# 11. Statistics

# Let us Work Out 11.1

## 1. Question

I have written the number of children belonging to each of 40 families in our locality below—

1	2	6	5	1	5	1	3	2	6
2	3	4	2	0	4	4	3	2	2
0	0	1	2	2	4	3	2	1	0
5	1	2	4	3	4	1	6	2	2

I prepare a frequency distribution table of the above given data whose classes are 0 – 2, 2–4, ...... etc.

From this frequency distribution table, let me understand and write

(i) class - interval

(ii) class - size

(iii) frequency of the class

(iv) class - limit.

## Answer

class - size = upper class boundary – lower class boundary

lower class boundary = lower limit - 0.5

Upper class boundary = upper limit + 0.5

Mid value of class =  $\frac{\text{lower class limit + upper class limit}}{2}$ 

Frequency density =  $\frac{\text{class frequency of that class}}{\text{class size}}$ 

From the given data, we can see that number of children in the range 0 - 2 belongs to 11 families, Similarly for other ranges Table is formulated below, Using the above formulas.

## Frequency distribution table

Class	Class Class size Frequency		Clas	s limit
interval		of class	Lower	Upper
0 - 2	2	11	0	2
2 - 4	2	17	2	4
4 - 6	2	9	4	6
6 - 8	2	3	6	8

# 2. Question

Given below are the marks obtained by 40 students in a test school:

34	27	45	21	30	40	11	47	01	15
03	40	12	47	48	18	30	24	25	28
32	31	25	22	27	41	12	13	02	44
43	07	09	49	13	19	32	39	24	03

I construct a frequency distribution table of these marks by taking the classes 1–10, 11–20, ......41–50.

## Answer

lower class boundary = lower limit - 0.5

Upper class boundary = upper limit + 0.5

class - size = upper class boundary – lower class boundary

Mid value of class =  $\frac{\text{lower class limit + upper class limit}}{2}$ 

Frequency density =  $\frac{\text{class frequency of that class}}{\text{class size}}$ 

The class limit is of inclusive type

From the given data, we can see that number of students in the range 1 - 10 marks are 6. Similarly for other ranges Table is formulated below, Using the above formulas.

Frequency distribution table

Class	Class frequency	Class	limit	Class boundary		Mid value of class	Class size	Frequency density
		lower	upper	lower	upper			
1 - 10	6	1	10	0.5	10.5	5.5	10	$\frac{6}{10} = 0.6$
11 - 20	8	11	20	10.5	20.5	15.5	10	$\frac{8}{10} = 0.8$
21 - 30	11	21	30	20.5	30.5	25.5	10	$\frac{11}{10} = 1.1$
31 - 40	7	31	40	30.5	40.5	35.5	10	$\frac{7}{10} = 0.7$
41 - 50	8	41	50	40.5	50.5	45.5	10	$\frac{8}{10} = 0.8$

# 3. Question

There are many oranges in a busket. From this busket, by aimlessly taking 40 oranges I wrote below their weights (gm):

45, 35, 30, 55, 70, 100, 80, 110, 80, 75, 85, 70, 75, 85, 90, 75, 90, 30, 55, 45, 40, 65, 60, 50, 40, 100, 65, 60, 40, 100, 30, 45, 84, 70, 80, 95, 85, 70.

Now, I construct a frequency distribution table and a less than type cumulative frequency distribution table for the above given data.

## Answer

lower class boundary = lower limit - 0.5

Upper class boundary = upper limit + 0.5

Mid value of class = (lower class limit + upper class limit)/2

class - size = upper class boundary – lower class boundary

Frequency density = class frequency of that class/class size

From the given data, we can see that weight of oranges in the range 30 - 40 gms are 4. Similarly for other ranges Table is formulated below, Using the above formulas.

