EXERCISE 13.1

Choose the correct answer from the given four options:

1. In the formula

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

For finding the mean of grouped data *di*'*s* are deviations from *a* of

(A) Lower limits of the classes

(B) Upper limits of the classes

(C) Mid points of the classes

(D) Frequencies of the class marks

Solution:

(C) Mid points of the classes

Explanation:

We know,

$d_i = x_i - a$

Where,

x_i are data and 'a' is the assumed mean

So, d_i are the deviations from of mid - points of the classes.

Hence, the option (C) is correct

2. While computing mean of grouped data, we assume that the frequencies are

(A) Evenly distributed over all the classes

(B) Centred at the class marks of the classes

(C) Centred at the upper limits of the classes

(D) Centred at the lower limits of the classes

Solution:

(B) Centered at the class marks of the classes

Explanation:

In computing the mean of grouped data, the frequencies are centered at the class marks of the classes.

Hence, the option (B) is correct

3. If *xi*'s are the mid points of the class intervals of grouped data, *fi*'s are the corresponding frequencies and *x* is the mean, then $(f_i x_i - \bar{x})$ is equal to

(A) 0 (B) –1 (C) 1 (D) 2

Solution:

(A) 0

Explanation:

Mean (x) = Sum of all the observations/ Number of observations

$x = (f_1x_1 + f_2x_2 + \ldots + f_nx_n) / f_1 + f_2 + \ldots + f_n$

$x = \Sigma fixi / \Sigma fi, \Sigma fi = n$

$x = \Sigma fixi / n$

$n x = \Sigma fixi$ …………… (1)

Σ (fixi - x) = (f_1x_1 - x) + (f_2x_2 - x)+ …..+ (fnxn - x)
Σ (fixi - x) = (f_1x_1 + f_2x_2 + …..+ fnxn) - (x +x +....n times)
Σ (fixi - x) = Σfixi –nx
Σ(fixi - x) = nx - nx (From eq1)
Σ(fixi - x) = 0
Hence, option (A) is correct

4. In the formula $x = a + h(f_iu_i/f_i)$, for finding the mean of grouped frequency distribution, u_i =
(A) $(x_i+a)/h$
(B) h ($xi – a$)
(C) (x_i –a)/h
(D) (a – x_i)/h

Solution:
(C) (x_i –a)/h
Explanation:
According to the question,
$x = a + h(f_iu_i/f_i)$,
Above formula is a step deviation formula.
In the above formula,
x_i is data values,
a is assumed mean,
h is class size,
When class size is same we simplify the calculations of the mean by computing the coded mean of u_1,u_2,u_3…..,
Where u_i = (x_i – a)/h
Hence, option (C) is correct

5. The abscissa of the point of intersection of the less than type and of the more than type cumulative frequency curves of a grouped data gives its
(A) mean **(B) median**
(C) mode **(D) all the three above**

Solution:
(B) Median
Explanation:
Since, the intersection point of less than ogive and more than ogive gives the median on the abscissa, the abscissa of the point of intersection of the less than type and of the more than type cumulative frequency curves of a grouped data gives its
Hence, option (B) is correct

6. For the following distribution :

Class	**0-05**	**5-10**	**10-15**	**15-20**	**20-25**
Frequency	**10**	**15**	**12**	**20**	**9**

the sum of lower limits of the median class and modal class is
(A) 15 (B) 25 (C) 30 (D) 35

Solution:
(B) 25

Explanation:

Class	Frequency	Cumulative Frequency
0-5	10	10
5-10	15	25
10-15	12	37
15-20	20	57
20-25	9	66

From the table, N/2 = 66/2 = 33, which lies in the interval 10 - 15.
Hence, lower limit of the median class is 10.
The highest frequency is 20, which lies in between the interval 15 - 20.
Hence, lower limit of modal class is 15.
Therefore, required sum is 10 + 15 = 25.
Hence, option (B) is correct

7. Consider the following frequency distribution:

Class	**0-05**	**6-11**	**12-17**	**18-23**	**24-29**
Frequency	**13**	**10**	**15**	**8**	**11**

The upper limit of the median class is
(A) 17 (B) 17.5 (C) 18 (D) 18.5

Solution:

(B) 17.5

Explanation:
According to the question,
Classes are not continuous, hence, we make the data continuous by subtracting 0.5 from lower limit and adding 0.5 to upper limit of each class.

