_i - 20)/8$	Frequency f_i	$f_i u_i$

interval					
0-8	4	-16	-2	-2	-10
8-16	12	-8	-1	-1	-6
16-24	20	0	0	0	0
24-32	28	8	1	1	3
32-40	36	16	2	2	4
				N = 20	Sum = -9

We have,

A = 20, h = 8

Mean = A + h (sum/N)

= 20 + 8 (-9/ 20)

= 20 – (72/20)

= 20 – 3.6

= 16.4

12.

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

Soln: Let the assumed mean (A) = 60

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

				N = 50	Sum = 14

We have

A = 60, h = 20

Mean = A + h (sum/N)

= 60 + 20 (14/ 5)

= 60 + 5.6

= 65.6

13.

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

Soln: Let the assumed mean (A) = 50

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

We have

A = 50, h = 10

Mean = A + h (sum/N)

= 50 + 10 (-2/ 40)

= 50 – 0.5

= 49.5

14.

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

Soln: Let the assumed mean (A) = 42

Class interval	Mid value x_i	$d_i = x_i - 42$	$u_i = (x_i - 42)/5$	Frequency f_i	f_iu_i
25 – 29	27	-15	-3	14	-42
30 – 34	32	-10	-2	22	-44
35 – 39	37	-5	-1	16	-16
40 – 44	42	0	0	6	0
45 – 49	47	5	1	5	5
50 – 54	52	10	2	3	6
55 – 59	57	15	3	4	12
				N = 70	Sum = -79

We have

A = 42, h = 5

Mean = A + h (sum/N)

= 42 + 5 (-79/70)

= 42 – 79/14

= 36.357

15.For the following distribution, calculate mean using all suitable methods:

Size of item:	**1 – 4**	**4 – 9**	**9 – 16**	**16 – 20**
Frequency:	**6**	**12**	**26**	**20**

Soln: By direct method

Class interval	Mid value x_i	Frequency f_i	f_ix_i
1 – 4	2.5	6	15
4 – 9	6.5	12	18
9 – 16	12.5	26	325
16 – 27	21.5	20	430
		N = 64	Sum = 848

Mean = (sum/N) + A

= 848/ 64

= 13.25

By assuming mean method

Let the assumed mean (A) = 65

Class interval	Mid value x_i	$u_i = (x_i – A) = x_i – 65$	Frequency f_i	f_iu_i
1 – 4	2.5	-4	6	-25
4 – 9	6.5	0	12	0
9 – 16	12.5	6	26	196
16 – 27	21.5	15	20	300
			N = 64	Sum = 432

Mean = A + sum/N

= 6.5 + 6.75

= 13.25

16.The weekly observation on cost of living index in a certain city for the year 2004 – 2005 are given below. Compute the weekly cost of living index.

Cost of living index	**Number of students**	**Cost of living index**	**Number of students**
1400 – 1500	**5**	**1700 – 1800**	**9**
1500 – 1600	**10**	**1800 – 1900**	**6**

1600 – 1700	**20**	**1900 – 2000**	**2**

Soln: Let the assumed mean (A) = 1650

Class interval	Mid value x_i	$d_i = x_i - A$ $= x_i - 1650$	$u_i = \frac{(x_i - 1650)}{100}$	Frequency f_i	$f_i u_i$
1400 – 1500	1450	-200	-2	5	-10
1500 – 1600	1550	-100	-1	10	-10
1600 – 1700	1650	0	0	20	0
1700 – 1800	1750	100	1	9	9
1800 – 1900	1850	200	2	6	12
1900 – 2000	1950	300	3	2	6
				N = 52	Sum = 7

We have

A = 16, h = 100

Mean = A + h (sum/N)

= 1650 + 100 (7/52)

= 1650 + (175/13)

= 21625/13

= 1663.46

17.The following table shows the marks scored by 140 students in an examination of a certain paper:

Marks:	**0-10**	**10-20**	**20-30**	**30-40**	**40-50**
Number of students:	**20**	**24**	**40**	**36**	**20**

Calculate the average marks by using all the three methods: direct method, assumed mean deviation and shortcut method.

Soln: (i) Direct method:

Class interval	Mid value x_i	Frequency f_i	f_ix_i
0 – 10	5	20	100
10 – 20	15	24	360
20 – 30	25	40	1000
30 – 40	35	36	1260
40 – 50	45	20	900
		N = 140	Sum = 3620

Mean = sum/ N

= 3620/ 140

= 25.857

(ii)Assumed mean method:

Let the assumed mean = 25

Mean = A + (sum/ N)

Class interval	Mid value x_i	$u_i = (x_i – A)$	Frequency f_i	f_iu_i
0 – 10	5	-20	20	-400
10 – 20	15	-10	24	-240
20 – 30	25	0	40	0
30 – 40	35	10	36	360
40 – 50	45	20	20	400
			N = 140	Sum = 120

Mean = A + (sum/ N)

= 25 + (120/ 140)

= 25 + 0.857

= 25.857

(iii)Step deviation method:

Let the assumed mean (A) = 25

Class interval	Mid value x_i	$d_i = x_i - A$ $= x_i - 25$	$u_i = \frac{(x_i - 25)}{10}$	Frequency f_i	$f_i u_i$
0 – 10	5	-20	-2	20	-40
10 – 20	15	-10	-1	24	-24
20 – 30	25	0	0	40	0
30 – 40	35	10	1	36	36
40 – 50	45	20	2	20	40
				N = 140	Sum = 12

Mean = A + h(sum/ N)

= 25 + 10(12/ 140)

= 25 + 0.857

= 25.857

18.The mean of the following frequency distribution is 62.8 and the sum of all the frequencies is 50. Compute the miss frequency f_1 and f_2.

Class:	**0-20**	**20-40**	**40-60**	**60-80**	**80-100**	**100-120**
Frequency:	**5**	**f_1**	**10**	**f_2**	**7**	**8**

Soln:

Class interval	Mid value x_i	Frequency f_i	$f_i x_i$
0 – 20	10	5	50
20 – 40	30	f_1	$30f_1$
40 – 60	50	10	500
60 – 80	70	f_2	$70f_2$
80 – 100	90	7	630
100 – 120	110	8	880

		N = 50	Sum = 30f1+70f_2+ 2060

Given,

sum of frequency = 50

$5 + f_1 + 10 + f_2 + 7 + 8 = 50$

$f_1 + f_2 = 20$

$3f_1 + 3f_2 = 60$ —- (1) [multiply both side by 3]

And mean = 62.8

Sum/ N = 62.8

(30f1+70f_2+ 2060)/ 50 = 62.8

30f1+70f_2 = 3140 – 2060

30f1+70f_2 = 1080

$3f1 + 7f_2 = 108$ —- (2) [divide it by 10]

subtract equation (1) from equation (2)

$3f1 + 7f_2 – 3f_1 – 3f_2 = 108 – 60$

$4f_2 = 48$

$f_2 = 12$

Put value of f_2 in equation (1)

$3f_1 + 3(12) = 60$

$f_1 = 24/3 = 8$

$f_1 = 8, f_2 = 12$

19.The following distribution shows the daily pocket allowance given to the children of a multistory building. The average pocket allowance is Rs 18.00. Find out the missing frequency.

Class interval:	**11-13**	**13-15**	**15-17**	**17-19**	**19-21**	**21-23**	**23-25**

Frequency:	**7**	**6**	**9**	**13**	**–**	**5**	**4**

Soln: Given mean = 18,

Let the missing frequency be v

Class interval	Mid value x_i	Frequency f_i	f_ix_i
11 – 13	12	7	84
13 – 15	14	6	88
15 – 17	16	9	144
17 – 19	18	13	234
19 – 21	20	x	20x
21 – 23	22	5	110
23 – 25	14	4	56
		N =44 + x	Sum = 752 + 20x

Mean = sum/ N

18 = 752+20x44+x $\frac{752+20x}{44+x}$

792 + 18x = 752 + 20x

2x = 40

x = 20

20.If the mean of the following distribution is 27. Find the value of p.

Class:	**0-10**	**10-20**	**20-30**	**30-40**	**40-50**
Frequency:	**8**	**p**	**12**	**13**	**10**

Soln:

Class interval	Mid value x_i	Frequency f_i	f_ix_i
0 – 10	5	8	40
10 – 20	15	P	152
20 – 30	25	12	300

30 – 40	35	13	455
40 – 50	45	16	450
		N = 43 + P	Sum = 1245 + 15p

Given mean =27

Mean = sum/ N

1245+15p43+p $\frac{1245+15p}{43+p}$ = 27

1245 + 15p = 1161 + 27p

12p = 84

P = 7

21.In a retail market, fruit vendors were selling mangoes kept in packing boxes. These boxes contain varying number of mangoes. The following was the distribution of mangoes according to the number of boxes.

Number of mangoes:	**50-52**	**53-55**	**56-58**	**59-61**	**62-64**
Number of boxes:	**15**	**110**	**135**	**115**	**25**

Find the mean number of mangoes kept in packing box. Which method of finding the mean did you choose?

Soln:

Number of mangoes	Number of boxes (f_i)
50 – 52	15
53 – 55	110
56 – 58	135
59 – 61	115
62 – 64	25

We may observe that class internals are not continuous

There is a gap between two class intervals. So we have to add ½ from lower class limit of each interval and class mark (x_i) may be obtained by using the relation

x_i = upperlimit+lowerclasslimit2 $\frac{upperlimit+lowerclasslimit}{2}$

Class size (h) of this data = 3

Now taking 57 as assumed mean (a) we may calculated d_i ,u_i, f_iu_i as follows

Class interval	Frequency f_i	Mid value x_i	$d_i = x_i - A$ $= x_i - 25$	$u_i = \frac{(x_i - 25)}{10}$	f_iu_i
49.5 – 52.5	15	51	-6	-2	-30
52.5 – 55.5	110	54	-3	-1	-110
55.5 – 58.5	135	57	0	0	0
58.5 – 61.5	115	60	3	1	115
61.5 – 64.5	25	63	6	2	50
Total	N = 400				Sum = 25

Now we have N = 400

Sum = 25

Mean = A + h (sum/ N)

= 57 + 3 (45/400)

= 57 + 3/ 16

= 57+ 0.1875

= 57.19

Clearly mean number of mangoes kept in packing box is 57.19

22.The table below shows the daily expenditure on food of 25 households in a locality

Daily expenditure (in Rs):	**100-150**	**150-200**	**200-250**	**250-300**	**300-350**
Number of households:	**4**	**5**	**12**	**2**	**2**

Find the mean daily expenditure on food by a suitable method.

