Chapter 7. Statistics

Exercise 7.1

1.) Calculate the mean for the following distribution.

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

→ We know that, Mean $= \frac{\Sigma fx}{N}$

Hence, we can write

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

Thus,

$\text{Mean} = \frac{\Sigma fx}{N}$

$= \frac{281}{40}$

$\therefore$ Mean = 7.025

2.) Find the mean of following data:

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

→

x	f	fx
19	13	247
21	15	315
23	16	368
25	18	450
27	16	432
29	15	435
31	13	403
	N = 106	$\Sigma fx = 2620$

We know that,

$\text{Mean} = \frac{\Sigma fx}{N}$

$= \frac{2620}{106}$

$\therefore$ Mean = 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

→ Here, Given that Mean = 20.6

But we know that, Mean $= \frac{\Sigma fx}{N}$

x	f	fx
10	3	30
15	10	150
p	25	$25p$
25	7	175
35	5	175
	$N = 50$	$\Sigma fx = 530 + 25p$

Thus, ~~Mean~~ $= \frac{(530 + 25p)}{50}$

$20.6 = (530 + 25p)/50$

$20.6 \times 50 - 530 = 25p$

$p = 500/25$

$\therefore p = 20$

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

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

→ Here, given that Mean = 15

Now,

x	f	fx
5	6	30
10	p	$10p$
15	6	90
20	10	200
25	5	125
	$N = p + 27$	Σfx

$\Sigma fx = 445 + 10p$

We know that,

Mean $= \frac{\Sigma fx}{N} = \frac{(445 + 10p)}{(p + 27)}$

$15 = \frac{(445 + 10p)}{(p + 27)}$

$15p + 405 = 445 + 10p$

$5p = 40$

$\therefore p = 8$

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

→

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

→

x	f	fx
5	2	10
8	5	40
10	8	80
12	22	264
p	7	$7p$
20	4	80
25	2	50
	$N = 50$	Σfx

$\Sigma fx = 524 + 7p$

we already know that,

$\text{Mean} = \frac{\Sigma fx}{N}$

Given that, Mean = 12.58

$12.58 = \frac{(524+7p)}{50}$

$629 = 524 + 7p$

$7p = 629 - 524$

$7p = 105$

$\therefore p = 15$

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

→

x	f	fx
3	6	18
5	8	40
7	15	105
9	p	$9p$
11	8	88
13	4	52
	$N = 41+p$	Σfx

$\Sigma fx = 303 + 9p$

We know that,

$\text{Mean} = \frac{\Sigma fx}{N} = \frac{(303+9p)}{(41+p)}$

But, Given that Mean = 7.68

$7.68 = (303+9p)/(41+p)$

$7.68(41+p) = 303 + 9p$

$7.68p + 314.88 = 303 + 9p$

$1.32p = 11.88$

$\therefore p = 11.88/1.32$

$p = 9$

Exercise 7.2

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.

→ Let, the assumed mean $(A) = 3$

No. of calls (x_i)	No. of intervals (f_i)	$u_i = x_i - A = x_i - 3$	$f_i u_i$
0	15	−3	−45
1	24	−2	−48
2	29	−1	−29
3	46	0	0
4	54	1	54
5	43	2	86
6	39	3	117
	$N = 250$		$\Sigma f_i x_i = 135$

Now, Mean number of calls $= A + \Sigma f_i x_i / N$

$= 3 + 135/250$

$= (750 + 135)/250$

$= 885/250$

$= 3.54$

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 & 5 heads were obtained are shown in the table below. Find the mean of the no. 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

→ Let us consider, Assumed mean $(A) = 2$

No. of heads per toss (x_i)	No. of intervals (f_i)	$u_i = x_i - A = x_i - 2$	$f_i u_i$
0	38	-2	-76
1	144	-1	-144
2	342	0	0
3	287	1	287
4	164	2	328
5	25	3	75
	$N = 1000$		$\Sigma f_i x_i$

Here, $\Sigma f_i x_i = 470$ we know that,

$$\text{Mean no. of heads per toss} = A + \frac{\Sigma f_i x_i}{N}$$

$$= 2 + \frac{470}{1000} = 2 + 0.47$$

$$= 2.470$$

3.) The following table gives the number of branches & no. 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.

