UNIT – 6
STATISTICS

CHAPTER 33

COLLECTION AND TABULATION OF DATA
[INCLUDING GRAPHS AND ARITHMETIC MEAN]

33.1 BASIC TREATMENT

Statistics *is the science which deals with the collection, classification and interpretation of available information and data.*

For example :

Mohit visits 20 families of a locality to collect informations about the families with less than 4 members, with 4 members and with more than 4 members. He then summarises the information collected as shown below :

No. of members in the family	No. of families
(i) with less than 4 members	8
(ii) with 4 members	7
(iii) with more than 4 members	5

33.2 DATA

The set of numerical facts collected (as shown above), *in order to reveal useful informations,* **is called data.**

Whatever be the method of collecting the data, once the data is collected, it must be arranged in a systematic way (form).

The arrangement of data in a systematic form, usually in a table (tabular) form, is called *tabulation.*

e.g., consider the following tabulation :

Class	First division	Second division	Detained	Total
I	95	30	nil	125
II	68	40	10	118
III	47	35	15	97

The above table represents the result of a particular examination of a primary school.

33.3 RAW DATA AND AN ARRAYED DATA

Suppose the marks (in a test) of 30 children of a class are as follows :

12	22	14	16	28	30	20	26	14	22
25	26	22	25	28	30	22	18	16	26
22	26	18	14	18	30	28	16	26	26

The data in this form, obtained as a result of observations in original form, is called **raw data** or **ungrouped data.**

If this raw data is re-arranged in ascending or descending order, the new arrangement is called an **array.**

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Thus the data, given above, can be arranged to form an array as follows :

12	14	14	14	16	16	16	18	18	18
20	22	22	22	22	22	25	25	26	26
26	26	26	26	28	28	28	30	30	30

As discussed above, an array can also be obtained by writing data in descending order, i.e., the array can be of the form :

30	30	30	28	28	28	26	26	26	26
26	26	25	25	22	22	22	22	22	20
18	18	18	16	16	16	14	14	14	12

33.4   FREQUENCY AND FREQUENCY DISTRIBUTION

The number of times a particular number occurs, in the given set of data, is called its frequency.

For example :

The above set of data, shows the marks of 30 students in which marks 14 occur 3 times, so we say that frequency of 14 is 3. Similarly, 22 occur 5 times, so the frequency of 22 is 5. In the same way, frequency of 12 is 1, frequency of 26 is 6   and so on.

When the given set of data is written in the form of a table showing each data with its frequency, the table so obtained is called a frequency distribution table.

In order to construct a frequency distribution table, make a table as shown below :

[Frequency Distribution Table]

Marks	Tally Marks	Frequency
12	/	1
14	///	3
16	///	3
18	///	3
20	/	1
22	ℳℋℐ	5
25	//	2
26	ℳℋℐ /	6
28	///	3
30	///	3
		TOTAL = 30

In the first column, write the marks in ascending order.

The marks of different children are recorded in the second column (headed with **Tally Marks**) by marking *a short slant line called a stroke.*

The marking of strokes is done as follows :

(i) The first mark in the given data is 12, so make a stroke in the **Tally Marks Column** opposite marks 12.

(ii) The next mark is 14, so make a stroke opposite marks 14 and so on.

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(iii) When four strokes are made opposite any particular mark, don't make the fifth stroke in the same way but make a stroke across the first four. This gives a bundle of five strokes. The next stroke starts a new bundle.

(iv) When marking of the strokes is completed, count the strokes against each mark and write the corresponding number (frequency) in the column headed as : **frequency.**

The table obtained above shows *ungrouped frequency disribution.* The distribution can be further condensed by grouping the numbers in classes and then writing the frequency of each class.

For this, first of all the given set of data is divided into suitable class-intervals and then the frequency of each class is found with the help of tally marks shown below :

Marks	Tally Marks	Frequency
1–10		0
11–20	ℕℕ I	11
21–30	ℕℕℕ IIII	19

In this table, marks of 30 students are divided in class-intervals 1–10, 11–20 and 21–30. Then, if a number belongs to the class 11–20 a stroke is marked for it in the column with heading 'Tally Marks' and against the class interval 11–20. In the same way, for each given number (mark) a stroke is marked. Finally, the frequency of marks in each class-interval is obtained and is written in column with heading 'Frequency'.