Soln: we may calculate class mark (x_i) for each interval by using the relation

x_i = upperlimit+lowerclasslimit2 $\frac{upperlimit+lowerclasslimit}{2}$

Class size = 50

Now, talking 225 as assumed mean (x_i) we may calculate d_i ,u_i, f_iu_i as follows

Daily expenditure	Frequency f_i	Mid value x_i	$d_i = x_i - 225$	$u_i = \frac{(x_i - 225)}{50}$	f_iu_i
100 – 150	4	125	-100	-2	-8
150 – 200	5	175	-50	-1	-5
200 – 250	12	225	0	0	0
250 – 300	2	275	50	1	2
300 – 350	2	325	100	2	4
	N = 25				Sum = -7

Now we may observe that

N = 25

Sum = -7

Mean $\bar{x}$=a+(sumN)×h$\bar{x} = a + \left(\frac{sum}{N}\right) \times h$

225 + 50 (-7/ 25)

225 – 14 = 211

So, mean daily expenditure on food is Rs 211

23.To find out the concentration of SO_2 in the air (in parts per million i.e ppm) the data was collected for localities for 30 localities in a certain city and is presented below:

	Frequency

Concentration of SO_2 (in ppm)	
0.00 – 0.04	**4**
0.04 – 0.08	**9**
0.08 – 0.12	**9**
0.12 – 0.16	**2**
0.16 – 0.20	**4**
0.20 – 0.24	**2**

Find the mean concentration of SO_2 in the air

Soln: we may find class marks for each interval by using the relation

x= upperlimit+lowerclasslimit2 $x = \frac{upperlimit+lowerclasslimit}{2}$

Class size of this data = 0.04

Now taking 0.04 assumed mean (x_i) we may calculate d_i ,u_i, f_iu_i as follows

Concentration of SO_2	Frequency f_i	Class interval x_i	$d_i = x_i - 0.14$	u_i	f_iu_i
0.00 – 0.04	4	0.02	-0.12	-3	-12
0.04 – 0.08	9	0.06	-0.08	-2	-18
0.08 – 0.12	9	0.10	-0.04	-1	-9
0.12 – 0.16	2	0.14	0	0	0
0.16 – 0.20	4	0.18	0.04	1	4
0.20 – 0.24	2	0.22	0.08	2	4
Total	N = 30				Sum = -31

From the table we may observe that

N = 30

Sum = -31

Mean $\bar{x}$=a+(sumN)×h$\bar{x} = a + \left(\frac{sum}{N}\right) \times h$

= 0.14 +(0.04)(-31/30)

= 0.099 ppm

So mean concentration of SO_2 in the air is 0.099 ppm

24.A class teacher has the following absentee record of 40 students of a class for the whole term. Find the mean number of days a student was absent.

Number of days:	**0-6**	**6-10**	**10-14**	**14-20**	**20-28**	**28-38**	**38-40**
Number of students:	**11**	**10**	**7**	**4**	**4**	**3**	**1**

Soln: We may find class mark of each interval by using the relation

X=upperlimit+lowerclasslimit2 $x = \frac{upperlimit+lowerclasslimit}{2}$

Now, taking 16 as assumed mean (a) we may

Calculate d_i and f_id_i as follows

Number of days	Number of students f_i	X_i	$d = x_i + 10$	f_id_i
0 – 6	11	3	-13	-143
6 – 10	10	8	-8	-280
10 – 14	7	12	-4	-28
14 – 20	7	16	0	0
20 – 28	8	24	8	32
28 – 36	3	33	17	51
30 – 40	1	39	23	23
Total	N = 40			Sum = -145

Now we may observe that

N = 40

Sum= -145

Mean $\bar{x}$=a+(sumN) $\bar{x} = a + \left(\frac{sum}{N}\right)$

= 16 + (-145/ 40)

= 16 – 3.625

= 12.38

So mean number of days is 12.38 days, for which student was absent

25.The following table gives the literacy rate (in percentage) of 35 cities. Find the mean literacy rate.

Literacy rate (in %):	**45-55**	**55-65**	**65-75**	**75-85**	**85-95**
Number of cites:	**3**	**10**	**11**	**8**	**3**

Soln: We may find class marks by using the relation

X= upperlimit+lowerclasslimit2 $x = \frac{upperlimit+lowerclasslimit}{2}$

Class size (h) for this data = 10

Now taking 70 as assumed mean (a) wrong

Calculate d_i ,u_i, f_iu_i as follows

Litracy rate (in %)	Number of cities (f_i)	Mid value x_i	$d_i = x_i - 70$	$u_i = \frac{d_i}{50}$	f_iu_i
45 – 55	3	50	-20	-2	-6
55 – 65	10	60	-10	-1	-10
65 – 75	11	70	0	0	0
75 – 85	8	80	10	1	8
85 – 95	3	90	20	2	6
Total	N = 35				Sum = -2

Now we may observe that

N = 35

Sum = -2

Mean $\bar{x}$=a+(sumN)×h$\bar{x} = a + \left(\frac{sum}{N}\right) \times h$

= 70 + (-2/35)

= 70 – 4/7

= 70 – 0.57

= 69.43

So, mean literacy rate is 69.43 %

Exercise 7.4: Statistics

1. Following are the lives in hours of 15 pieces of the components of aircraft engine. Find the median: 715, 724, 725, 710, 729, 745, 694, 699, 696, 712, 734, 728, 716, 705, 719

Soln:

Lives in hours of is pieces are = 715, 724, 725, 710, 729, 745, 694, 699, 696, 712, 734, 728, 716, 705, 719

Arrange the above data in ascending order = 694, 696, 699, 705, 710, 712, 715, 716, 719, 721, 725, 728, 729, 734, 745

N = 15 (odd)

Median = $(\text{N+12})^{\text{th}} \left(\frac{N+1}{2}\right)^{th}$ terms

= $(\text{15+12})^{\text{th}} \left(\frac{15+1}{2}\right)^{th}$ terms = 8^{th} terms = 716

2.The following is the distribution of height of students of a certain class in a certain city:

Height (in cm):	160-162	163-165	166-168	169-171	172-174
No of students:	15	118	142	127	18

Find the median height.

Soln:

Class interval (exclusive)	Class interval (inclusive)	Class interval frequency	Cumulative frequency
160 – 162	159.5 – 162.5	15	15
163 – 165	162.5 – 165.5	118	133 (F)
166 – 168	165.5 – 168.5	142 (f)	275
169 – 171	168.5 – 171.5	127	402
172 – 174	171.5 – 174.5	18	420
		N = 420	

We have

N = 420

N/2 = 420/ 2 = 120

The cumulative frequency just greater than N/2 is 275 then 165.5 – 168.5 is the median class such, that

L = 165.5, f = 142, F = 133 and h = 168.5 – 165.5 = 3

Mean = L+ N2−Ff×h$L + \frac{\frac{N}{2} - F}{f} \times h$

= Missing close brace Missing close brace = 166.5 + 1.63 = 168.13

3. Following is the distribution of I.Q of 100 students. Find the median I.Q.

I.Q:	**55-64**	**65-74**	**75-84**	**85-94**	**95-104**	**105-114**	**115-124**	**125-134**	**135-144**
No of students:	**1**	**2**	**9**	**22**	**33**	**22**	**8**	**2**	**1**

Soln:

Class interval (exclusive)	Class interval (inclusive)	Class interval frequency	Cumulative frequency
55 – 64	54.5 – 64-5	1	1
65 – 74	64.5 – 74.5	2	3
75 – 84	74.5 – 84.5	9	12
85 – 94	84.5 – 94.5	22	34 (f)
95 – 104	94.5 – 104.5	33 (f)	67
105 – 114	104.5 – 114.5	22	89
115 – 124	114.5 – 124.5	8	97
125 – 134	124.5 – 134.5	2	99
135 – 144	134.5 – 144.5	1	100
		N = 100	

We have N = 100

N/ 2 = 100/ 2 = 50

The cumulative frequency just greater than N/ 2 is 67 then the median class is 94.5-104.5 such that

L=94.5,F = 33 h =104.5 – 94.5=10

Mean = L+ N2−Ff×h$L + \frac{\frac{N}{2} - F}{f} \times h$

= 94.5+ 50−3433×1094.5 + $\frac{50-34}{33} \times 10$ = 94.5 + 4.88 = 99.35

4.Calculate the median from the following data:

Rent (in Rs):	**15-25**	**25-35**	**35-45**	**45-55**	**55-65**	**65-75**	**75-85**	**85-95**
No of houses:	**8**	**10**	**15**	**25**	**40**	**20**	**15**	**7**

Soln:

Class interval	Frequency	Cumulative frequency
15 – 25	8	8
25 – 35	10	18
35 – 45	15	33(f)
45 – 55	25	58
55 – 65	40(f)	28
65 – 75	20	38
75 – 85	15	183
85 – 95	7	140
	N = 140	

We have N = 140

N/ 2 = 140/ 2 = 70

The cumulative frequency just greater than N/ 2 is 98 then median class is 55 – 65 such that

L = 55, f = 40, F = 58, h = 65 – 55 = 10

Mean = L+ N2−Ff×h$L + \frac{\frac{N}{2} - F}{f} \times h$

= 55+ 70–5840×1055 + $\frac{70-58}{40} \times 10$ = 55 + 3 = 58

5.Calculate the median from the following data:

Marks below:	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**
No of students:	**15**	**35**	**60**	**84**	**96**	**127**	**198**	**250**

Soln:

Marks below	No of students	Class interval	Frequency	Cumulative frequency
10	15	0 – 10	15	15
20	35	10 – 20	20	35
30	60	20 – 30	25	60
40	84	30 – 40	24	84
50	96	40 – 50	12	96(F)
60	127	50 – 60	31 (f)	127
70	198	60 – 70	71	198
80	250	70 – 80	52	250
			N = 250	

We have N = 250

N/ 2 = 250/ 2 = 125

The cumulative frequency just greater than N/ 2 is 127 then median class is 50 – 60 such that

L = 50, f = 31, F = 96, h = 60 -50 = 10

Mean = L+ N2−Ff×h$L + \frac{\frac{N}{2} - F}{f} \times h$

= 50+ 125−9631 ×1050 + $\frac{125-96}{31} \times 10$ = 50 + 9.35 = 59.35

6.Calculate the missing frequency from the following distribution, it being given that the median of the distribution is 24.

Age in years:	**0-10**	**10-20**	**20-30**	**30-40**	**40-50**
No of persons:	**5**	**25**	**?**	**18**	**7**

Soln:

Class interval	Frequency	Cumulative frequency
0 – 10	5	5
10 – 20	25	30 (F)
20 – 30	x (f)	30 + x
30 – 40	18	48 + x
40 – 50	7	55 + x
	N = 170	

Given

Median = 24

Then, median class = 20 – 30

L = 20, h = 30 -20 = 10, f = x, F = 30

Median = L+ N2−Ff×h$L + \frac{\frac{N}{2} - F}{f} \times h$

24 = 20+ 55+x2−30x ×1020 + $\frac{\frac{55+x}{2} - 30}{x} \times 10$

24 – 20 = 55+x2−30x ×10$\frac{\frac{55+x}{2} - 30}{x} \times 10$

4x = $(55+x2-30)\times 10\left(\frac{55+x}{2}-30\right)\times 10$

4x = 275 + 5x – 300

4x – 5x = -25

-x = -25

x = 25

Missing frequency = 25

7.The following table gives the frequency distribution of married women by age at marriage.