Let us consider, the assumed mean $(A) = 4$

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

Average no. of branches per plant $= A + \frac{\Sigma f_i x_i}{N}$

$= 4 + \left(\frac{-77}{200}\right) = 4 - 77/200$

$= (800 - 77)/200$

$= 3.615$

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 no. of children per family.

→ Let us consider, Assumed mean $(A) = 2$

Average no. of children for family $= A + \frac{\Sigma f_i x_i}{N}$

$= 2 + \frac{52}{150}$

$= (300 + 52)/150$

$= (352/150)$

$= 2.35$

No. of children x_i	No. of families f_i	$u_i = x_i - A$ $u_i = x_i - 2$	$f_i u_i$
0	10	-2	-20
1	21	-1	-21
2	55	0	0
3	42	1	42
4	15	2	30
5	7	3	21
	$N = 150$		$\Sigma f_i x_i = 52$

Exercise 7.3

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.

→ Let us consider, The assumed mean $(A) = 275$

$A = 275$ and $h = 50$

Then, Mean $= A + h \Sigma f_i u_i / N$

$= 275 + 50(-35/200)$

$= 275 - 8.75$

Mean $= 266.25$

Class interval	Mean 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	-72
150 - 200	175	-100	-2	40	-80
200 - 250	225	-50	-1	33	-33
250 - 300	275	0	0	28	0
300 - 350	325	50	1	30	30
350 - 400	375	100	2	22	44
400 - 450	425	150	3	16	48
450 - 500	475	200	4	7	28
				$N = 200$	$\Sigma f_i u_i = -35$

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 no. of plants in 200 houses in a locality. Find the mean no. of plants per house.

Number of Plants	0-2	2-4	4-6	6-8	8-10	10-12	12-14
Number of house	1	2	1	5	6	2	3

Which method did you use for finding the mean & why?

→ From given conditions,

To find the class interval, we have

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

Now, we shall find x_i & f_i.

Number of Plants	Number of house (fi)	x_i	$f_i x_i$
0-2	1	1	1
2-4	2	3	6
4-6	1	5	5
6-8	5	7	35
8-10	6	9	54
10-12	2	11	22
12-14	3	13	39
Total	N = 20		$\Sigma f_i x_i = 162$

Here, we can write

$$\text{Mean} = \Sigma f_i x_i / N$$

$$\text{Mean} = 162/20 = 8.1$$

Hence, the mean number of plants in a house is 8.1.
Here, we used the direct method because the values of class mark x_i & f_i is very small.

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

Daily wages (in ₹)	100-120	120-140	140-160	160-180	180-200
No. of workers	12	14	8	6	10

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

→ Let us consider, The assumed mean (A) = 150

Then, A = 150 & h = 20

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

$= 150 + 20 \times (-12/50)$

$= 150 - 24/5$

$= 150 - 4.8$

Mean = 145.2

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

4) Find the mean of each of the following distribution (5-14)

Class interval	0-6	6-12	12-18	18-24	24-30
frequency	6	8	10	9	7

→ Let us consider, Assumed mean $(A) = 15$

Class interval	Midvalue (x_i)	$d_i = x_i - 15$	$u_i = (x_i - 15)/6$	f_i	$f_i u_i$
0 - 6	3	-12	-2	6	-12
6 - 12	9	-6	-1	8	-8
12 - 18	15	0	0	10	0
18 - 24	21	6	1	9	9
24 - 30	27	12	2	7	14
				N = 40	$\Sigma f_i u_i$