Class	Frequency	Class limit		Class boundary		Mid value of	Class size	Frequency density
		Lower	Upper	Lower	upper	class		
30 - 40	4	30	40	30	40	35	10	$\frac{4}{10} = 0.4$
40 - 50	6	40	50	40	50	45	10	$\frac{6}{10} = 0.6$
50 - 60	3	50	60	50	60	55	10	$\frac{3}{10} = 0.3$
60 - 70	4	60	70	60	70	65	10	$\frac{4}{10} = 0.4$
70 - 80	7	70	80	70	80	75	10	$\frac{7}{10} = 0.7$
80 - 90	7	80	90	80	90	85	10	$\frac{7}{10} = 0.7$
90 - 100	3	90	100	90	100	95	10	$\frac{3}{10} = 0.3$
100 - 110	3	100	110	100	110	105	10	$\frac{3}{10} = 0.3$
110 - 120	1	110	120	110	120	115	10	$\frac{1}{10} = 0.1$

Frequency distribution table

The class limit in this table is exclusive type

### Less than type cumulative distribution frequency table

Weight	Frequency (no of oranges)
Less than 30	0
Less than 40	4
Less than 50	6 + 4 = 10
Less than 60	3 + 6 + 4 = 13
Less than 70	4 + 3 + 6 + 4 = 17
Less than 80	7 + 4 + 3 + 6 + 4 = 24
Less than 90	7 + 7 + 4 + 3 + 6 + 4 = 31
Less than 100	3 + 7 + 7 + 4 + 3 + 6 + 4 = 34
Less than 110	3 + 3 + 7 + 7 + 4 + 3 + 6 + 4 = 37
Less than 120	1 + 3 + 3 + 7 + 7 + 4 + 3 + 6 + 4 = 38

# 4. Question

Mitali and Mohidul wrote below the amount of money of electricity bills for this month of the 45 houses of their village.

116, 127, 100, 82, 80, 101, 91, 65, 95, 89, 75, 92, 129, 78, 87, 101, 65, 52, 59, 65, 95, 108, 115, 121, 128, 63, 76, 130, 116, 108, 118, 61, 129, 127, 91, 130, 125, 101, 116, 105, 92, 75, 98, 65, 100.

I construct a frequency distribution table for the above data.

# Answer

lower class boundary = lower limit - 0.5

Upper class boundary = upper limit + 0.5

Mid value of class =  $\frac{\text{lower class limit + upper class limit}}{2}$ 

class - size = upper class boundary – lower class boundary

Frequency density = class frequency of that class/class size

From the given data, we can see that electricity bill in the range 50 - 60 are 2 .Similarly for other ranges Table is formulated below. Using the above formulas.

Class	Frequency	Class limit		Class bo	oundary Mid value of		Class size	Frequency density
		Lower	Upper	Lower	upper	class		
50 - 60	2	50	60	50	60	55	10	$\frac{2}{10} = 0.2$
60 - 70	6	60	70	60	70	65	10	$\frac{6}{10} = 0.6$
70 - 80	4	70	80	70	80	75	10	$\frac{4}{10} = 0.4$
80 - 90	4	80	90	80	90	85	10	$\frac{4}{10} = 0.4$
90 - 100	7	90	100	90	100	95	10	$\frac{7}{10} = 0.7$
100 - 110	8	100	110	100	110	105	10	$\frac{8}{10} = 0.8$
110 - 120	5	110	120	110	120	115	10	$\frac{5}{10} = 0.5$
120 - 130	7	120	130	120	130	125	10	$\frac{7}{10} = 0.7$
130 - 140	2	130	140	130	140	135	10	$\frac{2}{10} = 0.2$

### Frequency distribution table

The class limit in this table is exclusive type

### 5. Question

Maria has written the ages of 300 patients of a hospital in the table given below:

I construct a more than type cumulative frequency distribution table for the above data.

Ages	(years)	10-20	20-30	30-40	40-50	50-60	60-70
The	number	80	40	50	70	40	20
of patients							

### Answer

This type of frequency distribution table is calculated on the basis of total number of data in or above the range. In this question in the range more than 10 years we have to conclude the patients also who has age more than 10 years like the patient whose age is 20,35,50,65,70 etc. Hence Frequency for More than 10 years will be sum of all the patient(data) including that and its above ranges i.e

80 + 40 + 50 + 70 + 40 + 20 = 300.