Age (in years)	**Frequency**	**Age (in years)**	**Frequency**
15 – 19	**53**	**40 – 44**	**9**
20 – 24	**140**	**45 – 49**	**5**
25 – 29	**98**	**50 – 54**	**3**
30 – 34	**32**	**55 – 59**	**3**
35 – 39	**12**	**60 and above**	**2**

Calculate the median and interpret the results

Soln:

Class interval (exclusive)	Class interval (inclusive)	Frequency	Cumulative frequency
15 – 19	14.5 – 19.5	53	53 (F)
20 – 24	19.5 – 24.5	140 (f)	193
25 – 29	24.5 – 29.5	98	291
30 – 34	29.5 – 34.5	32	323
35 – 39	34.5 – 39.5	12	335
40 – 44	39.5 – 44.5	9	344
45 – 49	44.5 – 49.5	5	349
50 – 54	49.5 – 54.5	3	352

55 – 54	54.5 – 59.5	3	355
60 and above	59.5 and above	2	357
		N = 357	

N = 357

N/ 2 = 357/ 2 = 178.5

The cumulative frequency just greater than N/ 2 is 193,

Then the median class is 19.5 – 24.5 such that l = 19.5, f = 140, F = 53, h = 25.5 – 19.5 = 5

Median = l+ N2−Ff×hl + $\frac{\frac{N}{2}-F}{f} \times h$

Median = 19.5+ 178.5−53140×519.5 + $\frac{178.5-53}{140} \times 5$

Median = 23.98

Nearly half the women were married between the ages of 15 and 25

8.The following table gives the distribution of the life time of 400 neon lamps:

Life time:	**Number of lamps**
1500 – 2000	**14**
2000 – 2500	**56**
2500 – 3000	**60**
3000 – 3500	**86**
3500 – 4000	**74**
4000 – 4500	**62**
4500 – 5000	**48**

Find the median life.

Soln: We can find cumulative frequencies with their respective class intervals as below

Life time	Number of lamps f_i	Cumulative frequency (cf)
1500 – 2000	14	14
2000 – 2500	56	70
2500 – 3000	60	130
3000 – 3500	86	216
3500 – 4000	74	290
4000 – 4500	62	352
4500 – 5000	48	400
Total (n)	400	

Now we may observe that cumulative frequency just greater than n/ 2 (400/ 2 = 200) is 216 belongs to class interval 3000 – 3500

Median class = 3000 – 3500

Lower limits (l) of median class = 3000

Frequency (f) of median class = 86

Cumulative frequency (cf) of class preceding median class = 130

Class size (h) = 500

Median = $l+(_{n2}-cff)\times hl + \left(\frac{\frac{n}{2}-cf}{f}\right) \times h$

= $3000+(200-13086)\times500)3000 + \left(\frac{200-130}{86}\right) \times 500)$

= 3000 + (35000/ 86)

= 3406.98

So, median life time of lamps is 3406.98 hours

9.The distribution below gives the weight of 30 students in a class. Find the median weight of students:

Weight (in kg):	**40-45**	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**
No of students:	**2**	**3**	**8**	**6**	**6**	**3**	**2**

Soln: We may find cumulative frequency with their respective class intervals as below

Weight (in kg)	Number of students f_i	Cumulative frequency (cf)
40 – 45	2	2
45 – 50	3	5
50 – 55	8	13
55 – 60	6	19
60 – 65	6	25
65 – 70	3	28
70 – 75	2	30

Cumulative frequency just greater than n/ 2 (i.e. 30/ 2 = 15) is 19, belonging to class interval 55 – 60

Median class = 55 – 60

Lower limit (l) of median class = 55

Frequency (f) of median class = 6

Cumulative frequency (cf) = 13

Class size (h) = 5

Median = $l+(\frac{n}{2}-cf)\times h l + \left(\frac{\frac{n}{2}-cf}{f}\right) \times h$

= $55+(\frac{15-13}{6})\times 5) 55 + \left(\frac{15-13}{6}\right) \times 5)$

= 55 +10/ 6

= 56.666

So, median weight is 56.67 kg

10.Find the missing frequencies and the median for the following distribution if the mean is 1.46

No of accidents:	**0**	**1**	**2**	**3**	**4**	**5**	**Total**
Frequencies (no of days):	**46**	**?**	**?**	**25**	**10**	**5**	**200**

Soln:

No of accidents (x)	No of days (f)	fx
0	46	0
1	x	x
2	y	2y
3	25	75
4	10	40
5	5	25
	N = 200	Sum = x + 2y + 140

Given

N = 200

46 + x + y + 25 + 10 + 5 = 200

x + y = 200 – 46 – 25 – 10 – 5

x + y = 114 —- (1)

And, Mean = 1.46

Sum/ N = 1.46

(x + 2y + 140)/ 200 = 1.46

x + 2y = 292 – 140

x + 2y = 152 —- (2)

Subtract equation (1) from equation (2)

x + 2y – x – y = 152 – 114

y = 38

Putting the value of y in equation (1), we have x = 114 – 38 = 76

No of accidents	No of days	Cumulative frequency
0	46	46
1	76	122
2	38	160
3	25	185
4	10	195
5	5	200
	N = 200	

We have,

N = 200

N/ 2 = 200/ 2 = 100

The cumulative frequency just more than N/ 2 is 122 then the median is 1

11.An incomplete distribution is given below:

Variable:	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**	**70-80**
Frequency:	**12**	**30**	**?**	**65**	**?**	**25**	**18**

You are given that the median value is 46 and the total number of items is 230.

(i) Using the median formula fill up the missing frequencies.

(ii) Calculate the AM of the completed distribution.

Soln:

(i)

Class interval	Frequency	Cumulative frequency
10 – 20	12	12

20 – 30	30	42
30 – 40	x	42+ x (F)
40 – 50	65 (f)	107 + x
50 – 60	Y	107 + x + y
60 – 70	25	132 + x + y
70 – 80	18	150 + x + y
	N = 150	

Given

Median = 46

Then, median class = 40 – 50

L = 40, h = 50 – 40 = 10, f = 65, F = 42 + x

Median = L+ N2−Ff×h$L + \frac{\frac{N}{2} - F}{f} \times h$

46 = 40+ 115−(42+x)65×10$40 + \frac{115-(42+x)}{65} \times 10$

46 – 40 = 115−42−x65×10$\frac{115-42-x}{65} \times 10$

6 (65/ 10) = 73 –x

39 = 73 – x

x = 73 – 39 = 34

Given

N = 230

12 + 30 + 34 + 65 + y + 25 + 18 = 230

184 + y = 230

Y = 230 – 184

Y = 46

(ii)

Class interval	Mid value x	Frequency f	Fx
10 – 20	15	12	180
20 – 30	25	30	750
30 – 40	35	34	1190
40 – 50	45	65	2925
50 – 60	55	46	2530
60 – 70	65	25	1625
70 – 80	75	18	1350
		N = 230	Σfx=10550$\Sigma fx = 10550$

Mean = ΣfxN $\frac{\Sigma fx}{N}$

= 10550/ 230 = 45.87

12.If the median of the following frequency distribution is 28.5 find the missing frequencies:

Class interval:	**0-10**	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**	**Total**
Frequency:	**5**	**f_1**	**20**	**15**	**f_2**	**5**	**60**

Soln:

Class interval	Frequency	Cumulative frequency
0 – 10	5	5
10 – 20	f_1	5 + f_1 (F)
20 – 30	20 (f)	25 + f_1
30 – 40	15	40 + f_1
40 – 50	f_2	40 + f_1 + f_2
	N = 60	

Given

Median = 28.5

Then, median class = 20 – 30

Median = l+ N2−Ff×hl + $\frac{\frac{N}{2}-F}{f} \times h$

28.5 = 20 30−(5+f1)20 ×1020 $\frac{30-(5+f_1)}{20} \times 10$

28.5 -20 = 30−5120 ×10 $\frac{30-5_1}{20} \times 10$

8.5 = 25–f12 $\frac{25-f_1}{2}$

17 = 25 – f_{1}

f_1 = 25 – 17 = 8

Given

Sum of frequencies = 60

5 + f_1 + 20 + 15 + f_2 + 5 = 60

5 + 8 + 20 + 15 + f_2 + 5 = 60

f_2 = 7

f_1 = 8 and f_2 = 7

13.The median of the following data is 525. Find the missing frequency, if it is given that there are 100 observations in the data.

Class interval	Frequency	Class interval	Frequency
0 – 100	2	500 – 600	20
100 – 200	5	600 – 700	f_2
200 – 300	f_1	700 – 800	9
300 – 400	12	800 – 900	7

400 – 500	**17**	**900 – 1000**	**4**

Soln:

Class interval	Frequency	Cumulative frequency
0 – 100	2	2
100 – 200	5	7
200 – 300	f_1	$7 + f_1$
300 – 400	12	$19 + f_1$
400 – 500	17	$36 + f_1$ (F)
500 – 600	20 (f)	$56 + f_1$
600 – 700	f_2	$56 + f_1 + f_2$
700 – 800	9	$65 + f_1 + f_2$
800 – 900	7	$72 + f_1 + f_2$
900 – 1000	4	$76 + f_1 + f_2$
	N = 100	

Given

Median = 525

Then, median class = 500 – 600

L = 500, f = 20, F = $36 + f_1$, h = 600 – 500 = 100

Median = $L + \frac{\frac{N}{2} - F}{f} \times h$

$525 = 500 + \frac{50 - (36 + f_1)}{20} \times 100$

$525 = 500 + \frac{50 - 36 - f_1}{20} \times 100$

25 = (14 – f_1) x 5

5 = 14 – f_1

$f_1 = 14 - 5 = 9$

Given

Sum of frequencies = 100

$2 + 5 + f_1 + 12 + 17 + 20 + f_2 + 9 + 7 + 4 = 100$

$2 + 5 + 9 + 12 + 17 + 20 + f_2 + 9 + 7 + 4 = 100$

$85 + f_2 = 100$

$f_2 = 100 - 85 = 15$

$f_1 = 9$ and $f_2 = 15$

14.If the median of the following data is 32.5, find the missing frequencies.