$\Sigma f_i u_i = 3$, $N = 40$

Now, $A = 15$ & $h = 6$

$$\text{Mean} = A + h \times (\Sigma f_i u_i / N)$$
$$= 15 + 6\,(3/40)$$
$$= 15 + 0.45$$

Mean = 15.45

6)

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

→ Let us consider, Assumed mean $(A) = 100$

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

From table, we can write

$A = 100$ & $h = 20$

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

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

$= 100 + 12.2$

$\boxed{\text{Mean} = 112.2}$

7)

Class interval	0-8	8-16	16-24	24-32	32-40
frequency	6	7	10	8	9

→ Let us consider, Assumed Mean $= A = 20$

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

from table, we can write $A = 20$ & $h = 8$

$$\text{Mean} = A + h(\Sigma f_i u_i / N)$$
$$= 20 + 8(7/40)$$
$$= 20 + 1.4$$

Mean = 21.4

8)

Class Interval	0-6	6-12	12-18	18-24	24-30
frequency	7	5	10	12	6

→ Let us consider, Assumed Mean $(A) = 15$

Class Interval	Mid-value (x_i)	$d_i = x_i - 15$	$u_i = (x_i - 15)/6$	f_i	$f_i u_i$
0-6	3	-12	-2	7	-14
6-12	9	-6	-1	5	-5
12-18	15	0	0	10	0
18-24	21	6	1	12	12
24-30	27	12	2	6	12
				$N = 40$	$\Sigma f_i u_i = 5$

from table, we can write

$A = 15$ & $h = 6$

$$\text{Mean} = A + h(\Sigma f_i u_i / N)$$
$$= 15 + 6(5/40)$$
$$= 15 + 0.75$$

Mean = 15.75

9)

Class Interval	0-10	10-20	20-30	30-40	40-50
frequency	9	12	15	10	14

↳ Let us consider, Assumed Mean (A) = 25

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

From the table, we can write $A = 25$ & $h = 10$

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

$= 25 + 10(8/60)$

$= 25 + 4/3 = 79/3$

Mean = 26.333

10.)

Class Interval	0-8	8-16	16-24	24-32	32-40
Frequency	5	9	10	8	8

→ Let us consider, the assumed Mean (A) = 20

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

from table, we can write

$A = 20$ & $h = 8$

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

$= 20 + 8(5/40)$

$= 20 + 1$

Mean = 21

11.)

Class Interval	0 - 8	8 - 16	16 - 24	24 - 32	32 - 40
frequency	5	6	4	3	2

→ Let us consider, The assumed mean (A) = 20

Class Interval	Mid-value (x_i)	$d_i = x_i - 20$	$u_i = (x_i - 20)/8$	f_i	$f_i u_i$
0 - 8	4	-16	-2	5	-10
8 - 16	12	-8	-1	6	-8
16 - 24	20	0	0	4	0
24 - 32	28	8	1	3	9
32 - 40	36	16	2	2	14
				N = 20	$\Sigma f_i u_i = -9$

From table, we can write

$A = 20, \; h = 8$

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

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

$= 20 - 72/20$

$= 20 - 3.6$

Mean = 16.4

12.)

Class Interval	10 - 30	30 - 50	50 - 70	70 - 90	90 - 110	110 - 130
frequency	5	8	12	20	3	2

→ Let us consider, The assumed mean (A) = 60

Class interval	Mid-value (x_i)	$d_i = x_i - 60$	$u_i = (x_i - 60)/20$	f_i	$f_i u_i$
10-30	20	-40	-2	5	-10
30-50	40	-20	-1	8	-8
50-70	60	0	0	12	0
70-90	80	20	1	20	20
90-110	100	40	2	3	6
110-130	120	60	3	2	6
				N=50	$\Sigma f_i u_i = 14$

from the table, we can write

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

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

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

$$= 60 + 28/5 = 60 + 5.6$$

$$\boxed{\text{Mean} = 65.6}$$

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

→ Let us consider, The assumed mean (A) = 42

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

from the table, $A = 42$ & $h = 5$

$$\text{Mean} = A + h(\Sigma f_i u_i / N)$$
$$= 42 + 5(-79/70)$$
$$= 42 - 79/14 = 42 - 5.643$$

Mean = 36.357

Exercise 7.4

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

→ First we arrange the given data in ascending order,
694, 696, 699, 705, 710, 712, 715, 716, 719, 721, 725, 728, 729, 734, 745.