More than type cumulative distribution frequency table

Ages (years)	Frequency (no of patients)					
10 or above 10	80 + 40 + 50 + 70 + 40 + 20 = 300					
20 or above 20	40 + 50 + 70 + 40 + 20 = 220					
30 or above 30	50 + 70 + 40 + 20 = 180					
40 or above 40	70 + 40 + 20 = 130					
50 or above 50	40 + 20 = 60					
60 or above 60	20					
70 or above 70	0					

# 6. Question

Let us observe the following cumulative frequency distribution table and construct a frequency distribution table:

Classes		Below	below	Below	Below	Below	below
		10	20	30	40	50	60
The number		17	22	29	37	50	60
or students							

## Answer

lower class boundary = lower limit - 0.5

Upper class boundary = upper limit + 0.5

Mid value of class =  $\frac{\text{lower class limit + upper class limit}}{2}$ 

class - size = upper class boundary – lower class boundary

Frequency density = class frequency of that class/class size

### frequency distribution table

Class	Frequency	Class limit		Class b	oundary	Mid value	Class size	Frequency density
		Lower	Upper	Lower	upper	of class		
0 - 10	17	0	10	0	10	5	10	$\frac{17}{10} = 1.7$
10 - 20	22 - 17 = 5	10	20	10	20	15	10	$\frac{5}{10} = 0.5$
20 - 30	29 - 22 = 7	20	30	20	30	25	10	$\frac{9}{10} = 0.9$
30 - 40	37 - 29 = 8	30	40	30	40	35	10	$\frac{8}{10} = 0.8$
40 - 50	50 - 37 = 13	40	50	40	50	45	10	$\frac{13}{10} = 1.3$
50 - 60	60 - 50 = 10	50	60	1 50	60	55	10	$\frac{10}{10} = 1$
60 - 70		60	70	60	70	65	10	$\frac{0}{10} = 0$

The class - limit in this table is exclusive type

## 7. Question

Let us observe the following cumulative frequency distribution table and construct the frequency distribution table:

Marks obtained	The number of students
More than 60	0
More than 50	16
More than 40	40
More than 30	75
More than 20	87
More than 10	92
More than 0	100

# Answer

lower class boundary = lower limit - 0.5

Upper class boundary = upper limit + 0.5

Mid value of class =  $\frac{\text{lower class limit + upper class limit}}{1}$ 

class - size = upper class boundary – lower class boundary

Frequency density = class frequency of that class/class size

### Frequency distribution table

Class	Frequency	Class li	imit	Class bo	oundary	Mid	Class	Frequency
		Lower	Upper	Lower	upper	value of class	size	density
1 - 10	100 - 92 = 8	1	10	0.5	10.5	5.5	10	$\frac{8}{10} = 0.8$
11 - 20	92 - 87 = 5	11	20	10.5	20.5	15.5	10	$\frac{5}{10} = 0.5$
21 - 30	87 - 75 = 12	21	30	20.5	30.5	25.5	10	$\frac{12}{10} = 1.2$
31 - 40	75 - 40 = 35	31	40	30.5	40.5	35.5	10	$\frac{35}{10} = 3.5$
41 - 50	40 - 16 = 24	41	50	40.5	50.5	45.5	10	$\frac{24}{10} = 2.4$
51 - 60	16 - 0 = 16	51	60	50.5	60.5	55.5	10	$\frac{16}{10} = 1.6$
61 - 70	0	61	70	60.5	70.5	65.5	10	$\frac{0}{10} = 0$

The class limit in this table is inclusive type

## 8 A. Question

Which one of the following is a graphical (pictorial) representation of a statistical data?

A. Line - graph

B. Raw data

C. Cumulative frequency

D. Frequency

# Answer

line graph is the graphical representation of data on x - y plane

Whereas raw data is only numerical data

And cumulative frequency & frequency is tabular data

# 8 B. Question

The range of the data 12, 25, 15, 18, 17, 20, 22, 26, 6, 16, 11, 8, 19, 10, 30, 20, 32 is

A. 10

B. 15

C. 18

D. 26

# Answer

The difference between the highest and the lowest value of a given data is called range. So, Range = 32 - 6 = 26.

# 8 C. Question

The class size of the classes 1–5, 6–10 is

A. 4

B. 5

C. 4.5

D. 5.5

# Answer

Class size = upper class boundary - lower class boundary.