Class interval:	**0-10 10-20 20-30 30-40 40-50 50-60 60-70**	**Total**
Frequency:	**f_1 5 9 12 f_2 3 2**	**40**

Soln:

Class interval	Frequency	Cumulative frequency
0 – 10	f_1	f_1
10 – 20	5	$5 + f_1$
20 – 30	9	$14 + f_1$
30 – 40	12 (f)	$26 + f_1$
40 – 50	f_2	$26 + f_1 + f_2$
50 – 60	3	$29 + f_1 + f_2$
60 – 70	2	$31 + f_1 + f_2$
	N = 40	

Given

Median = 32.5

The median class = 90 – 40

L = 30, h = 40 – 30 = 10, f = 12, F = 14 + f_1

Median = L+ N2−Ff×h$L + \frac{\frac{N}{2} - F}{f} \times h$

32.5 = 30+ 20−(14+f_1)12 ×1030 + $\frac{20-(14+f_1)}{12} \times 10$

32.5 – 30 = 20−(14+f_1)12 ×10$\frac{20-(14+f_1)}{12} \times 10$

2.5 (12) = (6 – f_1) * 10

30 = (6 – f_1) * 10

3 = 6 – f_1

f_1 = 6 – 3 = 3

Given

Sum of frequencies = 40

f_1 + 5 + 9 + 12 + f_2 + 3 + 2 = 40

3 + 5 + 9 + 12 + f_2 + 3 + 2 = 40

34 + f_2 = 40

f_2 = 40 – 34 = 6

f_1 = 3 and f_2 = 6

15.Compute the median for each of the following data

(i)		**(ii)**	
Marks	**No of students**	**Marks**	**No of students**
Less than 10	**0**	**More than 80**	**150**
Less than 30	**10**	**More than 90**	**141**
Less than 50	**25**	**More than 100**	**124**

Less than 70	**43**	**More than 110**	**105**
Less than 90	**65**	**More than 120**	**60**
Less than 110	**87**	**More than 130**	**27**
Less than 130	**96**	**More than 140**	**12**
Less than 150	**100**	**More than 150**	**0**

Soln:(i)

Marks	No of students	Class interval	Frequency	Cumulative frequency
Less than 10	0	0 – 10	0	0
Less than 30	10	10 – 30	10	10
Less than 50	25	30 – 50	15	25
Less than 70	43	50 – 70	18	43 (F)
Less than 90	65	70 – 90	22 (f)	65
Less than 110	87	90 – 110	22	87
Less than 130	96	110 – 130	9	96
Less than 150	100	130 – 150	4	100
			N = 100	

We have

N = 100

N/ 2 = 100/ 2 = 50

The cumulative frequency just greater than N/ 2 is 65 then median class is 70 – 90 such that

L = 70, h = 90 – 70 = 20, f = 22, F = 43

Median = L+ N2−Ff×h$L + \frac{\frac{N}{2} - F}{f} \times h$

= 70+ 50−4322×2070 + $\frac{50-43}{22} \times 20$

= 70+ 7×2022 70 + $\frac{7 \times 20}{22}$

= 70 + 6.36

= 76.36

(ii)

Marks	No of students	Class interval	Frequency	Cumulative frequency
More than 80	150	80 – 90	9	9
More than 90	141	90 – 100	17	26
More than 100	124	100 – 110	19	45 (F)
More than 110	105	110 – 120	45 (f)	90
More than 120	60	120 – 130	33	123
More than 130	27	130 – 140	15	138
More than 140	12	140 – 150	12	150
More than 150	0	150 – 160	0	150
			N = 150	

We have

N = 150

N/ 2 = 150/ 2 = 75

The cumulative frequency just more than N/ 2 is 90 then the median class is 110 – 120 such that

L = 70, h = 120 – 110 = 10, f = 45, F = 45

Median = L+ N2−Ff×h$L + \frac{\frac{N}{2} - F}{f} \times h$

= 110+ 75−4545 ×10$110 + \frac{75-45}{45} \times 10$

= 110+ 30×1045 $110 + \frac{30 \times 10}{45}$

= 110 + 6.67

= 116.67

16.A survey regarding the height (in cm) of 51 girls of class X of a school was conducted and the following data was obtained:

Height in cm	**number of girls**
Less than 140 **Less than 145** **Less than 150** **Less than 155** **Less than 160** **Less than 165**	**4** **11** **29** **40** **46** **51**

Find the median height.

Soln: To calculate the median height, we need to find the class intervals and their corresponding frequencies.

The given distribution being of the less than type, 140, 145, 150, 155, 160, 165 give the upper limits of the corresponding class intervals. So, the classes should be below 140, 140-145, 145-150, 150-155, 155-160, 160-165. Observe that from the given distribution, we find that there are 4 girls with height less than 140, i.e. the frequency of class interval below 140 is 4. Now, there are 11 girls with heights less than 145 and 4 girls with height less than 140. Therefore, the number of girls with height in the interval 140 – 145 is 11 – 4 = 7. Similarly, the frequency of 145 – 150 is 29 – 11 = 18, for 150 – 155, it is 40 – 29 = 11, and so on. So, our frequency distribution table with given cumulative frequencies becomes:

Class interval	Frequency	Cumulative frequency
Below 140	4	4
140 – 145	7	11
145 – 150	18	29
150 – 155	11	40
155 – 160	6	46
160 – 165	5	51

Now n = 51. S0, n/ 2 = 51/ 2 =25.5 this observation lies in the class 145 – 150

Then,

L (the lower limit) = 145

cf (the cumulative frequency of the class preceding 145 – 150) = 11

f (the frequency of the median class 145 – 150) = 18

h (the class size) = 5

Using the formula, median = l+(n2−cff)×hl + $\left(\frac{\frac{n}{2}-cf}{f}\right) \times h$, we have

Median = Missing close brace Missing close brace

= 145 + 72.5/ 18 = 149.03

So, the median height of the girls is 149.03 cm

This means that the height of about 50% of the girls in less than this height, and 50% are taller than this height.

17.A life insurance agent found the following data for distribution of ages of 100 policy holders. Calculate the median age, if policies are only given to persons having age 18 years onwards but less than 60 years.

Ages in years	Number of policy holders
Below 20	2
Below 25	6
Below 30	24
Below 35	45
Below 40	78
Below 45	89
Below 50	92
Below 55	98
Below 60	100

Soln: Here class width is not same. There is no need to adjust the frequencies according to class interval. Now given frequencies table is less type represented with upper class limits. As policies were given only to persons having age 18 years onwards but less than 60 years we can define class intervals with their respective cumulative frequency as below.

Age (in years)	Number of policy holders f_i	Cumulative frequency (cf)
18 – 20	2	2
20 – 25	6 – 2 = 4	6
25 – 30	24 – 6 = 18	24
30 – 35	45 – 24 = 21	45
35 – 40	78 – 45 = 33	78
40 – 45	89 – 78 = 11	89
45 – 50	92 – 89 = 3	92
50 – 55	98 – 92 = 6	98
55 – 60	100 – 98 = 2	100
Total		

Now from table we may observe that n = 100

Cumulative frequency (cf) just greater than n/ 2 (i.e. 100/ 2 = 50) is 78 belonging to interval 35 – 40

So median class = 35 – 40

Lower limit (l) of median class = 35

Class size (h) = 5

Frequency (f) of median class = 33

Cumulative frequency (cf) of class preceding median class = 45

Median = $l+\left(\frac{n}{2}-cf\right)\times h l + \left(\frac{\frac{n}{2}-cf}{f}\right) \times h$

= $35+\left(\frac{50-45}{33}\right)\times 535 + \left(\frac{50-45}{33}\right) \times 5$

$= 35 + \frac{25}{33} \times 35$

= 35.76

So median age is 35.76 years

18.The lengths of 40 leaves of a plant are measured correct to the nearest millimeter, and the data obtained is represented in the following table:

Length (in mm)	**No of leaves**
118 – 126	**3**
127 – 135	**5**
136 – 144	**9**
145 – 153	**12**
154 – 162	**5**
163 – 171	**4**
172 – 180	**2**

Find the mean length of life

Soln: The given data is not having continuous class intervals. We can observe the difference between two class intervals is 1. So we have to add and subtract

1/ 2 = 0.5 to upper class limits and lower class limits

Now continuous class intervals with respective cumulative frequencies can be represented as below:

Length (in mm)	Number of leaves f_i	Cumulative frequency (cf)
117.5 – 126.5	3	3
126.5 – 135.5	5	8
135.5 – 144.5	9	17
144.5 – 153.5	12	29
153.5 – 162.5	5	34
162.5 – 171.5	4	38

171.5 – 180.5	2	40

From the table we may observe that cumulative frequency just greater then n/ 2 (i.e. 40/ 2 =20) is 29, belongs to class interval 144.5 – 153.5

Median class = 144.5 – 153.5

Lower limit (l) = 144.5

Class size (h) = 9

Frequency (f) of median class = 12

Cumulative frequency (cf) of class preceding median class = 17

Median = l+(n2−cff)×hl + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h

= 144.5+(20−1712)×9)144.5 + \left(\frac{20 - 17}{12} \right) \times 9)

= 144.5 + 9/ 4 = 146.75

So median length of leaves is 146.75mm

19.An incomplete distribution is given as follows:

Variable:	**0-10**	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**
Frequency:	**10**	**20**	**?**	**40**	**?**	**25**	**15**

You are given that the median value is 35 and sum is all the frequencies are 170. Using the median formula, fill up the missing frequencies

Soln:

Class interval	Frequency	Cumulative frequency
0 – 10	10	10
10 – 20	20	30
20 – 30	f_1	30 + f_1 (F)
30 – 40	40 (F)	70 + f_1
40 – 50		

	f_2	$70 + f_1 + f_2$
50 – 60	25	$95 + f_1 + f_2$
60 – 70	15	$110 + f_1 + f_2$
	N = 170	

Given

Median = 35

Then median class = 30 – 40

L = 30, h = 40 – 30 = 10, f = 40, F = $30 + f_1$

Median = $L + \frac{\frac{N}{2} - F}{f} \times h$

$35 = 30 + \frac{85 - (30 + f_1)}{40} \times 10$

$35 - 30 = \frac{85 - 30 - f_1}{40} \times 10$

$5 = \frac{55 - f_1}{4}$

$20 = 55 - f_1$

$f_1 = 55 - 20 = 35$

Given

Sum of frequencies = 170

$10 + 20 + f_i + 40 + f_2 + 25 + 15 = 170$

$10 + 20 + 35 + 40 + f_2 + 25 + 15 = 170$

$f_2 = 25$

$f_1 = 35$ and $f_2 = 25$

Exercise 7.5: Statistics

1. Find the mode of the following data:

(i) 3, 5, 7, 4, 5, 3, 5, 6, 8, 9, 5, 3, 5, 3, 6, 9, 7, 4

(ii) 3, 3, 7, 4, 5, 3, 5, 6, 8, 9, 5, 3, 5, 3, 6, 9, 7, 4

(iii) 15, 8, 26, 25, 24, 15, 18, 20, 24, 15, 19, 15

Soln:

(i)

Value (x)	3	4	5	6	7	8	9
Frequency (f)	4	2	5	2	2	1	2

Mode = 5 because it occurs the maximum number of times.