Here, the total no. of terms is an odd number i.e. $N = 15$

Then, Median = $(N+1)/2^{th}$ term
$= (15+1)/2^{th}$ term

Median = 8^{th} term

Hence, the 8^{th} term is the median when given data is arranged in ascending order.
Thus, 716 is the median of the given data.

2) The following is 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.

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	

Here, we have $N = 420$

Then $N/2 = 420/2 = 210$

$L = 165.5$, $f = 142$, $F = 133$ & $h = (168.5 - 165.5) = 3$

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

$$= 165.5 + \frac{210 - 133}{142} \times 3$$

$$= 165.5 + \frac{77}{142} \times 3 = 165.5 + \frac{231}{142}$$

$$= 165.5 + 1.63$$

Median = 167.13

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

→

Class Interval	Frequency	Cumulative frequency
15-25	8	8
25-35	10	18
35-45	15	33
45-55	25	58 (F)
55-65	40 (f)	98
65-75	20	118
75-85	15	133
85-95	7	140
	N = 140	

Here, $N = 140$

Then $N/2 = 140/2 = 70$

And $L = 55$, $f = 40$, $F = 58$, $h = 65 - 55 = 10$

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

$= 55 + \frac{(70 - 58)}{40} \times 10$

$= 55 + 3$

Median = 58

5.) Calculate the median from the following data:

Marks below	10-20	20-30	30-40	40-50	50-60	60-70	70-80	85-95
No. of students	15	35	60	84	96	127	198	250

→ Here, from the following table

$N = 250$

Then $N/2 = 250/2 = 125$

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

Then, Median $= L + \frac{N/2 - f}{f} \times h$

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, $N = 250 \Rightarrow N/2 = 250/2 = 125$

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

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

$$= 50 + \frac{(125 - 96)}{31} \times 10 = 50 + 9.35$$

Median = 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 person	5	25	?	18	7

Let us consider, unknown frequency be 'x'.

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	

Here, Given that Median = 24

Then, median class = 20-30 ; L = 20, h = 30-20 = 10

And f = x, f = 30

$$\text{Median} = L + \frac{(N/2 - f)}{f} \times h$$

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

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

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

$$4x = 275 + 5x - 300$$

$$4x - 5x = -25$$

$$-x = -25$$

$$\boxed{x = 25}$$

Thus, Missing frequency is 25.

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

Life-time: (In hours)	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.

→

Life time	Number of lamps (fi)	Cumulative frequency (cf)
1500 - 2000	14	14
2000 - 2500	56	70
2500 - 3000	60	130 (f)
3000 - 3500	86 (f)	216
3500 - 4000	74	290
4000 - 4500	62	352
4500 - 5000	48	400
	N = 400	

Here, it is observed that, the cumulative frequency just greater than $n/2$ ($400/2 = 200$) is 216 & hence it belongs to the interval (3000 - 3500) which becomes the median class.

3000 - 3500

Lower limit (l) of median class = 3000

& Frequency (f) of median class = 86

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

Thus, $$\text{Median} = l + \frac{(n/2 - cf)}{f} \times h$$

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

$$= 3000 + (35000/86)$$

$$\boxed{\text{Median} = 3406.98}$$

Hence, the median life time of lamps is 3406.98 hours

9.) The distribution below gives the weight of 30 students in 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

→

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

It is found that, the cumulative frequency is just greater than $n/2$ ($30/2 = 15$) is 19 & belongs to the 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

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

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

$= 55 + 10/6 = 56.666$

Thus, the median weight is 56.67 kg.