Class	Frequency	Cumulative Frequency
0.5-5.5	13	13
6.5-11.5	10	23
11.5-17.5	15	38
17.5-23.5	8	46
23.5-29.5	11	57

According to the question,
N/2 = 57/2 = 28.5
28.5 lies in between the interval 11.5 - 17.5.
Therefore, the upper limit is 17.5.
Hence, option (B) is correct

8. For the following distribution:

Marks	**Number of students**
Below 10	**3**
Below 20	**12**
Below 30	**27**
Below 40	**57**
Below 50	**75**
Below 60	**80**

The modal class is
(A) 10-20 (B) 20-30 (C) 30-40 (D) 50-60

Solution:

(C) 30-40

Explanation:

Marks	Number of students	Cumulative Frequency
Below 10	3=3	3
10-20	(12 – 3) = 9	12
20-30	(27 – 12) = 15	27
30-40	(57 – 27) = 30	57
40-50	(75 – 57) = 18	75
50-60	(80 – 75) = 5	80

Here, we see that the highest frequency is 30, which lies in the interval 30 - 40.
Hence, option (C) is correct

9. Consider the data :

Class	65-85	85-105	105-125	125-145	145-165	165-185	185-205
Frequency	**4**	**5**	**13**	**20**	**14**	**7**	**4**

The difference of the upper limit of the median class and the lower limit of the modal class is
(A) 0 (B) 19 (C) 20 (D) 38

Solution:

(C) 20

Explanation:

Class	Frequency	Cumulative Frequency
65-85	4	4
85-105	5	9
105-125	13	22
125-145	20	42
145-165	14	56
165-185	7	63
185-205	4	67

Here, N/2 = 67/2 = 33.5 which lies in the interval 125 – 145.
Hence, upper limit of median class is 145.
Here, we see that the highest frequency is 20 which lies in 125 - 145.
Hence, the lower limit of modal class is 125.
∴ Required difference = Upper limit of median class – Lower limit of modal class
= 145 – 125 = 20
Hence, option (C) is correct

10. The times, in seconds, taken by 150 athletes to run a 110 m hurdle race are tabulated below

Class	13.8-14	14-14.2	14.2-14.4	14.4-14.6	14.6-14.8	14.8-15
Frequency	**2**	**4**	**5**	**71**	**48**	**20**

The number of athletes who completed the race in less than 14.6 seconds is :
(A) 11 (B) 71 (C) 82 (D) 130

Solution:

(C) 82

Explanation:

The number of athletes who completed the race in less than 14.6 second= 2 + 4 + 5 + 71 = 82

Hence, option (C) is correct

11. Consider the following distribution :

Marks obtained	Number of students
More than or equal to 0	63
More than or equal to 10	58
More than or equal to 20	55
More than or equal to 30	51
More than or equal to 40	48
More than or equal to 50	42

The frequency of the class 30-40 is

(A) 3 (B) 4 (C) 48 (D) 51

Solution:

(A) 3

Explanation:

Marks Obtained	Number of students	Cumulative Frequency
0-10	(63 – 58) = 5	5
10-20	(58 – 55) = 3	3
20-30	(55 – 51) = 4	4
30-40	(51 – 48) = 3	3
40-50	(48 – 42) = 6	6
50<	42 = 42	42

Hence, frequency in the class interval 30 - 40 is 3.

Hence, option (A) is correct

12. If an event cannot occur, then its probability is

(A) 1 (B) ¾ (C) ½ (D) 0

Solution:

(D) 0

Explanation:

The event which cannot occur is said to be impossible event.

The probability of impossible event = zero.

Hence, option (D) is correct

13. Which of the following cannot be the probability of an event?

(A)1/3 (B) 0.1 (C) 3% (D)17/16

Solution:

(D)17/16

Explanation:

Probability of an event always lies between 0 and 1.

Probability of any event cannot be more than 1 or negative as (17/16) > 1

Hence, option (D) is correct

EXERCISE 13.2 PAGE NO: 161

1. The median of an ungrouped data and the median calculated when the same data is grouped are always the same. Do you think that this is a correct statement? Give reason.

Solution:

In order to calculate the median of a grouped data, the formula used is based on the assumption that the observations in the classes are uniformly distributed or equally spaced. Hence, we cannot say that the statement "the median of an ungrouped data and the median calculated when the same data is grouped are always the same" is always correct.