(ii)

Value (x)	3	4	5	6	7	8	9

Frequency (f)	**5**	**2**	**4**	**2**	**2**	**1**	**2**

Mode = 3 because it occurs maximum number of times.

(iii)

Value (x)	8	15	18	19	20	24	25	26
Frequency (f)	1	4	1	1	1	2	1	1

Mode = 15 because it occurs maximum number of times.

2. The shirt size worn by a group of 200 persons, who bought the shirt from a store, are as follows:

Shirt size:	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**
Number of persons:	**15**	**25**	**39**	**41**	**36**	**17**	**15**	**12**

Find the model shirt size worn by the group.

Soln:

Shirt size	37	38	39	40	41	42	43	44
Number of persons	15	25	39	41	36	17	15	12

Model shirt size = 40 because it occurs maximum number of times.

3. Find the mode of the following distribution.

(i)

Class interval:	**0-10**	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**	**70-80**
Frequency:	**5**	**8**	**7**	**12**	**28**	**20**	**10**	**10**

(ii)

Class interval:	**10-15**	**15-20**	**20-25**	**25-30**	**30-35**	**35-40**
Frequency:	**30**	**45**	**75**	**35**	**25**	**15**

(iii)

Class interval:	**25-30**	**30-35**	**35-40**	**40-45**	**45-50**	**50-60**
Frequency:	**25**	**34**	**50**	**42**	**29**	**15**

Soln:

(i)

Class interval	0 – 10	10–20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	5	8	7	12	28	20	10	10

Here the maximum frequency is 28 then the corresponding class 40 – 52 is the modal class

l = 40, h = 50 – 40 = 10, f = 28, f_1 = 12, f_2 = 20

Mode = l+f–f1 2f–f1–f2 ×h$l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= 40+28−122×28–12–20×1040 + $\frac{28-12}{2\times28-12-20} \times 10$

= 40 + 160/ 24

= 40 + 6.67

= 46.67

(ii)

Class interval	10-15	15–20	20-25	25-30	30-35	35-40
Frequency	30	45	75	35	25	15

Here the maximum frequency is 75, then the corresponding class 20 – 25 is the modal class

l = 20, h = 25 – 20 = 5, f = 75, f_1 = 45, f_2 = 35

Mode = $l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= $20 + \frac{75-45}{2\times75-45-35} \times 5$

= 20 + 150/ 70

= 20 + 2.14

= 22.14

(iii)

Class interval	25-30	30-35	35-40	40-45	45-50	50-60
Frequency	25	34	50	42	38	14

Here the maximum frequency is 50 then the corresponding class 35 – 40 is the modal class

l = 35, h = 40 – 35 = 5, f = 50, f_1 = 34, f_2 = 42

Mode = $l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= $35 + \frac{50-34}{2\times50-34-42} \times 5$

= 35 + 80/24

= 35 + 3.33

= 38.33

4.Compare the modal ages of two groups of students appearing for an entrance test:

Age (in years):	**16–18**	**18–20**	**20–22**	**22–24**	**24–26**
Group A:	**50**	**78**	**46**	**28**	**23**
Group B:	**54**	**89**	**40**	**25**	**17**

Soln:

Age in years	16-18	18-20	20-22	22-24	24-26
Group A	50	78	46	28	23
Group B	54	89	40	25	17

For Group A

Here the maximum frequency is 78, then the corresponding class 18 – 20 is model class

l = 18, h = 20 – 18 = 2, f = 78, f_1 = 50, f_2 = 46

Mode = $l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= $18 + \frac{78-50}{2\times78-50-46} \times 2$

= 18 + 56/ 60

= 18 + 0.93

= 18.93 years

For group B

Here the maximum frequency is 89, then the corresponding class 18 – 20 is the modal class

l = 18, h = 20 – 18 = 2, f = 89, f_1 = 54, f_2 = 40

Mode = $l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= $18 + \frac{89-54}{2\times89-54-40} \times 2$

= 18 + 70/ 84

= 18+ 0.83

= 18.83 years

Hence the modal age for the Group A is higher than that for Group B

5.The marks in science of 80 students of class X are given below. Find the mode of the marks obtained by the students in science.

Marks:	**0-10 10-20 20-30 30-40 40-50 50-60 60-70 70-80 80-90 90-100**
Frequency:	**3 5 16 12 13 20 5 4 1 1**

Soln:

Marks	0 – 10	10– 20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	3	5	16	12	13	20	5	4	1	1

Here the maximum frequency is 20, then the corresponding class 50 – 60 is the modal class

l = 50, h = 60 – 50 = 10, f = 20, f_1 = 13, f_2 = 5

Mode = l+f–f₁2f–f₁–f₂×h$l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= 50+20–132×20–13–5×1050 + $\frac{20-13}{2\times 20-13-5} \times 10$

= 50 + 70/ 22

= 50 + 3.18

= 53.18

6.The following is the distribution of height of students of a certain class in a city:

Height (in cm):	**160-162 163-165 166-168 169-171 172-174**
No of students:	**15 118 142 127 18**

Find the average height of maximum number of students.

Soln:

Heights(exclusive)	160-162	163-165	166-168	169-171	172-174
Heights (inclusive)	159.5-162.5	162.5-165.5	165.5-168.5	168.5-171.5	171.5-174.5
No of students	15	118	142	127	18

Here the maximum frequency is 142, then the corresponding class 165.5 – 168.5 is the modal class

l = 165.5, h = 168.5 – 165.5 = 3, f = 142, f_1 = 118, f_2 = 127

Mode = l+f–f1 2f–f1–f2 ×h$l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= 165.5+ 142–118 2×142–118–127 ×3$165.5 + \frac{142-118}{2\times142-118-127} \times 3$

= 165.5 + 72/ 39

= 165.5 + 1.85

= 167.35 cm

7.The following table shows the ages of the patients admitted in a hospital during a year:

Ages (in years):	**5-15**	**15-25**	**25-35**	**35-45**	**45-55**	**55-65**
No of students:	**6**	**11**	**21**	**23**	**14**	**5**

Find the mode and the mean of the data given above. Compare and interpret the two measures of central tendency.

Soln: We may compute class marks (xi) as per the relation

x_i = upperclasslimit+lowerclasslimit2 $\frac{upperclasslimit+lowerclasslimit}{2}$

Now taking 30 as assumed mean (a) we may calculate d_i and f_id_i as follows.

Age (in years)	Number of patients f_i	Class marks x_i	$d_i = x_i – 275$	f_id_i
5 – 15	6	10	-20	-120

15 – 25	11	20	-10	-110
25 – 35	21	30	0	0
35 – 45	23	40	10	230
45 – 55	14	50	20	280
55 – 65	5	60	30	150
Total	80			430

From the table we may observe that

Σf_i = 80

$\Sigma f_i d_i$ = 430

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

30 + 430/ 80

30 + 5.375

35.375

≈ 35.38

Clearly, mean of this data is 35.38. It represents that on an average the age of a patients admitted to hospital was 35.38 years.

As we may observe that maximum class frequency is 23 belonging to class interval 35 – 45

So, modal class = 35 – 45

Lower limit (l) of modal class = 35

Frequency (f) of modal class = 23

Class size (h) = 10

Frequency (f_1) of class preceding the modal class = 21

Frequency (f_2) of class succeeding the modal class = 14

Mode = $l + \frac{f - f_1}{2f - f_1 - f_2} \times h$

= 35+ 23–212×23–21–14 ×1035 + $\frac{23-21}{2\times23-21-14}$ × 10

= 35+ 246–35 ×1035 + $\frac{2}{46-35}$ × 10

= 35 + 1.81

= 36.8

Clearly mode is 36.8. It represents that maximum number of patients admitted in hospital were of 36.8 years.

8.The following data gives the information on the observed lifetimes (in hours) of 225 electrical components:

Lifetimes (in hours):	**0-20**	**20-40**	**40-60**	**60-80**	**80-100**	**100-120**
No of components:	**10**	**35**	**52**	**61**	**38**	**29**

Determine the modal lifetimes of the components.

Soln: From the data given as above we may observe that maximum class frequency is 61 belonging to class interval 60 – 80

So, modal class limit (l) of modal class = 60

Frequency (f) of modal class = 61

Frequency (f_1) of class preceding the modal class = 52

Frequency (f_2) of class succeeding the modal class = 38

Class size (h) = 20

Mode = l+ f–f$_1$2f–f$_1$–f$_2$ ×hl + $\frac{f-f_1}{2f-f_1-f_2}$ × h

= 60+ 61–522×61–52–38 ×2060 + $\frac{61-52}{2\times61-52-38}$ × 20

= 60+ 9122–90 ×2060 + $\frac{9}{122-90}$ × 20

= 60+ 9×2032 60 + $\frac{9\times20}{32}$

= 60 + 90/16

= 60 + 5.625

= 65.625

So, modal lifetime of electrical components is 65.625 hours

9.The following table gives the daily income of 50 workers of a factory:

Daily income	**100 – 120**	**120 – 140**	**140 – 160**	**160 – 180**	**180 – 200**
Number of workers	**12**	**14**	**8**	**6**	**10**

Find the mean, mode and median of the above data.

Soln:

Class interval	Mid value (x)	Frequency (f)	fx	Cumulative frequency
100 – 120	110	12	1320	12
120 – 140	130	14	1820	26
140 – 160	150	8	1200	34
160 – 180	170	6	1000	40
180 – 200	190	10	1900	50
		N = 50	ΣfxΣfx = 7260	

Mean = Σfx50 $\frac{\Sigma fx}{50}$ = 145.2

We have,

N = 50

Then, N/2 = 50/2 = 25

The cumulative frequency just greater than N/ 2 is 26, then the median class is 120 – 140 such that

l = 120, h = 140 – 120 = 20, f = 14, F = 12

Median = $l + \frac{\frac{N}{2} - F}{f} \times h$

= $120 + \frac{25 - 12}{14} \times 20$

= 120 + 260/ 14

= 120 + 18.57

= 138.57

Here the maximum frequency is 14, then the corresponding class 120 – 140 is the modal class

l = 120, h = 140 – 120 = 20, f = 14, f_1 = 12, f_2 = 8

Mode = $l + \frac{f - f_1}{2f - f_1 - f_2} \times h$

= $120 + \frac{14 - 12}{2 \times 14 - 12 - 8} \times 20$

= 120 + 40/ 8

= 120 + 5

= 125

10.The following distribution gives the state-wise teachers-students ratio in higher secondary schools of India. Find the mode and mean of this data. Interpret the two measures:

Number of students per teacher	Number of states/ U.T	Number of students per teacher	Number of states/ U.T
15 – 20	3	35 – 40	3
20 – 25	8	40 – 45	0
25 – 30	9	45 – 50	0

30 – 35	**10**	**50 – 55**	**2**

Soln: WE may observe from the given data that maximum class frequency is 10 belonging to class interval 30 – 35.