10.) find the missing frequencies & 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

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 $= x + 2y + 140$

It is found that, $N = 200$

$\Rightarrow 46 + x + y + 25 + 10 + 5 = 200$

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

$x + y = 114$ —— ①

And also given that, Mean $= 1.46$

Sum/N $= 1.46$

$\Rightarrow (x + 2y + 140)/200 = 1.46$

$x + 2y = 292 - 140$

$x + 2y = 152$ —— ②

② − ① $\Rightarrow$ $x + 2y - x - y = 152 - 114$

$\boxed{y = 38}$

$\Rightarrow x = 114 - 38 = 76$ $\boxed{x = 76}$

Thus,

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

$N = 200$, $N/2 = 100$

Cumulative frequency is just more than $N/2$ is 122.

Thus, Median is 1.

Exercise 7.5

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.

→

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

Thus, the mode = 5
since, it occurs the maximum number of times.

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

→

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

Thus, the mode = 3
since, it occurs the maximum number of times.

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

→

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

Thus, the mode = 15
Since it occurs the 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
No. of Persons	15	25	39	41	36	17	15	12

find the model shirt size worn by the group.

Shirt size	37	38	39	40	41	42	43	44
No of persons	15	25	39	91	36	17	15	12

From the table, Model shirt size = 40

Since it was the size which occurred for the maximum no. 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

→

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

It is found that, Maximum frequency is 28.

The corresponding class i.e. 40-50 is modal class.

And, $l = 40$, $h = 50 - 40 = 10$, $f = 28$, $f_1 = 12$ & $f_2 = 20$

Thus, $$\text{Mode} = l + \frac{(f - f_1)}{(2f - f_1 - f_2)} \times h$$

$$= 40 + \frac{(28 - 12)}{2 \times 28 - 12 - 20} \times 10$$

$$= 40 + 160/29$$

$$= 40 + 6.67$$

Mode = 46.67

ii)

class interval	10-15	15-20	20-25	25-30	30-35	35-40
frequency	30	45	75	35	25	15

→

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

It is found that, maximum frequency is 75.

Then, corresponding class i.e. 20-25 is the modal class.

Thus, $l=20$, $h=25-20=5$, $f=75$, $f_1=45$, $f_2=35$

Then, $$\text{Mode} = l + \frac{(f-f_1)}{(2f-f_1-f_2)} \times h$$

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

$$= 20 + 150/70 = 20 + 2.14$$

Mode = 22.14

iii)

Class interval	25-30	30-35	35-40	40-45	45-50	50-55
Frequency	25	34	50	42	38	14

→

Class interval	25-30	30-35	35-40	40-45	45-50	50-55
Frequency	25	34	50	42	38	14

It is found that, the maximum frequency is 50.

Then, the corresponding class i.e. 35-40 is the modal class.

And, $l=35$, $h=40-35=5$, $f=50$, $f_1=34$, $f_2=42$

Thus, $$\text{Mode} = l + \frac{(f-f_1)}{(2f-f_1-f_2)} \times h$$

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

$$= 35 + 80/24$$

$$= 35 + 3.33$$

Mode = 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

→

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: It is found that, maximum frequency is 78.

Then, the corresponding class 18-20 is the modal class.

And $l=18$, $h=20-18=2$, $f=78$, $f_1=50$, $f_2=46$

Thus, $\text{Mode} = l + \frac{(f-f_1)}{(2f-f_1-f_2)} \times h$

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

$= 18 + 56/60$

$= 18 + 0.93$

$\boxed{\text{Mode} = 18.93 \text{ years}}$

For Group B: It is found that, the maximum frequency is 89.

Then, the corresponding class 18-20 is the modal class.