2. In calculating the mean of grouped data, grouped in classes of equal width, we may use the formula

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

where *a* is the assumed mean. *a* must be one of the mid-points of the classes. Is the last statement correct? Justify your answer.

Solution:

No, the statement is not correct. It is not necessary that assumed mean should be the mid - point of the class interval. a can be considered as any value which is easy to simplify it.

3. Is it true to say that the mean, mode and median of grouped data will always be different? Justify your answer.

Solution:

No, the values of mean, mode and median of grouped data can be the same as well, it depends on the type of data given.

4. Will the median class and modal class of grouped data always be different? Justify your answer.

Solution:

The median class and modal class of grouped data is not always different, it depends on the data given.

5. In a family having three children, there may be no girl, one girl, two girls or three girls. So, the probability of each is ¼. Is this correct? Justify your answer.

Solution:

No it is not correct that in a family having three children, there may be no girl, one girl, two girls or three girls, the probability of each is ¼. .

Let boys be B and girls be G

Outcomes can be BBB , GGG , BBG , BGB , GBB, GGB, GBG , BGG

Then Probability of 3 girls = 1/8

Probability of 0 girls = 1/8

Probability of 2 girls = 3/8

Probability of 1 girl = 3/8

6. A game consists of spinning an arrow which comes to rest pointing at one of the regions (1, 2 or 3) (Fig. 13.1). Are the outcomes 1, 2 and 3 equally likely to occur? Give reasons.

Solution:

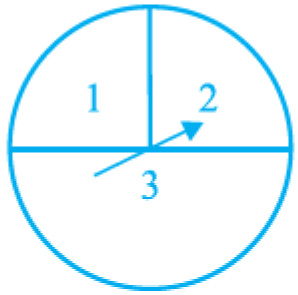

Fig. 13.1

Total no. of outcome = 360
p(1)= 90/360 =1/4
p(2) = 90/ 360 = 1/4
p(3) = 180/360 =1/2
Hence, it is clear that the outcome are not equal

7. Apoorv throws two dice once and computes the product of the numbers appearing on the dice. Peehu throws one die and squares the number that appears on it. Who has the better chance of getting the number 36? Why?

Solution:

Apoorv throw two dice at once.
Hence, the total number of outcomes = 36
Number of outcomes for getting product 36 = 1(6×6)
∴ Probability for Apoorv = 1/36
Peehu throws one die,
Hence, the total number of outcomes = 6
Number of outcomes for getting square = 36
∴ Probability for Peehu = 6/36 = 1/6
Therefore, Peehu has a better chance of getting the number 36.

EXERCISE 13.3 PAGE NO: 166

1. Find the mean of the distribution :

Class	**1-3**	**3-5**	**5-7**	**7-10**
Frequency	**9**	**22**	**27**	**17**

Solution:

We first, find the class mark x_i of each class and then proceed as follows.

Class	Class Marks (x_i)	Frequency (f_i)	f_ix_i
1-3	2	9	18
3-5	4	22	88
5-7	6	27	162
7-10	8.5	17	144.5
		$\Sigma f_i = 75$	$\Sigma f_ix_i = 412.5$

Mean,

$$(\bar{x}) = \frac{\sum f_ix_i}{\sum f_i} = \frac{412.5}{75} = 5.5$$

Therefore, mean of the given distribution = 5.5.

2. Calculate the mean of the scores of 20 students in a mathematics test :

Marks	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**
Number of students	**2**	**4**	**7**	**6**	**1**

Solution:

We first, find the class mark x_i of each class and then proceed as follows

Class	Class Marks (x_i)	Frequency (f_i)	f_ix_i
10-20	15	2	30
20-30	25	4	100
30-40	35	7	245
40-50	45	6	270
50-60	55	1	55
		$\Sigma f_i = 20$	$\Sigma f_ix_i = 700$

Mean,

$$\bar{x} = \frac{\sum f_ix_i}{\sum f_i} = \frac{700}{20} = 35$$

Therefore, mean of scores of 20 students in mathematics test = 35.

3. Calculate the mean of the following data :

Class	**4 – 7**	**8 –11**	**12– 15**	**16 –19**
Frequency	**5**	**4**	**9**	**10**

Solution:

The given data is not continuous.

So, we subtract 0.5 from the lower limit and add 0.5 in the upper limit of each class.