So, modal class = 30 – 35

Class size (h) = 5

Lower limit (l) of modal class = 30

Frequency (f) of modal class = 10

Frequency (f_1) of class preceding modal class = 9

Frequency (f_2) of class succeeding modal class = 3

Mode = l+f–f$_1$2f–f$_1$–f$_2$×h$l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= 30+10–92×10–9–3×530 $+ \frac{10-9}{2\times10-9-3} \times 5$

= 30+120–12×530 $+ \frac{1}{20-12} \times 5$

= 30 + 5/8

= 30.625

Mode = 30.6

It represents that most of states/ U.T have a teacher- student ratio as 30.6

Now we may find class marks by using the relation

Class mark = upperclasslimit+lowerclasslimit2 $\frac{upperclasslimit+lowerclasslimit}{2}$

Now taking 32.5 as assumed mean (a) we may calculate d_i, u_i, and f_iu_i as following

Number of students per teacher	Number of states/ U.T (f_i)	x_i	$d_i = x_i - 32.5$	U_i	f_iu_i
15 – 20	3	17.5	-15	-3	-9
20 – 25	8	22.5	-10	-2	-16
25 – 30	9	27.5	-5	-1	-9

30 – 35	10	32.5	0	0	0
35 – 40	3	37.5	5	1	3
40 – 45	0	42.5	10	2	0
45 – 50	0	47.5	15	3	0
50 – 55	2	52.5	20	4	8
Total	35				-23

Now Mean $\bar{x}=a+\frac{\Sigma f_i d_i}{\Sigma f_i}\times h$ $\bar{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i} \times h$

$= 32.5+\frac{-23}{35}\times 5 = 32.5 + \frac{-23}{35} \times 5$

= 32.5 – 23/7

= 32.5 – 3.28

= 29.22

So mean of data is 29.2

It represents that on an average teacher-student ratio was 29.2

11. Find the mean, median and mode of the following data:

Classes:	**0 – 50**	**50 – 100**	**100 – 150**	**150 – 200**	**200 – 250**	**250 – 300**	**300 – 350**
Frequency:	**2**	**3**	**5**	**6**	**5**	**3**	**1**

Soln:

Class interval	Mid value (x)	Frequency (f)	fx	Cumulative frequency
0 – 50	35	2	50	2
50 – 100	75	3	225	5
100 – 150	125	5	625	10

150 – 200	175	6	1050	16
200 – 250	225	5	1127	21
250 – 300	275	3	825	24
300 – 350	325	1	325	25
		N = 25	$\Sigma fx\Sigma fx$ = 4225	

Mean = ΣfxN =422525 $\frac{\Sigma fx}{N} = \frac{4225}{25}$ = 169

We have,

N = 25

Then, N/ 2 =25/ 2 = 12.5

The cumulative frequency just greater than N/2 is 16, then the median class is 150 – 200 such that

l = 150, h = 200 – 150 = 50, f = 6, F = 10

Median = l+ N2−Ff×h$l + \frac{\frac{N}{2} - F}{f} \times h$

= 150+ 12.5−106×50$150 + \frac{12.5-10}{6} \times 50$

= 150 + 125/ 6

= 150 + 20.83

= 170.83

Here the maximum frequency is 6, then the corresponding class 150 – 200 is the modal class

l = 150, h = 200 – 150 = 50, f = 6, f_1 = 5, f_2 = 5

Mode = l+ f–f1 2f–f1–f2 ×h$l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= 150+ 6–52×6–5–5×50$150 + \frac{6-5}{2\times6-5-5} \times 50$

= 150 + 50/ 2

= 150 + 25

= 175

12.A students noted the number of cars pass through a spot on a road for 100 periods each of 3 minute and summarized it in the table given below. Find the mode of the data.

Soln: From the given dat6a we may observe that maximum class frequency is 20 belonging to 40 – 50 class intervals.

So, modal class = 40 – 50

Lower limit (l) of modal class = 40

Frequency (f) of modal class = 20

Frequency (f_1) of class preceding modal class = 12

Frequency (f_2) of class succeeding modal class = 11

Class size = 10

Mode = $l + \frac{f - f_1}{2f - f_1 - f_2} \times h$

$= 40 + \frac{20 - 12}{2(20) - 12 - 11} \times 10$

$= 40 + \frac{80}{40 - 23}$

= 40 + 80/ 17

= 40 + 4.7

= 44.7

So mode of this data is 44.7 cars

13.The following frequency distribution gives the monthly consumption of electricity of 68 consumers of a locality. Find the median, mean and mode of the data and compare them.

Monthly consumption:	**65-85**	**85-105**	**105-125**	**125-145**	**145-165**	**165-185**	**185-205**
No of consumers:	**4**	**5**	**13**	**20**	**14**	**8**	**4**

Soln:

Class interval	Mid value x_i	Frequency f_i	Fx	Cumulative frequency
65 – 85	75	4	300	4
85 – 105	95	5	475	9
105 – 125	115	13	1495	22
125 – 145	135	20	2700	42
145 – 165	155	14	2170	56
165 – 185	175	8	1400	64
185 – 205	195	4	780	68
		N = 68		ΣfxΣfx = 9320

Mean = ΣfxN =932068=137.05$\frac{\Sigma fx}{N} = \frac{9320}{68} = 137.05$

We have, N = 68

N/ 2 = 68/ 2 = 34

The cumulative frequency just greater than N/ 2 is 42 then the median class is 125 – 145 such that

l = 125, h = 145 – 125 = 20, f = 20, F = 22

Median = l+ N2−Ff×h$l + \frac{\frac{N}{2} - F}{f} \times h$

= 125+34−2220×20125 + $\frac{34-22}{20} \times 20$

= 125 + 12

= 137

Here the maximum frequency is 20, then the corresponding class 125 – 145 is the modal class

l = 125, h = 145 – 125 = 20, f = 20, f_1 = 13, f_2 = 14

Mode = l+f–f₁2f–f₁–f₂×hl + $\frac{f-f_1}{2f-f_1-f_2} \times h$

= 125+20–132(20)–13–14×20125 + $\frac{20-13}{2(20)-13-14} \times 20$

= 125 + 140/ 13

= 135.77

14.100 surnames were randomly picked up from a local telephone directly and the frequency distribution of the number of letter English alphabets in the surnames was obtained as follows:

Number of letters:	**1-4**	**4-7**	**7-10**	**10-13**	**13-16**	**16-19**
Number surnames:	**6**	**30**	**40**	**16**	**4**	**4**

Determine the median number of letters in the surnames. Find the mean number of letters in the surnames. Also, find the modal size of the surnames.

Soln:

Class interval	Mid value (x)	Frequency (f)	fx	Cumulative frequency
1 – 4	2.5	6	15	6
4 – 7	5.5	30	165	36
7 – 10	8.5	40	340	76
10 – 13	11.5	16	184	92
13 – 16	14.5	4	58	96

16 – 19	17.5	4	70	100
		N = 100	ΣfxΣfx = 832	

Mean = ΣfxN =832100=8.32$\frac{\Sigma fx}{N} = \frac{832}{100} = 8.32$

We have,

N = 100

N/ 2 = 100/ 2 = 50

The cumulative frequency just greater than N/ 2 is 76, then the median class is 7 – 10 such that

l = 7, h = 10 – 7 = 3, f = 40, F = 36

Median = l+ N2−Ff×h$l + \frac{\frac{N}{2} - F}{f} \times h$

= 7+50−3640×37 + $\frac{50-36}{40} \times 3$

= 7 + 52/ 40

= 7 + 1.05

= 8.05

Here the maximum frequency is 40, then the corresponding class 7 – 10 is the modal class

l = 7, h = 10 – 7 = 3, f = 40, f_1 = 30, f_2 = 16

Mode = l+ f–f1$_2$f–f$_1$–f$_2$ ×h$l + \frac{f - f_1}{2f - f_1 - f_2} \times h$

= 7+40–302×40–30–16×37 + $\frac{40-30}{2\times 40-30-16} \times 3$

= 7 + 30/ 34

= 7 + 0.88

= 7.88

15.Find the mean, median and mode of the following data:

Class	**0 – 20**	**20 – 40**	**40 – 60**	**60 – 80**	**80 – 100**	**100 – 120**	**120 – 140**
Frequency	**6**	**8**	**10**	**12**	**6**	**5**	**3**

Soln:

Class interval	Mid value (x)	Frequency (f)	fx	Cumulative frequency
0 – 20	10	6	60	6
20 – 40	30	8	240	17
40 – 60	50	10	500	24
60 – 80	70	12	840	36
80 – 100	90	6	540	42
100 – 120	110	5	550	47
120 – 140	130	3	390	50
		N = 50	Σfx = 3120	

Mean = ΣfxN =312050=62.4$\frac{\Sigma fx}{N} = \frac{3120}{50} = 62.4$

We have,

N = 50

Then, N/ 2 = 50/ 2 = 25

The cumulative frequency just greater than N/ 2 is 36, then the median class is 60 – 80 such that

l = 60, h = 80 – 60 = 20, f = 12, F = 24

Median = l+ N2−Ff×h$l + \frac{\frac{N}{2} - F}{f} \times h$

= 60+25−2412×20$60 + \frac{25-24}{12} \times 20$

= 60 + 20/ 12

= 60 + 1.67

= 61.67

Here the maximum frequency is 12, then the corresponding class 60 – 80 is the modal class

l = 60, h = 80 – 60 = 20, f = 12, f_1 = 10, f_2 = 6

Mode = l+ f–f1 2f–f1–f2 ×h $l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= 60+ 12–10 2×12–10–6 ×20 $60 + \frac{12-10}{2\times12-10-6} \times 20$

= 60 + 40/ 8

= 65

16.The following data gives the distribution of total monthly household expenditure of 200 families of a village. Find the modal monthly expenditure of the families. Also, find the mean monthly expenditure:

Expenditure	Frequency	Expenditure	Frequency
1000-1500	24	3000-3500	30
1500-2000	40	3500-4000	22
2000-2500	33	4000-4500	16
2500-3000	28	4500-5000	7

Soln: We may observe from the given data that maximum class frequency is 40 belonging to 1500 -200 intervals

So, modal class = 1500 -2000

Lower limit (l) of modal class = 1500

Frequency (f) of modal class = 40

Frequency (f_1) of class preceding modal class = 24

Frequency (f_2) of class succeeding modal class = 33

Class size (h) = 500

Mode = l+ f–f₁2f–f₁–f₂ ×hl + $\frac{f-f_1}{2f-f_1-f_2} \times h$

= 1500+ 40–242×40–24–33 ×5001500 + $\frac{40-24}{2\times40-24-33} \times 500$

= 1500+ 1680–57 ×5001500 + $\frac{16}{80-57} \times 500$

= 1500 + 347.826

= 1847.826 ≈ 1847.83

So modal monthly expenditure was Rs. 1847.83

Now we may find class mark as

Class mark = upperclasslimit+lowerclasslimit2 $\frac{upperclasslimit+lowerclasslimit}{2}$

Class size (h) of given data = 500

Now taking 2750 as assumed mean (a) we may calculate d_i u_i as follows:

Expenditure (in Rs)	Number of families f_i	x_i	$d_i = x_i - 2750$	U_i	f_iu_i
1000-1500	24	1250	-1500	-3	-72
1500-2000	40	1750	-1000	-2	-80
2000-2500	33	2250	-500	-1	-33
2500-3000	28	2750	0	0	0
3000-3500	30	3250	500	1	30
3500-4000	22	3750	1000	2	44
4000-4500	16	4250	1500	3	48
4500-5000	7	4750	2000	4	28
Total	200				-35

Now from table may observe that

ΣfiΣf_i = 200

$\Sigma f_i d_i$ = -35

Mean $\bar{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i} \times h$

$\bar{x} = 2750 + \frac{-35}{200} \times 500$

$\bar{x}$ = 2750 – 87.5

$\bar{x}$ = 2662.5

So mean monthly expenditure was Rs. 2662.5

17.The given distribution shows the number of runs scored by some top batsmen of the world in one day international cricket matches.