= (5 + 0.5) - (1 - 0.5) = (5.5 - 0.5) = 5.

# 8 D. Question

In a frequency distribution table, the midpoints of the classes are 15, 20, 25 30, ..... respectively. The class having midpoint as 20 is

- A. 12.5 17.5 B. 17.5 – 22.5
- C. 18.5 21.5

D. 19.5 - 20.5

## Answer

Mid value of class interval =  $\frac{\text{upper class boundary + lower class boundary}}{\text{model}}$ 

 $\frac{22.5 + 17.5}{2} = 20$ 

# 8 E. Question

In a frequency distribution table, the mid - point of a class is 10 and the class size of each class is 6; the lower limit of the class is

A. 6

B. 7

C. 8

D. 12

Answer

Let the upper limit of the class is u

And lower limit of the class is l

mid value of class interval =  $\frac{\text{upper class boundary} + \text{lower class boundary}}{2}$ 

 $10 = \frac{u+1}{2}$  (i)

Also class size = upper classs boundary – lower class boundary

From (i) and (ii), u = 13 and l = 7

So, upper class boundary = 13 and lower class boundary = 7

## 9 A. Question

In a continuous frequency distribution table if the mid - point of a class is m and the upper class - boundary is u, then let us find out the lower class - boundary.

## Answer

given mid - point = m Upper class boundary = u Let lower class boundary = l mid value of class interval = <u>upper class boundary + lower class boundary</u>

$$\Rightarrow m = \frac{u+l}{2} \Rightarrow l = 2m - u$$

So lower class boundary = 2m - u

### 9 B. Question

In a continuous frequency distribution table, if the mid - point of a class is 42 and class size is 10, then let us write the upper and lower limit of the class.

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### Answer

given mid - point = 42

Class size = 10

Let lower class boundary = L

mid value of class interval =  $\frac{\text{upper class boundary + lower class boundary}}{\text{mid value of class interval}}$ 

$$\Rightarrow 42 = \frac{u+L}{2}$$
 (i)

class size = upper class boundary - lower class boundary

 $\Rightarrow 10 = u - L_{(ii)}$ 

Solving equation (i) and (ii), we get

So lower class boundary = 37 and upper class boundary = 47

### 9 C. Question

Class - limit	70-74	75-79	80-84	85-89
Frequency	3	4	5	8

Let us write the frequency density of the first class of the above frequency distribution table.

## Answer

class size of class = (upper limit + 0.5) - (lower limit - 0.5)

= (74 + 0.5) - (70 - 0.5)

= 74.5 - 69.5 = 5

 $Frequency density of class = \frac{Class frequency of that class}{class size}$ 

$$=\frac{3}{5}=0.6$$

So frequency density of the first class = 0.6

### 9 D. Question

Let us write the frequency density of the last class of the question (c).

# Answer

class size of class = (upper limit + 0.5) - (lower limit - 0.5)

= (89 + 0.5) - (85 - 0.5)

= 89.5 - 84.5 = 5

 $Frequency density of class = \frac{Class frequency of that class}{class size}$ 

$$=\frac{8}{5}=1.6$$

So frequency density of the last class = 1.6

# 9 E. Question

Let us write from the following examples which one indicates attribute and which one indicates variable.

(i) Population of the family.

(ii) Daily temperature.

(iii)Educational value.

(iv)Monthly income.

(v) Grade obtained in Madhyamik Examination.

## Answer

(i)variable as it varies from family to family and is measurable

(ii)variable as it is varying/changing and measurable

(iii)attribute as it is not measurable

(iv)variable as it is measurable and varies from person to person

(v)variable as it is varying and measurable

# Let us Work Out 11.2

## 1. Question

I write below in lobular form the daily profit of the 50 shops of the village Bakultala.

Daily profit (Rs.)	0-50	50-100	100-150	150-200	200-250
Number of shops	8	15	10	12	5

I draw the histogram for the above data.

## Answer

The class size of the data set is 50.

Now, let's make the histogram.



# 2. Question

By measuring, Mita wrote the heights of her 75 friends of their school in the table given below:

Height (cm)	136-142	142-148	148-154	154-160	160-166
Number of friends	12	18	26	14	05

I draw the histogram of the data collected by Mita.