The table showing class-intervals with their frequencies is called a *grouped frequency distribution.*

In this table the frequency of class-interval 11–20 is 11. This means there are 11 students who scored marks from 11 to 20. Similarly, the frequency of class-interval 21–30 is 19 means there are 19 students who scored marks from 21 to 30.

EXERCISE 33(A)

1. Arrange the given data as an array :
   (i) 2, 5, 32, 6, 19, 26, 9, 13, 25 and 42
   (ii) 4, 10, 30, 6, 2, 4, 3, 15, 10, 3, 2, 10, 15, 12, 2, 11, 3, 4, 6 and 11.

2. The number of children in each of the 25 families is given below. Represent the given data in the form of a frequency distribution :

   1, 3, 2, 4, 3, 2, 1, 5, 1, 2, 2, 3, 1, 4, 0, 5, 3, 1, 2, 0, 4, 4, 2, 1 and 3.

3. The following observations show the number of children present for daily sports practice during the month of May. Represent the given data in the form of a frequency distribution :

35	40	40	42	41	40	41	44	40	40
38	37	40	41	39	38	39	40	42	37
35	30	35	36	38	37	41	42	41	38	37

4. The marks obtained by 50 children in a class are shown below. Taking class-intervals 0 – 4, 5 – 9, 10 – 14, ..., etc., arrange the data in a grouped frequency distribution.

45	39	46	39	18	13	35	38	30	28
33	31	49	22	37	47	8	10	32	15

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22	3	27	35	11	31	21	37	24	36
17	20	18	36	4	12	38	35	14	43
28	17	23	28	42	34	35	25	26	38

5. The weights (in g) of 40 oranges picked at random from a basket are as follows :

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

Arrange the data in a suitable grouped frequency distribution.

33.5 GRAPHICAL REPRESENTAION OF DATA

The graphical representation of statistical data has a more effecting and more lasting effect on the mind of a person as compared to a written statement.

There are several ways of representing the statistical data graphically but here we confine our study to only following three types of graphs :

  (i) **Pie-graph** (Pie-chart)   (ii) **Bar-graph** (Column-graph)

  (iii) **Line-graph**
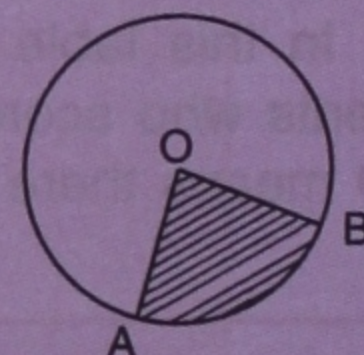
1. Pie-graph (Pie-chart) :

  In a pie-graph, the numerical data is represented by the sectors of a circle

Sector is the region of the circle enclosed by two radii.

  The adjoining figure shows a sector, represented by shaded portion, which is bounded by two radii of the circle.

  The angle AOB is called the central angle of the sector shown by the shaded portion.

Example 1 :

  In class XI of a particular school in Delhi with 90 students, 36 students score first division, 27 score second division, 18 score third division and remaining fail.

  Represent the data given above by a pie-graph.

**Solution :**

  Steps :

  1. Divide 360° in proportion of 36 : 27 : 18 : 9

[No. of students failed = 90 − (36 + 27 + 18) = 9]

Since, the sum of the angles formed at the centre of a circle is 360°, divide 360° in the proportion of the given data.