Class	Class Marks (x_i)	Frequency (f_i)	f_ix_i
3.5 – 7.5	5.5	5	27.5
7.5 – 11.5	9.5	4	38
11.5 – 15.5	13.5	9	121.5
15.5 – 19.5	17.5	10	175
		$\Sigma f_i = 28$	$\Sigma f_ix_i = 362$

Mean,

$$\bar{x} = \frac{\sum f_ix_i}{\sum f_i} = \frac{362}{28} = 12.93$$

Therefore, mean of the given data = 12.93.

4. The following table gives the number of pages written by Sarika for completing her own book for 30 days :

Number of pages written per day	**16-18**	**19-21**	**22-24**	**25-27**	**28-30**
Number of days	**1**	**3**	**4**	**9**	**13**

Find the mean number of pages written per day.

Solution:

Class Marks	Mid – Value (x_i)	Number of days (f_i)	f_ix_i
15.5 – 18.5	17	1	17
18.5 – 21.5	20	3	60
21.5 – 24.5	23	4	92
24.5 – 27.5	26	9	234
27.5 – 30.5	29	13	377
		$\Sigma f_i = 30$	$\Sigma f_ix_i = 780$

The given data is not continuous.

Hence, we subtract 0.5 from the lower limit and add 0.5 in the upper limit of each class.

$$\text{Mean } (x) = \frac{\sum f_ix_i}{\sum f_i} = \frac{780}{30} = 26$$

Therefore, the mean of pages written per day = 26.

5. The daily income of a sample of 50 employees are tabulated as follows :

Income (in Rs)	**1-200**	**201-400**	**401-600**	**601-800**
Number of employees	**14**	**15**	**14**	**7**

Find the mean daily income of employees.

Solution:

C.I	x_i	$d_i = (x_i - a)$	F_i	f_id_i
1 – 200	100.5	– 200	14	– 2800
201 – 400	300.5	0	15	0
401 – 600	500.5	200	15	2800
601 – 800	700.5	400	7	2800
			$\Sigma f_i = 50$	$\Sigma f_ix_i = 2800$

∴ Assumed mean, a = 300.5 and $d_i = (x_i - a)$

$$\bar{x} = a + \frac{\sum f_id_i}{\sum f_i}$$

= 300.5 + 2800/50
= 356.5
Hence, the average daily income of employees = Rs.356.5

6. An aircraft has 120 passenger seats. The number of seats occupied during 100 flights is given in the following table :

Number of seats	**100-104**	**104-108**	**108-112**	**112-116**	**116-120**
Frequency	**15**	**20**	**32**	**18**	**15**

Determine the mean number of seats occupied over the flights.

Solution:

Class Interval	**Class Marks (x_i)**	**Frequency (f_i)**	**Deviation ($d_i = x_i - a$)**	**$f_i d_i$**
100 – 104	102	15	– 8	– 120
104 – 108	106	20	– 4	– 80
108 – 112	110	32	0	0
112 – 116	114	18	4	72
116 – 120	118	15	8	120
		$N = \Sigma f_i = 100$		$\Sigma f_i d_i = -8$

∴ Assumed mean, a = 110
Class width, h = 4
And total observations, N = 100
Hence, finding mean,

$$\text{Mean}(\overline{x}) = a + \frac{\sum f_i d_i}{\sum f_i}$$

= 110 + (-8/100)
= 110 – 0.08
= 109.92
But we know that the seats cannot be in decimal.
Therefore, the number of seats = 109.

7. The weights (in kg) of 50 wrestlers are recorded in the following table :

Weight (in kg)	**100-110**	**110-120**	**120-130**	**130-140**	**140-150**
Number of wrestlers	**4**	**14**	**21**	**8**	**3**

Find the mean weight of the wrestlers.

Solution:

Weight (in kg)	**Number of Wrestlers (f_i)**	**Class Marks (x_i)**	**Deviation ($d_i = x_i - a$)**	**$f_i d_i$**
100 – 110	4	105	– 20	– 80
110 – 120	14	115	– 10	– 140
120 – 130	21	125	0	0
130 – 140	8	135	10	80
140 – 150	3	145	20	60
		$N = \Sigma f_i = 50$		$\Sigma f_i d_i = -80$

∴ Assumed mean, (a) = 125

Class width, (h) = 10
and total observations, (N) = 50
By step deviation method,

$$\text{Mean}(\bar{x}) = a + \frac{\sum f_i d_i}{\sum f_i}$$

$$\text{Mean}(\bar{x}) = 125 + \frac{(-80)}{50}$$

= 125 – 16
= 123.4kg
Hence, mean weight of wrestlers = 123.4kg

8. The mileage (km per litre) of 50 cars of the same model was tested by a manufacturer and details are tabulated as given below :

Mileage (km/*l*)	**10-12**	**12-14**	**14-16**	**16-18**
Number of cars	**7**	**12**	**18**	**13**

Find the mean mileage.
The manufacturer claimed that the mileage of the model was 16 km/litre. Do you agree with this claim?