## Answer

The class size of the data set is 6.



# 3. Question

In our locality, by collecting the number of Hindi speaking people between ages of 10 years to 45 years, I write them in the table given below:

Age (In year)	10-15	16-21	22-27	28-33	34-39	40-45
Number of Hindi speaking people	8	14	10	20	6	12

I draw the histogram for the above data.

### Answer

Class size is 5

We need to adjust the boundaries to make it continuous.

Age (In year)	10-15	16-21	22-27	28-33	34-39	40-45
Particular class (with class boundary)	9.5-15.5	15.5-21.5	21.5-27.5	27.5-33.5	33.5-39.5	39.5-45.5
Number of Hindi speaking people	8	14	10	20	6	12

Now the class size is 6.

Let's make the histogram.



# 4. Question

I draw the histogram of the frequency distribution table given below:

Class	1-10	11-20	21-30	31-40	41-50	51-60
Frequency	8	3	6	12	2	7

### Answer

Making the class continuous.

Class	1-10	11-20	21-30	31-40	41-50	51-60
	0.5-10.5	10.5-20.5	20.5-30.5	30.5-40.5	40.5-50.5	50.5-60.5
Frequency	8	3	6	12	2	7

# Now, the histogram



# 5. Question

I construct the frequency polygon for the following marks obtained by 75 learners of Pritha's school.

Marks obtained	30	40	50	60	70	80
Number of students	12	18	21	15	6	3

In the graph paper, taking suitable measures along horizontal and vertical lines, the points (20, 0), (30, 12), (40, 18), (50, 21), (60, 15), (70, 6), (80, 3) and (90, 0) are plotted on the graph paper and then I draw the frequency polygon by adding them.

# Answer

Plotting points (20, 0), (30, 12), (40, 18), (50, 21), (60, 15), (70, 6), (80, 3) and (90, 0) and joining them to make the frequency polygon.



# 6. Question

I draw the frequency polygon for the following frequency distribution table.

Class	0-5	5-10	10-15	15-20	20-25	25-30
Frequency	4	10	24	12	20	8

### Answer

We will find the middle value of classes and then plot it on a graph with frequency as x coordinate and middle value as y coordinate to get the frequency polygon.

Class	0-5	5-10	10-15	15-20	20-25	25-30
Middle Value	2.5	7.5	12.5	17.5	22.5	27.5
Frequency	4	10	24	12	20	8



## 7. Question

By drawing histogram, I draw the frequency polygon of the frequency distribution table given below:

Amount of subscription (Rs.)	20	25	30	35	40	45	50
Number of members	20	26	16	10	4	18	6

## Answer

The data is not related to class and the difference of two consecutive values is 5.

 $\therefore$  To obtain class lengths, I shall take the mid points of the class-interval.

17.5-22.5, 22.5-27.5, 27.5-32.5, 32.5-37.5, 37.5-42.5, 42.5-47.5, 47.5-52.5, for wages 20,25,30,35,40,45,50 respectively.

$$\left[ \therefore \left( 20 - \frac{5}{2} \right) - \left( 20 + \frac{5}{2} \right) \rightarrow (17.5 - 22.5) \right]$$

Amount of subscription (Rs.)	20	25	30	35	40	45	50
Class	17.5- 22.5	22.5- 27.5	27.5- 32.5	32.5- 37.5	37.5- 42.5	42.5- 47.5	47.5- 52.5
Number of members	20	26	16	10	4	18	6



By joining the middle values of classes, we get the frequency polygon



# 8. Question

I draw the histogram for the following frequency distribution table.

Number children	of	0	1	2	3	4	5
Number families	of	120	85	50	25	15	5

**Hints:** At first, by exclusive class method the statistical data will be constructed as frequency distribution table with class-boundaries given below:

Number children	of	0-1	1-2	2-3	3-4	4-5	5-6
Number families	of	120	85	50	25	15	5

### Answer

We will make the histogram with the data with class boundaries

Number children	of	0-1	1-2	2-3	3-4	4-5	5-6
Number families	of	120	85	50	25	15	5



### 9. Question

I have written the ages of 32 teachers of Primary School in the village Virsingha in a table given below:

Ages (year	s)	25-31	31-37	37-43	43-49	49-55
Number teachers	of	10	13	05	03	01

I represent the above given data graphically by histogram and frequency polygon.