  2. Construct a table as shown below.

  3. Draw a circle of any suitable radius.

  4. For each angle (central-angle), obtained in Step 1, draw a sector.

| Division	No. of student	Central-angle
First	36	$\dfrac{360°}{90} \times 36 = 144°$
Second	27	$\dfrac{360°}{90} \times 27 = 108°$
Third	18	$\dfrac{360°}{90} \times 18 = 72°$
Failed	9	$\dfrac{360°}{90} \times 9 = 36°$
Total	90	360°
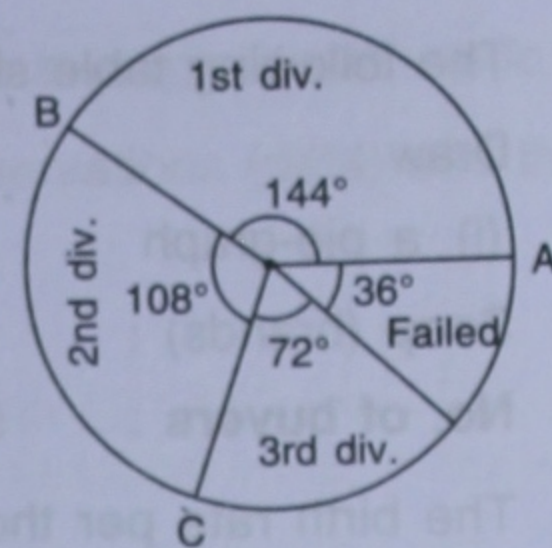
Ans.

2. Bar Graph (Column Graph) :

It is the simplest and most widely used graph in which the numerical data is represented by the height of rectangular bars of equal widths.

For example :

The following table gives the number of children classified according to their favourite subjects and the corresponding bar graph is drawn alongside :

| Subject	No. of Children
English	32
Hindi	18
Mathematics	28
Science	40
History	36
Geography	26
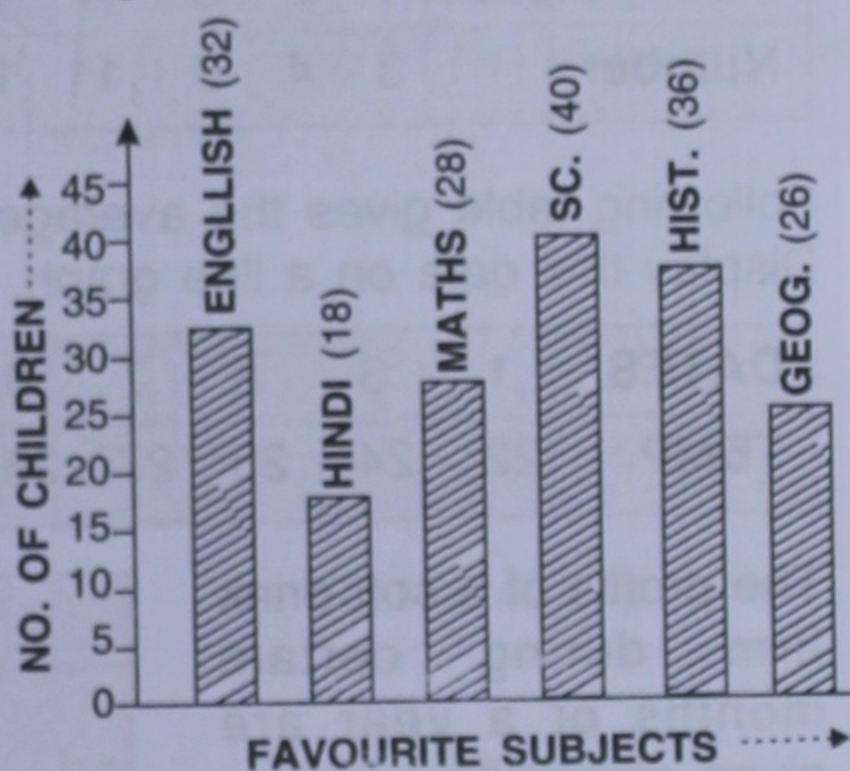
For drawing this bar graph :
1. Names of the different subjects are taken along horizontal axis and number of children is taken along vertical axis.
2. The height of a bar is proportionally drawn according to the number it represents.
3. Bars drawn can be of any suitable width, but widths of all the bars must be the same.
4. The space between consecutive bars must also be same. It is *not necessary that this space between the consecutive bars is same as the width of the bars.*
5. These bars are normally shaded for better effect.