Solution:

Mileage (km L^{-1})	**Class –Marks (x_i)**	**Number of cars (f_i)**	**$f_i x_i$**
10 – 12	11	7	77
12 – 14	13	12	156
14 – 16	15	18	270
16 – 18	17	13	221
Total		$\Sigma f_i = 50$	$\Sigma f_i x_i = 724$

Here, $\Sigma f_i = 50$
$\Sigma f_i x_i = 724$

$$\therefore \text{Mean } \bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

= 724/50 = 14.48
Hence, mean mileage = 14.48 km/h
No, I don't agree with the claim because the manufacturer is claiming mileage 1.52 km/h more than average mileage.

9. The following is the distribution of weights (in kg) of 40 persons :

Weight (in kg)	**40-45**	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**75-80**
Number of persons	**4**	**4**	**13**	**5**	**6**	**5**	**2**	**1**

Construct a cumulative frequency distribution (of the less than type) table for the data above.

Solution:

Weight (in kg)	**Cumulative frequency**
Less than 45	4
Less than 50	4 + 4 = 8
Less than 55	8 + 13 = 21
Less than 60	21 + 5 = 26
Less than 65	26 + 6 = 32

Less than 70	32 + 5 = 37
Less than 75	37 + 2 = 39
Less than 80	39 1 = 40

10. The following table shows the cumulative frequency distribution of marks of 800 students in an examination:

Marks	**Number of students**
Below 10	**10**
Below 20	**50**
Below 30	**130**
Below 40	**270**
Below 50	**440**
Below 60	**570**
Below 70	**670**
Below 80	**740**
Below 90	**780**
Below 100	**800**

Construct a frequency distribution table for the data above.

Solution:

The frequency distribution table for the given data is:

Class Interval	**Number of students**
0-10	10
10-20	50 – 10 = 40
20-30	130 – 50 = 80
30-40	270 – 130 = 140
40-50	440 – 270 = 170
50-60	570 – 440 = 130
60-70	670 – 570 = 100
70-80	740 – 670 = 70
80-90	780 – 740 = 40
90-100	800– 780 = 20

11. Form the frequency distribution table from the following data :

Marks (out of 90)	**Number of candidates**
More than or equal to 80	**4**
More than or equal to 70	**6**
More than or equal to 60	**11**
More than or equal to 50	**17**
More than or equal to 40	**23**
More than or equal to 30	**27**
More than or equal to 20	**30**
More than or equal to 10	**32**
More than or equal to 0	**34**

Solution:

The frequency distribution table for the given data is:

Class Interval	Number of students
0-10	34 – 32 = 2
10-20	32 – 30 = 2
20-30	30 – 27 = 3
30-40	27 – 23 = 4
40-50	23 – 17 = 6
50-60	17 – 11 = 6
60-70	11 – 6 = 5
70-80	6 – 4 = 2
80-90	4

12. Find the unknown entries *a, b, c, d, e, f* in the following distribution of heights of students in a class:

Height (in cm)	Frequency	Cumulative frequency
150-155	**12**	***a***
155-160	***b***	**25**
160-165	**10**	***c***
165-170	***d***	**43**
170-175	***e***	**48**
175-180	**2**	***f***
Total	**50**	

Solution:

Height (in cm)	Frequency	Cumulative frequency given	Cumulative frequency
150 – 155	12	a	12
155 – 160	b	25	12 + b
160 – 165	10	c	22 + b
165 – 170	d	43	22 + b + d
170 – 175	e	48	22 + b + d + e
175 – 180	2	f	24 + b + d + e
Total	50		

On comparing last two tables, we get

a = 12

$\therefore 12 + b = 25$

$\Rightarrow b = 25 - 12 = 13$

$22 + b = c$

$\Rightarrow c = 22 + 13 = 35$

$22 + b + d = 43$

$\Rightarrow 22 + 13 + d = 43$

$\Rightarrow d = 43 - 35 = 8$

$22 + b + d + e = 48$

$\Rightarrow 22 + 13 + 8 + e = 48$

$\Rightarrow e = 48 - 43 = 5$

$24 + b + d + e = f$

$\Rightarrow f = 24 + 13 + 8 + 5 = 50$

13. The following are the ages of 300 patients getting medical treatment in a hospital on a particular day:

Age (in years)	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**
Number of patients	**60**	**42**	**55**	**70**	**53**	**20**

Form:

(i) Less than type cumulative frequency distribution.