Runs scored	No of batsmen	Runs scored	No of batsmen
3000 – 4000	4	7000 – 8000	6
4000 – 5000	18	8000 – 9000	3
5000 – 6000	9	9000 – 10000	1
6000 – 7000	7	10000 – 11000	1

Find the mode of the data.

Soln: From the given data we may observe that maximum class frequency is 18 belonging to class interval 4000 – 5000.

So, modal class = 4000 – 5000

Lower limit (l) of modal class = 4000

Frequency (f) of modal class = 18

Frequency (f_1) of class preceding modal class = 4

Frequency (f_2) of class succeeding modal class = 9

Class size (h) = 1000

Now mode = $l + \frac{f - f_1}{2f - f_1 - f_2} \times h$

$= 4000 + \frac{18-4}{2(18)-4-9} \times 1000 4000 + \frac{18-4}{2(18)-4-9} \times 1000$

= 4000 + (14000/ 23)

= 4000 + 608.695

= 4608.695

So mode of given data is 4608.7 runs

Exercise 7.6: Statistics

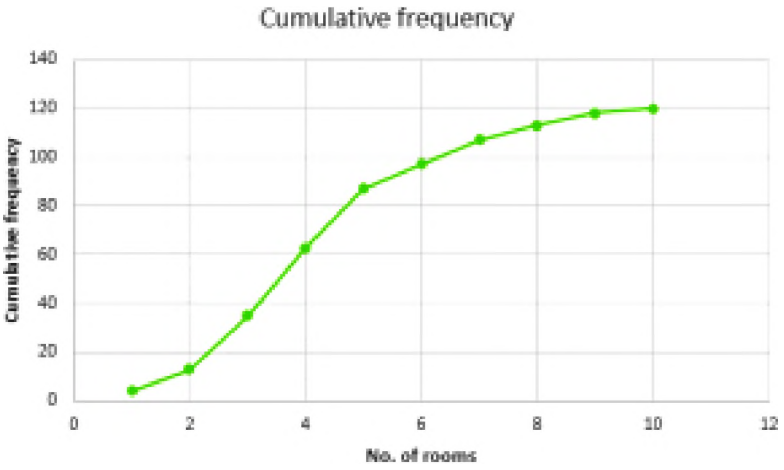
Q.1 Draw an ogive by less than the method for the following data:

No. of rooms	No. of houses
1	4
2	9
3	22
4	28
5	24
6	12
7	8
8	6
9	5
10	2

Soln:

No. of rooms	No. of houses	Cumulative Frequency
Less than or equal to 1	4	4
Less than or equal to 2	9	13
Less than or equal to 3	22	35
Less than or equal to 4	28	63
Less than or equal to 5	24	87
Less than or equal to 6	12	97
Less than or equal to 7	8	107
Less than or equal to 8	6	113
Less than or equal to 9	5	118
Less than or equal to 10	2	120

We need to plot the points (1,4) , (2,3) , (3,35) , (4,63) , (5,87) , (6,99) , (7,107) , (8,113) , (9,118) , (10,120), by taking upper class limit over the x-axis and cumulative frequency over the y-axis.



Q.2): The marks scored by 750 students in an examination are given in the form of a frequency distribution table:

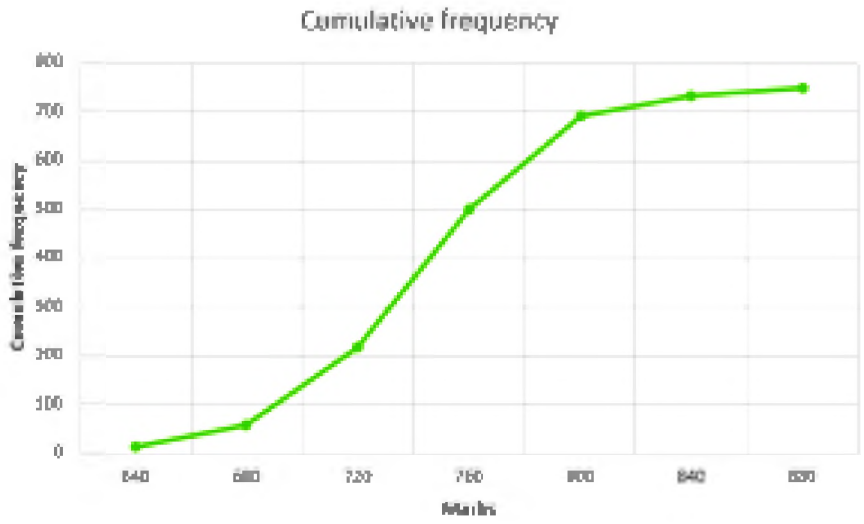
Marks	No. of Students
600-640	

640-680	**16**
680-720	**45**
720-760	**156**
760-800	**284**
800-840	**172**
840-880	**59**
	18

Soln:

Marks	No. of Students	Marks less than	Cumulative Frequency
600-640	16	640	16
640-680	45	680	61
680-720	156	720	217
720-760	284	760	501
760-800	172	800	693
800-840	59	840	732
840-880	18	880	750

Plot the points (640-16), (680, 61), (720,217), (760,501), (800,673), (840,732), (880,750) by taking upper class limit over the x-axis and cumulative frequency over the y-axis.



Q.3) Draw an ogive to represent the following frequency distribution:

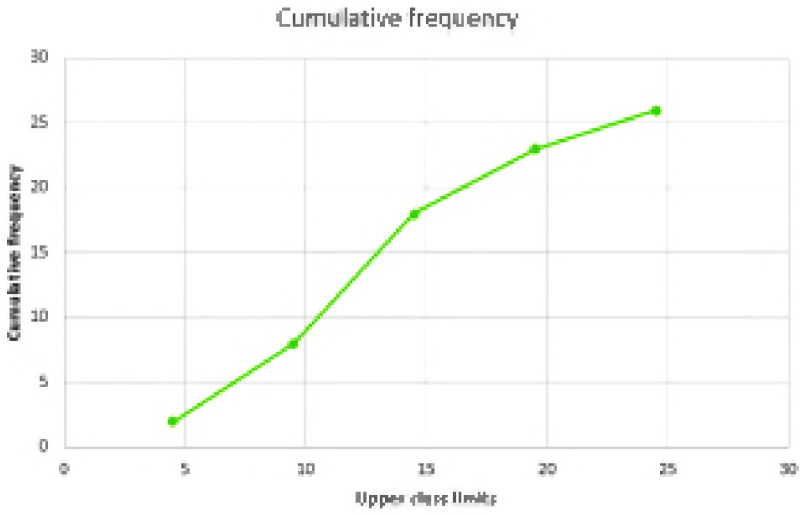
Class-interval	**0-4**	**5-9**	**10-14**	**15-19**	**20-24**
No. of students	**2**	**6**	**10**	**5**	**3**

Soln:

The given frequency distribution is not continuous, so we will first make it continuous and then prepare the cumulative frequency:

Class-interval	No. of Students	Less than	Cumulative frequency
0.5-4.5	2	4.5	2
4.5-9.5	6	9.5	8
9.5-14.5	10	14.5	18
14.5-19.5	5	19.5	23
19.5-24.5	3	24.5	26

Plot the points (4.5, 2), (9.5, 8), (14.5, 18), (19.5, 23), (24.5,26) by taking the upper class limit over the x-axis and cumulative frequency over the y-axis.



Q.4) The monthly profits (in Rs) of 100 shops are distributed as follows:

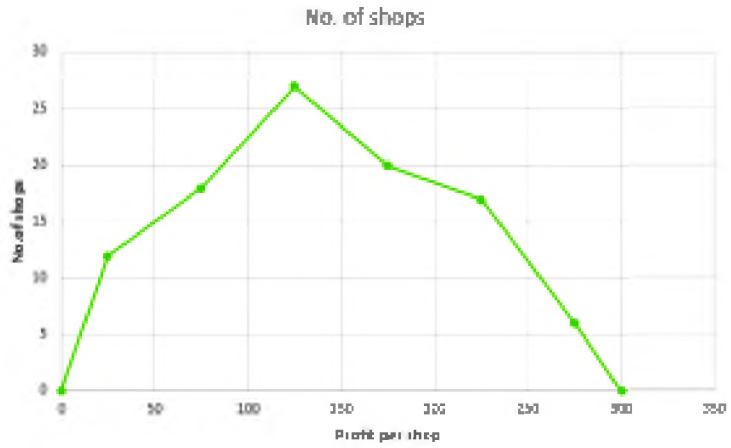
Profits per shop:	**0-50**	**50-100**	**100-150**	**150-200**	**200-250**	**250-300**
No of shops:	**12**	**18**	**27**	**20**	**17**	**6**

Draw the frequency polygon for it

Soln:

We have

Profit per shop	Mid-value	No. of shops
Less than 0	0	0
0-60	25	12
60-120	75	18
120-180	125	27
180-240	175	20
240-300	225	17
300-360	275	6
Above 300	300	0



Q.5) The following distribution gives the daily income of 50 workers of a factory:

Daily income (in Rs):	**100-120**	**120-140**	**140-160**	**160-180**	**180-200**
No of workers:	**12**	**14**	**8**	**6**	**10**

Convert the above distribution to a 'less than' type cumulative frequency distribution and draw its ogive.