3. Line Graph :

A line graph, for the observations given in the above table, is drawn alongside.

For drawing a line graph :
1. Names of the subjects are taken along horizontal axis and number of children is taken along vertical axis.
2. Thick points are marked against the number of children in respect of each subject and then these points are joined by straight lines.

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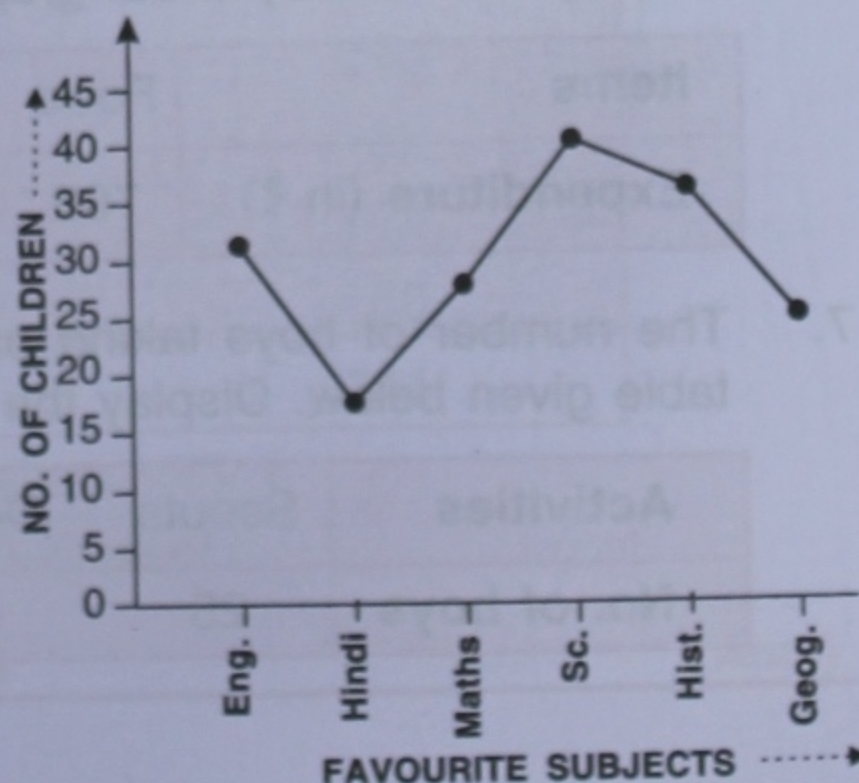
EXERCISE 33(B)

1. The following table shows the market positions of some brands of soap.
   Draw :
   (i) a pie-graph   (ii) a bar-graph

Soap (brands) :	A	B	C	D	E
No. of buyers :	51	27	15	24	18

2. The birth rate per thousand of different countries over a particular period of time is shown below :

INDIA	U.K.	CHINA	GERMANY	SWEDEN
35	22	42	13	8

   Draw : (i) a pie-graph   (ii) a bar-graph

3. In a Malaria epidemic, the number of cases diagonosed were as follows. Draw a line graph for this data :

Date (August)	1	2	3	4	5	6	7	8	9	10	11	12
Number	3	4	0	11	12	25	45	32	31	20	10	0

4. Following table gives the average temperature during the alternate days of a month. Display this data on a line graph.

DATES	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29
TEMP.	22°	24°	23°	27°	25°	24°	26°	25°	27°	28°	27°	30°	29°	28°	30°

5. The profits of a soft drink firm during certain months of a year are given alongside.
   Draw a :
   (i) bar graph
   (ii) line graph, for this data.

Months	Profits (in thousands)
January	2.4
February	1.8
March	3.0
April	4.0
May	5.2
June	4.0
July	2.0

6. The following table shows the expenditure on different house hold items by a family. Display the data by a bar-graph.

Items	Food	Rent	Clothing	Education	Savings	Others
Expenditure (in ₹)	700	350	175	200	250	150

7. The number of boys taking part in different extracurricular activities is shown in the table given below. Display the data by a (i) bar graph, (ii) line graph, (iii) pie-chart.