(ii) More than type cumulative frequency distribution.

Solution:

(i)

Less than type cumulative frequency distribution of the data is given below.

(i) Less than type	
Age (in year)	Number of patients
Less than 10	0
Less than 20	60 + 0 = 60
Less than 30	60 + 42 = 102
Less than 40	102 + 55 = 157
Less than 50	157 + 70 = 227
Less than 60	227 + 53 = 280
Less than 70	280 + 20 =300

(ii)

More than type cumulative frequency distribution of the data is given below.

(i) More than type	
Age (in year)	Number of patients
More than or equals 10	60 + 42 + 55 + 70 + 53 + 20 = 300
More than or equals 20	42 + 55 + 70 + 53 + 20 = 240
More than or equals 30	55 + 70 + 53 + 20 = 198
More than or equals 40	70 + 53 + 20 = 143
More than or equals 50	53 + 20 = 73
More than or equals 60	20
More than or equals 70	0

14. Given below is a cumulative frequency distribution showing the marks secured by 50 students of a class:

Marks	**Below 20**	**Below 40**	**Below 60**	**Below 80**	**Below 100**
Number of students	**17**	**22**	**29**	**37**	**50**

Form the frequency distribution table for the data.

Solution:

The frequency distribution table for given data.

Marks	Number of students
0 – 20	12
20 – 40	22 – 17 = 5
40 – 60	29 – 22 = 7
60 – 80	37 – 29 = 8
80 – 100	50 – 37 = 13

15. Weekly income of 600 families is tabulated below :

Weekly income (in Rs)	**Number of families**
0-1000	**250**
1000-2000	**190**
2000-3000	**100**
3000-4000	**40**
4000-5000	**15**
5000-6000	**5**
Total	**600**

Compute the median income.

Solution:

Weekly Income	Number of families (f_i)	Cumulative frequency (cf)
0-1000	250	250
1000-2000	190	250 + 190 = 400
2000-3000	100	440 + 100 = 540
3000-4000	40	540 + 40 = 580
4000-5000	15	580 + 15 = 595
5000-6000	5	595 + 5 = 600

According to the question,

n = 600

∴ n/2 = 600/2 = 300

Cumulative frequency 440 lies in the interval 1000 – 2000.

Hence, lower median class, l = 1000

f = 190,

c_f = 250,

Class width, h = 1000

And total observation n = 600

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

$$= 1000 + \frac{(300 - 250)}{190} \times 1000$$

$$= 1000 + \frac{50}{190} \times 1000$$

= 1000 + 5000/19

= 1000 + 263.15 = 1263.15

Hence, the median income is Rs.1263.15.

16. The maximum bowling speeds, in km per hour, of 33 players at a cricket coaching centre are given as follows:

Speed (km/h)	**85-100**	**100-115**	**115-130**	**130-145**
Number of players	**11**	**9**	**8**	**5**

Calculate the median bowling speed.

Solution:

First we construct the cumulative frequency table

Speed (in km/h)	**Number of players**	**Cumulative frequency**
85 – 100	11	11
100 – 115	9	11 + 9 = 20
115 – 130	8	20 + 8 = 28
130 – 145	5	28 + 5 = 33

It is given that, n = 33

∴ n/2 = 33/2 = 16.5

Hence, the median class is 100 - 115.

Where, lower limit(l) = 100

Frequency (f) = 9

Cumulative frequency (cf) = 11

And class width(h) = 15

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

$$= 100 + \frac{(16.5 - 11)}{9} \times 15$$

$$= 100 + \frac{5.5 \times 15}{9}$$

= 100 + 82.5/9

= 100 + 9.17

= 109.17

Hence, the median bowling speed is 109.17 km/h.