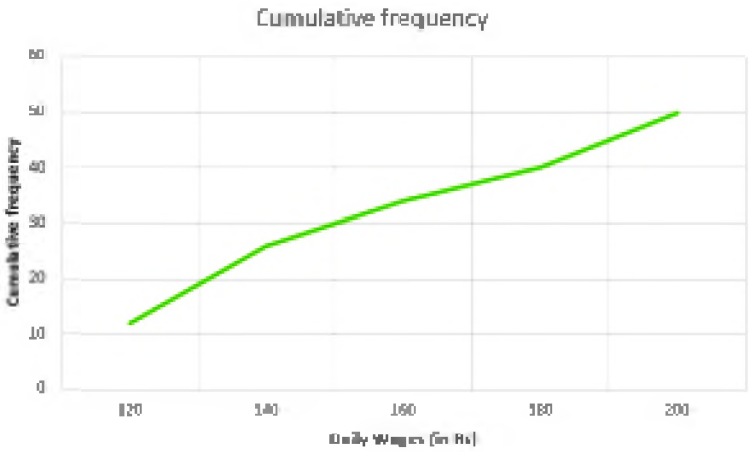
Soln:

We first prepare the cumulative frequency table by less than method as given below

Daily income	Cumulative frequency
<120	12
<140	26
<160	34
<180	40
<200	50

Now we mark on x-axis upper class limit, y-axis cumulative frequencies.

Thus we plot the point (120,12)(140,26)(160,34)(180,40)(200,50).



Q.6) The following table gives production yield per hectare of wheat of 100 farms of a village:

Production yield:	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**75-80 in kg per hectare**
No of farms:		**2**	**8**	**12**	**24**	**38**	**16**

Draw 'less than' ogive and 'more than' ogive

Soln:

Less than method:

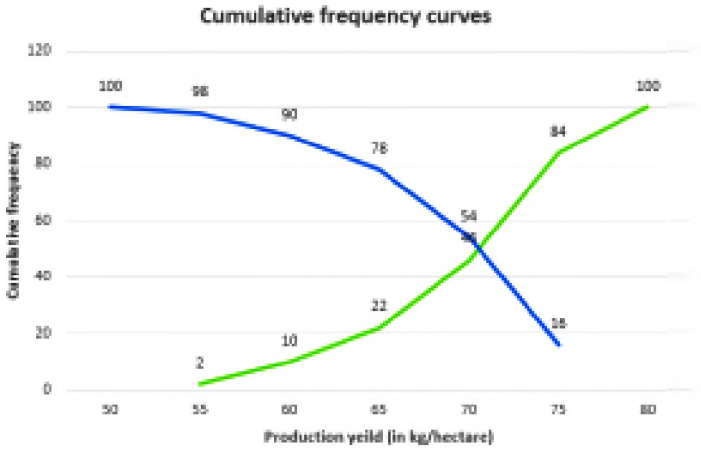
Cumulative frequency table by less than method

Production yield	Number of farms	Production yield more than	Cumulative frequency
50-55	2	55	2
55-60	8	60	10
60-65	12	65	22
65-70	24	70	46
70-80	38	75	84

75-80	16	80	100

Now we mark on x-axis upper class limit, y-axis cumulative frequencies.

We plot the point (50,100) (55, 98) (60, 90) (65, 78) (70, 54) (75, 16)



Q.7)During the medical check-up of 35 students of a class, their weight recorded as follows:

Weight (in kg)	**No of students**
Less than 38	**0**
Less than 40	**3**
Less than 42	**5**
Less than 44	**9**
Less than 46	**14**
Less than 48	**28**
Less than 50	**32**
Less than 52	**35**

Draw a less than type ogive for the given data. Hence, obtain the median weight from the graph and verify the verify the result my **using the formula.**

Soln: Less than method

It is given that

On x-axis upper class limits. Y-axis cumulative frequency

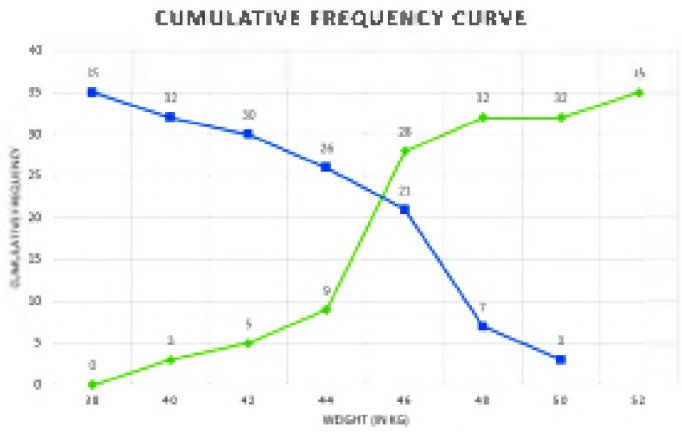
We plot the points (38,0) (40,3)(42,5)(44,9)(46,4)(48,28)(50,32)(52,35)

More than method: cumulative frequency

Weight	No. of students	Weight more than	Cumulative frequency
38-40	3	38	34
40-42	2	40	32
42-44	4	42	30
44-46	5	44	26
46-48	14	46	21
48-50	4	48	7
50-52	3	50	3

X-axis lower class limits on y-axis cf

We plot the points (38,35)(40,32)(42,30)(44,26)(46,26)(48,7)(50,3)



We find the two types of curves intersect at a point P. From point P perpendicular PM is draw on x-axis

The verification,

We have

Weight (in kg)	No. of students	Cumulative frequency

36-38	0	0
38-40	3	3
40-42	2	5
42-44	4	9
44-46	5	28
46-48	14	32
48-50	4	32
50-0	3	35

Now, N = 35

$N2 = 17.5 \frac{N}{2} = 17.5$

The cumulative frequency just greater than $N2 \frac{N}{2}$ is 28 and the corresponding class is 46 – 48

Thus 46 – 48 is the median class such that

L = 46, f = 14, $C_1 C_1$ =14 h = 2

Median = $L + N2 - c_1 f \times h L + \frac{\frac{N}{2} - c_1}{f} \times h$

$= 46 + 17.5 - 1414 \times 246 + \frac{17.5 - 14}{14} \times 2$

= 46 +7/14

46.5

Median = 46.5 kg

Hence verified

Q.9) The following table shows the height of trees:

Height	**No. of trees**
Less than 7	**26**
Less than 14	**57**

Less than 21	**92**
Less than 28	**134**
Less than 35	**216**
Less than 42	**287**
Less than 49	**341**
Less than 56	**360**

Draw 'less than 'ogive and 'more than 'ogive

Soln:

By less than method

Height	No. of trees
Less than 7	26
Less than 14	57
Less than 21	92
Less than 28	134
Less than 35	216
Less than 42	287
Less than 49	341
Less than 56	360

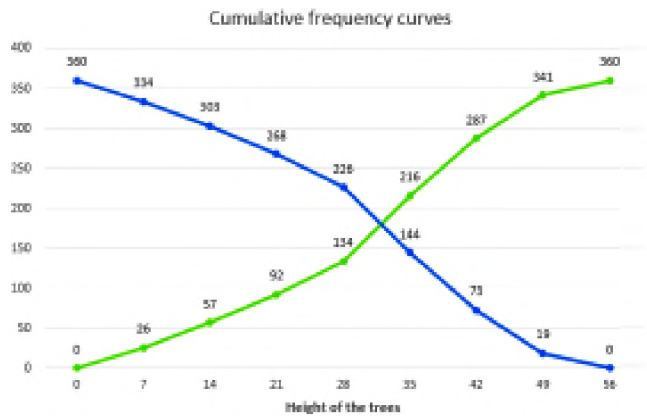
Plot the points (7,26) , (14,57) , (21,92) , (28,134) , (35,216) , (42,287) , (49,341) , (56,360) by taking upper class limit over the x-axis and cumulative frequency over the y-axis.

By more than method:

Height	Frequency	Height more than	C.F.
0-7	26	0	360
7-14	31	5	334
14-21	35	10	303
21-28	42	15	268

28-35	82	20	226
35-42	71	25	144
24-49	54	30	73
49-56	19	35	19

Take lower class limit over the x-axis and CF over the y-axis and plot (0,360) , (7,334) , (14,303) , (21,268) (28,226) , (35,144) , (42,73) , (49,19).



Q.10) The annual profits earned by 30 shops of a shopping complex in a locality give rise to the following distribution:

Profit (In lakhs In Rs)	**Number of shops (frequency)**
More than or equal to 5	**30**
More than or equal to 10	**28**
More than or equal to 15	**16**
More than or equal to 20	**14**
More than or equal to 25	**10**
More than or equal to 30	**7**
More than or equal to 35	**3**

Draw both ogive **for the above data and hence obtain the median.**

Soln:

More than method

Profit (In lakhs in Rs)	Number of shops (frequency)
More than or equal to 5	30
More than or equal to 10	28
More than or equal to 15	16
More than or equal to 20	14
More than or equal to 25	10
More than or equal to 30	7
More than or equal to 35	3

Now, we mark on x-axis lower class limits, y-axis cumulative frequency

Thus, we plot the points (5,30)(10,28)(15,16)(20,14)(25,10)(30,7) and (35,3)

Less than method

Profit in lakhs	No of shops	Profits less than	C.F
0-10	2	10	2
10-15	12	15	14
15-20	2	20	16
20-25	4	25	20
25-30	3	30	23
30-35	4	35	27
35-40	3	40	30

Now we mark the upper class limits along x-axis and cumulative frequency along y-axis.

Thus we plot the points (10,2)(15,14)(20,16)(25,20)(30,23)(35,27)(40,30)

We find that the two types of curves intersect of P from point L it is drawn on x-axis

The value of a profit corresponding to M is 17.5. Hence median is 17.5 lakh

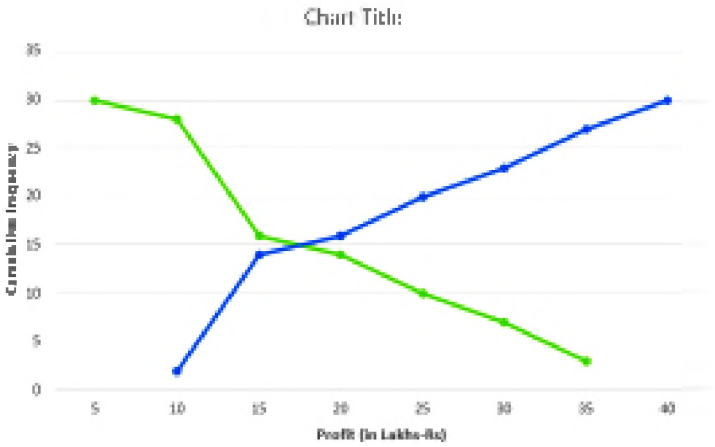


Chart Title
35
30
25
20
15
10
5
0
Cumulative Frequency
5
10
15
20
25
30
35
40
Profit (in Lakhs-Rs)