Exercise 7.4

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.
Solution:

Arranging the given data in ascending order, we have
694, 696, 699, 705, 710, 712, 715, 716, 719, 721, 725, 728, 729, 734, 745

As the number of terms is an old number i.e., N = 15
We use the following procedure to find the median.
Median = $(N + 1)/2^{th}$ term
$= (15 + 1)/2^{th}$ term
$= 8^{th}$ term
So, the 8^{th} term in the arranged order of the given data should be the median.
Therefore, 716 is the median of the data.

1. 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.

Solution:

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,
So, N/2 = 420/ 2 = 210

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

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

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

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

$$= 165.5 + \frac{231}{142}$$

= 165.5 + 1.63
= 167.13

2. 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

Solution:

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	98
135 - 144	134.5 – 144.5	1	100
		N = 100	

Here, we have N = 100,
So, 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

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

$$= 94.5 + \frac{50 - 34}{33} \times 10$$

= 94.5 + 4.85

= 99.35

3. 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**

Solution:

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, we have N = 140,
So, 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

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

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

= 55 + 3 = 58

4. 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**

Solution:

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	

Here, we have N = 250,
So, 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

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

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

= 50 + 9.35
= 59.35

5. 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**

Solution:

Let the unknown frequency be taken as 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	

It's given that
Median = 24
Then, median class = 20 - 30; L = 20, h = 30 -20 = 10, f = x, F = 30

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

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

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

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

4x = 275 + 5x - 300
4x - 5x = – 25
- x = – 25
x = 25

Therefore, the Missing frequency = 25

6. 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**	**45 – 49**	**3**
30 – 34	**32**	**55 – 59**	**3**
35 – 39	**12**	**60 and above**	**2**

Calculate the median and interpret the results.

Solution:

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	

Here, we have N = 357,
So, N/2 = 357/ 2 = 178.5

The cumulative frequency just greater than N/2 is 193, so then the median class is (19.5 – 24.5) such that l = 19.5, f = 140, F = 53, h = 25.5 – 19.5 = 5

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

$$\text{Median} = 19.5 + \frac{178.5 - 53}{140} \times 5$$

Median = 23.98

Which means nearly half the women were married between the ages of 15 and 25

7. 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.

Solution:

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	

It's seen that, the cumulative frequency just greater than n/2 (400/2 = 200) is 216 and it belongs to the class interval 3000 – 3500 which becomes the Median class = 3000 - 3500
Lower limits (l) of median class = 3000 and,
Frequency (f) of median class = 86
Cumulative frequency (cf) of class preceding median class = 130
And, the Class size (h) = 500

Thus, calculating the median by the formula, we get

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

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

= 3000 + (35000/86)
= 3406.98

Thus, the median life time of lamps is 3406.98 hours

8. 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**

Solution:

Weight (in kg)	Number of students fi	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's seen that, the cumulative frequency just greater than n/ 2 (i.e. 30/ 2 = 15) is 19, belongs to class interval 55 – 60.

So, it's chosen that
Median class = 55 – 60
Lower limit (l) of median class = 55
Frequency (f) of median class = 6
Cumulative frequency (cf) = 13
And, Class size (h) = 5

Thus, calculating the median by the formula, we get

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

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

$$= 55 + 10/6 = 56.666$$

So, the median weight is 56.67 kg.

9. 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**

Solution:

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's given that, N = 200
⇒ 46 + x + y + 25 + 10 + 5 = 200
⇒ x + y = 200 – 46 – 25 – 10 – 5
⇒ x + y = 114----- (i)

And also given, Mean = 1.46
⇒ Sum/ N = 1.46
⇒ (x + 2y + 140)/ 200 = 1.46
⇒ x + 2y = 292 – 140
⇒ x + 2y = 152 -----(ii)
Subtract equation (i) from equation (ii), we get
x + 2y – x – y = 152 – 114
⇒ y = 38

Now, on putting the value of y in equation (i), we find x = 114 – 38 = 76

Thus, the table become:

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	

It's seen that,
N = 200 N/2 = 200/2 = 100
So, the cumulative frequency just more than N/2 is 122
Therefore, the median is 1.