Activities	Scouts	Debate	Science Club	Inst. Music	S.U.P.W.
No. of boys	25	13	7	30	15

33.6 ARITHMETIC MEAN (OR AVERAGE)

The arithmetic mean in Statistics has the same meaning as average in arithmetic.

For finding arithmetic mean of a given data, add all the observations (data) and then divide their sum by the number of observations.

Example 2 :

Find the arithmetic mean of : 8, 7, 10, 6 and 11.

Solution :

$$\text{Arithmetic mean} = \frac{\text{Sum of given observations (data)}}{\text{Number of given observations}}$$

Since, the sum of given observations = 8 + 7 + 10 + 6 + 11 = 42

And, number of given observations = 5

$$\therefore \text{ Their } \textbf{arithmetic mean} = \frac{42}{5} = 8.4. \qquad \text{(Ans.)}$$

When the given observations are in the form of a frequency distribution table, then, to find their arithmetic mean, each observation is multiplied by its frequency and the sum of all such products is divided by the total frequency.

Example 3 :

Find the arithmetic mean of the data, given in the table below :

x	20	22	24	26	28	30
f	2	5	10	7	4	2

Solution :

$$\text{Arithmetic mean} = \frac{20 \times 2 + 22 \times 5 + 24 \times 10 + 26 \times 7 + 28 \times 4 + 30 \times 2}{2 + 5 + 10 + 7 + 4 + 2}$$

$$= \frac{744}{30} = 24 \cdot 8 \qquad \text{(Ans.)}$$

The detailed working is shown below :

x	f (frequency)	f × x
20	2	40
22	5	110
24	10	240
26	7	182
28	4	112
30	2	60
Total	**30**	**744**

$$\text{Arithmetic Mean} = \frac{\text{Sum of all values of } f \times x}{\text{Sum of all values of } f}$$

$$= \frac{744}{30} = 24.8 \qquad \text{(Ans.)}$$

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EXERCISE 33(C)

1. Find the arithmetic mean of the numbers, given below :
   (i) 2, 9, 3 and 6 (ii) 4, 2, 7, 9, 7 and 1
   (ii) 5, 0, 3, 8, 4 and 0 (iv) 1.3, 2.1, 4.6 and 3.8
   (v) 28, 63, 95, 42, 50 and 76 (vi) 15, −12, 4, 13, 25, −16, 20 and 8
   (vii) $1\frac{1}{2}$, $2\frac{1}{5}$, 3, $4\frac{1}{6}$, 5 and $7\frac{1}{5}$ (viii) − 6, −5, −2, −1, 0, 2, 4, 8 and 9
   (ix) first six whole numbers (x) first ten natural numbers.

2. The arithmetic mean of the numbers 4, 9, 3, 2, x, 5 and 1 is 4. Find x.

3. Find y, if the arithmetic mean of 1.2, 3.9, 4.6, 11.2, and y is 5.

4. The following table shows marks (out of 100) scored, in different subjects, by a student. Find his average of marks :

English	Hindi	Science	History	Geography	Maths	Social Studies
69	71	46	58	62	66	55

5. Find the mean from the given tables :

(a)
x	2	3	4	5	6	7	8	9	10
f	1	2	4	6	4	3	2	1	1

(b)
Score	10	20	30	40	50
Frequency	2	15	27	11	5

(c)
Marks	10	20	30	40	50
No. of children	1	3	21	11	0

(d)
No. of schools	5	10	12	15
No. of children	1000	750	1250	500

6. Find the mean of :
   (i) first 8 natural numbers.
   (ii) first 10 whole numbers.
   (iii) first 5 prime numbers.
   (iv) first 8 odd natural numbers.

7. If the mean of 8, 5, x, 4, x + 3 and 2x − 4 is 6. Find the value of x.

8. Find the mean of :
   15, 24, 30 − x, 20 − x, 16, 2x − 3 and 17.