17. The monthly income of 100 families are given as below :

Income (in Rs)	**Number of families**
0-5000	**8**
5000-10000	**26**
10000-15000	**41**
15000-20000	**16**
20000-25000	**3**
25000-30000	**3**
30000-35000	**2**
35000-40000	**1**

Calculate the modal income.

Solution:

According to the data given,

The highest frequency = 41,

41 lies in the interval 10000 - 15000.

Here, l = 10000, $f_m = 41, f_1 = 26, f_2 = 16$ and h = 5000

$$\therefore \text{ Mode} = l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$$
$$= 10000 + \left(\frac{41-26}{2\times41-26-16}\right) \times 5000$$
$$= 10000 + \left(\frac{15}{82-42}\right) \times 5000$$
$$= 10000 + \left(\frac{15}{40}\right) \times 5000$$

= 10000 + 15×125
= 10000 + 1875
= 11875
Hence, the modal income = Rs.11875 per month.

18. The weight of coffee in 70 packets are shown in the following table :

Weight (in g)	Number of packets
200-201	12
201-202	26
202-203	20
203-204	9
204-205	2
205-206	1

Determine the modal weight.

Solution:

In the given data, the highest frequency is 26, which lies in the interval 201 – 202
Here, l = 201, $f_m = 26, f_1 = 12, f_2 = 20$ and (class width) h = 1

$$\therefore \text{ Mode} = l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$$
$$= 201 + \frac{26-12}{(2\times26-12-20)} \times 1$$
$$= 201 + \frac{14}{(52-32)}$$
$$= 201 + 14/20$$
$$= 201 + 0.7$$
$$= 201.7\text{g}$$

Hence, the modal weight = 201.7 g.

19. Two dice are thrown at the same time. Find the probability of getting
- **(i) Same number on both dice.**
- **(ii) Different numbers on both dice.**

Solution:

Two dice are thrown at the same time.
So, total number of possible outcomes = 36
(i) Same number on both dice.
Possible outcomes = (1,1), (2,2), (3, 3), (4, 4), (5, 5), (6, 6).
Hence, number of possible outcomes = 6

Therefore, the probability of getting same number on both dice = 6/36 = 1/6

(ii) Different number on both dice.
Hence, number of possible outcomes
= 36 – Number of possible outcomes for same number on both dice
= 36 - 6 = 30
Therefore, the probability of getting different number on both dice = 30/36 = 5/6

20. Two dice are thrown simultaneously. What is the probability that the sum of the numbers appearing on the dice is
(i) 7? (ii) a prime number? (iii) 1?

Solution:

According to the question,
Two dice are thrown simultaneously.
So, that number of possible outcomes = 36
(i) Sum of the numbers appearing on the dice is 7.
So, the possible outcomes = (1, 6), (2,5), (3, 4), (4, 3), (5, 2), (6, 1).
Hence, number of possible outcomes = 6
∴ the probability that the sum of the numbers appearing on the dice is 7 = 6/36 = 1/6

(ii) Sum of the numbers appearing on the dice is a prime number i.e., 2, 3, 5, 7 and 11.
So, the possible outcomes are (1, 1), (1,2), (2, 1), (1, 4), (2, 3), (3, 2), (4, 1), (1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1), (5, 6) = (6, 5).
Hence, number of possible outcomes = 15
∴ the probability that the sum of the numbers appearing on the dice is a prime number = 15/36 = 5/12

(iii) Sum of the numbers appearing on the dice is 1.
It is not possible, so its probability is zero.
∴ the probability that the sum of the numbers appearing on the dice is 1 = 0

21. Two dice are thrown together. Find the probability that the product of the numbers on the top of the dice is
(i) 6 (ii) 12 (iii) 7

Solution:

Number of total outcomes = 36
(i) When product of the numbers on the top of the dice = 6.
The possible outcomes = (1, 6), (2,3), (3, 2), (6, 1).
Hence, number of possible ways = 4
∴ Probability that the product of the numbers on the top of the dice is 6= 4/36 = 1/9

(ii) When product of the numbers on the top of the dice = 12.
The possible ways are (2, 6), (3,4), (4, 3), (6, 2).
Hence, number of possible ways = 4
∴ Probability that the product of the numbers on the top of the dice is 12= 4/36 = 1/9

(iii) Product of the numbers on the top of the dice cannot be 7.
Hence, the probability is zero.
∴ Probability that the product of the numbers on the top of the dice is $7 = 0$