And $l=18$, $h=20-18=2$, $f=89$, $f_1=54$, $f_2=40$

Thus, $\text{Mode} = l + \frac{(f-f_1)}{(2f-f_1-f_2)} \times h$

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

$= 18 + 70/84 = 18 + 0.83$

Mode = 18.83 years

Thus, the modal age of the Group A is higher than that of 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

→

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

It is found that, the maximum frequency is 20.

Then, the corresponding class 50-60 is the modal class.

And $l = 50$, $h = 60 - 50 = 10$, $f = 20$, $f_1 = 13$, $f_2 = 5$

Thus, $\text{Mode} = l + \frac{(f - f_1)}{(2f - f_1 - f_2)} \times h$

$= 50 + \frac{(20 - 13)}{(2 \times 20 - 13 - 5)} \times 10$

$= 50 + 70/22$

$= 50 + 3.18$

Mode = 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 no. of students.

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

It is found that, the maximum frequency is 142.

Then corresponding class 165.5 - 168.5 is the modal class.

And, $l = 165.5$, $h = 168.5 - 165.5 = 3$, $f = 142$, $f_1 = 118$, $f_2 = 127$

Thus, $\text{Mode} = l + \frac{(f - f_1)}{(2f - f_1 - f_2)} \times h$

$= 165.5 + \frac{(142 - 118)}{(2 \times 142 - 118 - 127)} \times 3$

$= 165.5 + 72/39$

$= 165.5 + 1.85$

$\boxed{\text{Mode} = 167.35 \text{ cm}}$

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

Lifetime (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

→ From the given data, the maximum class frequency is 61 which belongs to class interval 60-80.

Then, 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 ~~preceding~~ succeeding the modal class = 38

class size = $h = 20$

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

$= 60 + \frac{(61 - 52)}{(2 \times 61 - 52 - 38)} \times 20$

$= 60 + \frac{9}{(122 - 90)} \times 20$

$= 60 + \frac{9 \times 20}{32}$

$= 60 + 5.625$

$\boxed{\text{Mode} = 65.625}$

Thus, the 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
No. of workers	12	14	8	6	10

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

→

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
		$N = 50$	$\Sigma fx = 7260$	

We have, Mean $= \Sigma fx / N$

$= 7260/50$

$\boxed{\text{Mean} = 145.2}$

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

Then, the cumulative frequency just greater than $N/2$ is 26, then the median class is 120-140.

And, $l = 120$, $h = 140 - 120 = 20$, $f = 14$, $F = 12$.

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

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

$$= 120 + 260/14$$

$$= 120 + 18.57$$

$$\boxed{\text{Median} = 138.57}$$

From the data, it is found that the maximum frequency is 14, then the corresponding class 120-140 is the modal class.

And, $l = 120$, $h = 140 - 120 = 20$, $f = 14$, $f_1 = 12$, $f_2 = 8$

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

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

$$= 120 + 40/8 = 120 + 5$$

$$\boxed{\text{Mode} = 125}$$

Thus, mean = 145.2 and median = 138.57, mode = 125.