#### Answer

By using the data

Ages (years)	25-31	31-37	37-43	43-49	49-55
Number of teachers	10	13	05	03	01

We make a histogram and then by joining middle values of classes we get the frequency polygon.



# 10. Question

I draw the frequency polygon for the following frequency distribution table.

Class	75-80	80-85	85-90	90-100	100-105
Frequency	12	18	22	10	8

### Answer

To make the frequency polygon we have to plot the class middle value as the x coordinate and its respective frequency as the y co-ordinate.

Class	75-80	80-85	85-90	90-100	100-105
Middle class value	77.5	82.5	87.5	92.5	102.5
Frequency	12	18	22	10	8



### 11. Question

I draw the frequency polygon for the following frequency distribution table.

Class	1-10	11-20	21-30	31-40	41-50
Frequency	8	3	6	12	4

### Answer

Making the class continuous.

Class	1-10	11-20	21-30	31-40	41-50
Modified class	0.5-10.5	10.5-20.5	20.5-30.5	30.5-40.5	40.5-50.5
Frequency	8	3	6	12	4

Now, we will find the middle-class values

Class	1-	10	11-20	21-30	31-40	41-50
Modified class	0.5-	10.5	10.5-20.5	20.5-30.5	30.5-40.5	40.5-50.5
Middle Cla value	is 5.	.5	15.5	25.5	35.5	45.5
Frequency	8	3	3	6	12	4

We can see that the middle-class value would have came same even if we didn't find the continuous class.



# 12. Question

A special drive will be taken for women literacy in total in our village. For this reason, we have collected following data:

Age	10-15	15-20	20-25	25-30	30-35
Number of illiterates	40	90	100	60	160

I draw the frequency polygon for the above data.

### Answer

To make the frequency polygon we have to plot the class middle value as the x coordinate and its respective frequency as the y co-ordinate.

Age	10-15	15-20	20-25	25-30	30-35
Middle class value	12.5	17.5	22.5	27.5	32.5
Number of illiterates	40	90	100	60	160

# Frequency Polygon



## 13. Question

I have written in the following the frequency of the number of goals given by the team in our Kolkata football-league in previous month.

Scores	0	1	2	3	4	5	6
Frequency	15	20	12	8	6	3	1

I draw the frequency polygon for the representation of the above data.

## Answer

We can make the frequency polygon by using score as abscissa and frequency as ordinate.

Scores	0	1	2	3	4	5	6
Frequency	15	20	12	8	6	3	1



# 14 A. Question

Each of the area of each of the rectangle of a histogram is proportional to

A. the mid-point of that class

- B. the class-size of that class
- C. the frequency of that class
- D. the cumulative frequency of that class

### Answer

If the frequency is more, the height of the rectangle would be more which would make the area of the rectangle greater.

## 14 B. Question

A frequency polygon is drawn by the frequency of the class and

- A. upper limit of the class
- B. lower limit of the class
- C. mid-value of the class

D. any value of the class

### Answer

frequency polygon is made by plotting the mid-value as x-coordinate and the frequency as the y-coordinate and then joining them to get the frequency polygon.

## 14 C. Question

To draw a histogram, the class-boundaries are taken

A. along y-axis

- B. along x-axis
- C. along x-axis and y-axis both

### D. in between x-axis and y-axis

# Answer

class boundaries are always made on x-axis.

# 14 D. Question

In case of drawing a histogram, the base of the rectangle of each class is

A. frequency

B. class-boundary

C. range

D. class-size

# Answer

The width of the base of the rectangle of a class is the class-size of that class.

# 14 E. Question

A histogram is the graphical representation of a grouped data whose class-boundary and frequency are taken respectively.

A. along vertical axis and horizontal axis.

- B. only along vertical axis.
- C. only along horizontal axis.
- D. along horizontal axis and vertical axis.

## Answer

class boundaries are taken on x-axis and the frequency is taken on the y-axis.