Exercise 7.6

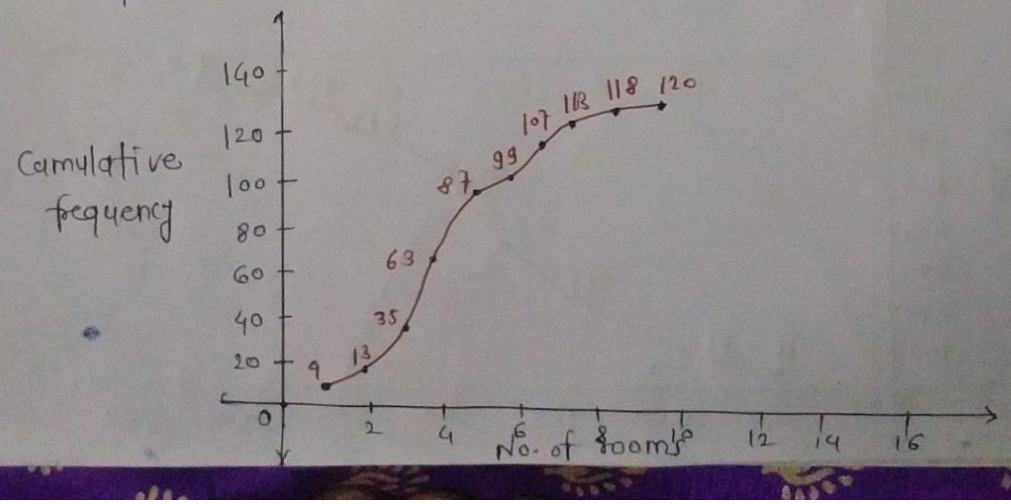
1) Draw an ogive by less than the method for the following data:

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

→

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	99
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

It is required to plot the points (1,4), (2,13), (3,35), (4,63), (5,87), (6,99), (7,107), (8,113), (9,118), (10,120) by taking the upper class limit over the X-axis & cumulative frequency over the Y-axis.



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

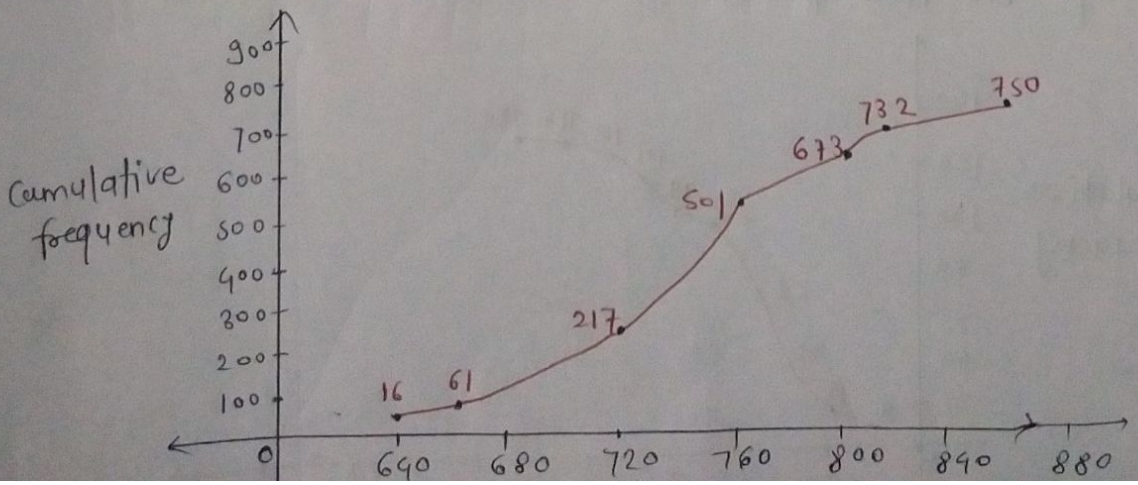
Marks	No. of students
600-640	16
640-680	45
680-720	156
720-760	284
760-800	172
800-840	59
840-880	18

Prepare a cumulative frequency distribution table by less than method & draw an ogive.

→

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	673
800-840	59	840	732
840-880	18	880	750

Now, we 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 & cumulative frequency over the y-axis.



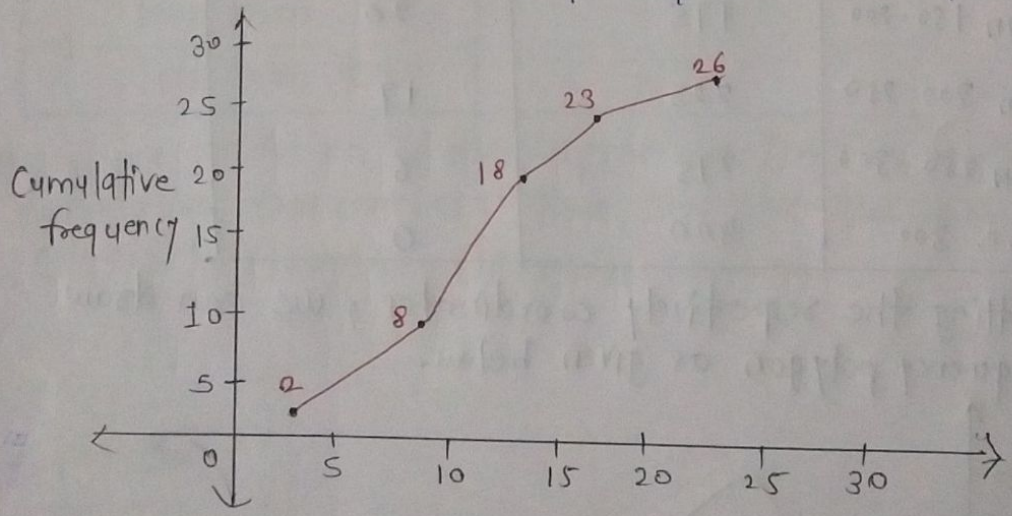
3) Draw an ogive to represent the following frequency distribution:

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

→ Since, the given frequency distribution is not continuous. So first we have to make it continuous & then we will prepare 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

Now, we will 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 & cumulative frequency over the Y-axis.



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

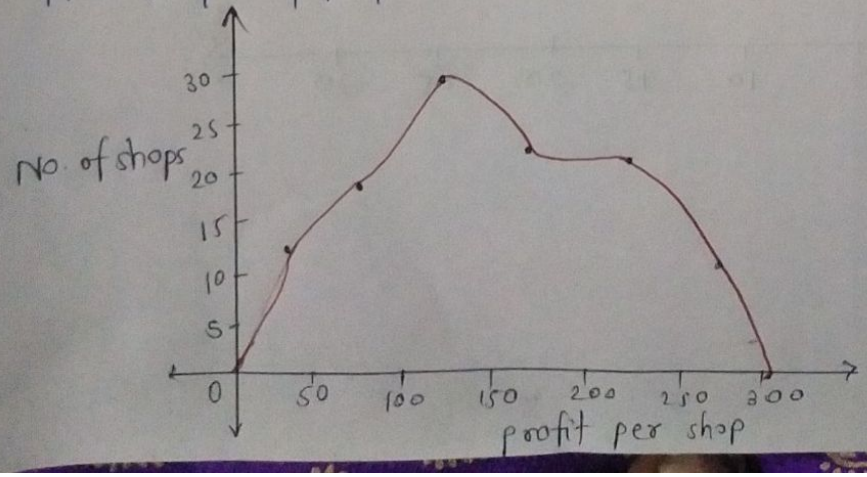
profit per shop	No. of shops
0 - 50	12
50 - 100	18
100 - 150	27
150 - 200	20
200 - 250	17
250 - 300	6

Draw the frequency polygon for it

→ For the less than method:

Profit per shop	Mid-value	No. of shops
less than 0	0	0
less than 0-50	25	12
less than 50-100	75	18
less than 100-150	125	27
less than 150-200	175	20
less than 200-250	225	17
less than 250-300	275	6
Above 300	300	0

By plotting the respectively co-ordinates, we can draw the frequency polygon as given below.



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

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

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

→ Initially, we will prepare the cumulative frequency table by the less than method as given below:

Daily income	Cumulative frequency
less than 120	12
less than 140	26
less than 160	34
less than 180	40
less than 100	50

Now, we mark on X-axis upper class limit, Y axis shows cumulative frequencies. Thus, we plot the points (120, 12), (140, 26), (160, 34), (180, 40), (200, 50).