UNIT II

Measurement Scales, Frequency Distribution, Diagrammatic and Graphical Representation

- Scales of Measurement
- Frequency Distribution and its Types
- Diagrammatic and Graphical Representation of Data

Diagrammatic and Graphical Representation of Data

6.1. DIAGRAMMATIC AND GRAPHICAL REPRESENTATION OF DATA

The easiest method of representing the statistical data is the use of diagrams and graphs. The diagrams and graphs are simple geometrical figures like lines, squares, rectangles, bars, circles, cubes, pictures, charts, maps, etc. The diagrammatic and graphical representations are more attractive, simple to understand and readily comprehensible. Even a layman can easily understand the diagrammatic representation whereas graphical representation needs some knowledge in the subject.

6.2. DIAGRAMMATIC REPRESENTATION OF DATA

Diagrammatic representation is a technique of presenting a numerical data through simple diagrams like bars, circles, maps, pictorials, cartograms etc. This kind representation is most attractive and appealing way to represent statistical data. Even a layman can easily understand this representation. This is only a representation brings out hidden facts and relationships.

There are many types of diagrammatic representation, some of the important methods are :

1. Bar diagram
2. Pie diagram
3. Pictograms and Cartograms.

6.3. BAR DIAGRAM

A bar diagram is diagrammatic representation of a numerical data presents with rectangular bars with heights are proportional to values of the variable under a statistical study. The bars can be plotted vertically or horizontally. The heights or the lengths of the bars indicate value of the variable of some population characteristic. In the

onstruction of bar diagram width of the bar has no relationship with the measurement nd it is only to make the diagram look more elegant and attractive. The bar diagram is seful to compare the different groups of data of some population characteristic. It is nore useful to observe changes in data *i.e.*, trends of the variable over time.

The following are different types of bar diagrams :

1. Simple bar diagrams
2. Multiple bar diagrams
3. Subdivided bar diagrams
4. Percentage bar diagrams

6.4. CONSTRUCTION OF BAR DIAGRAM

To construct the bar diagram, first we represent different time periods or places or items etc. on X-axis. The values of the variable are represented as vertical or horizontal bars on Y-axis against different time periods, places etc. This diagrammatic representation of bars is called bar diagram.

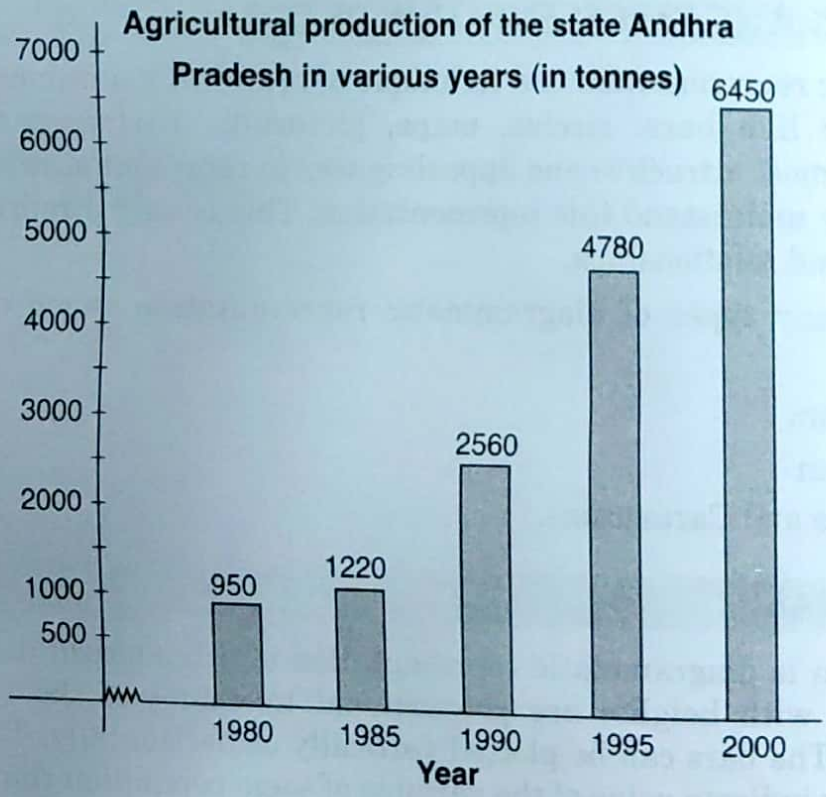
6.5. SIMPLE BAR DIAGRAM

A simple bar diagram represents the data of only one variable. The variable may be sales, profits, population, production, income, agricultural production etc. The construction of bar diagram with one variable is known as simple bar diagram.

PROBLEM 1. The following data relates to agricultural production in tonnes of the state Andhra Pradesh in tonnes for various years. Represent the data by suitable bar diagram.

Year	*1980*	*1985*	*1990*	*1995*	*2000*
Agricultural Production (in tonnes)	950	1220	2560	4780	6450

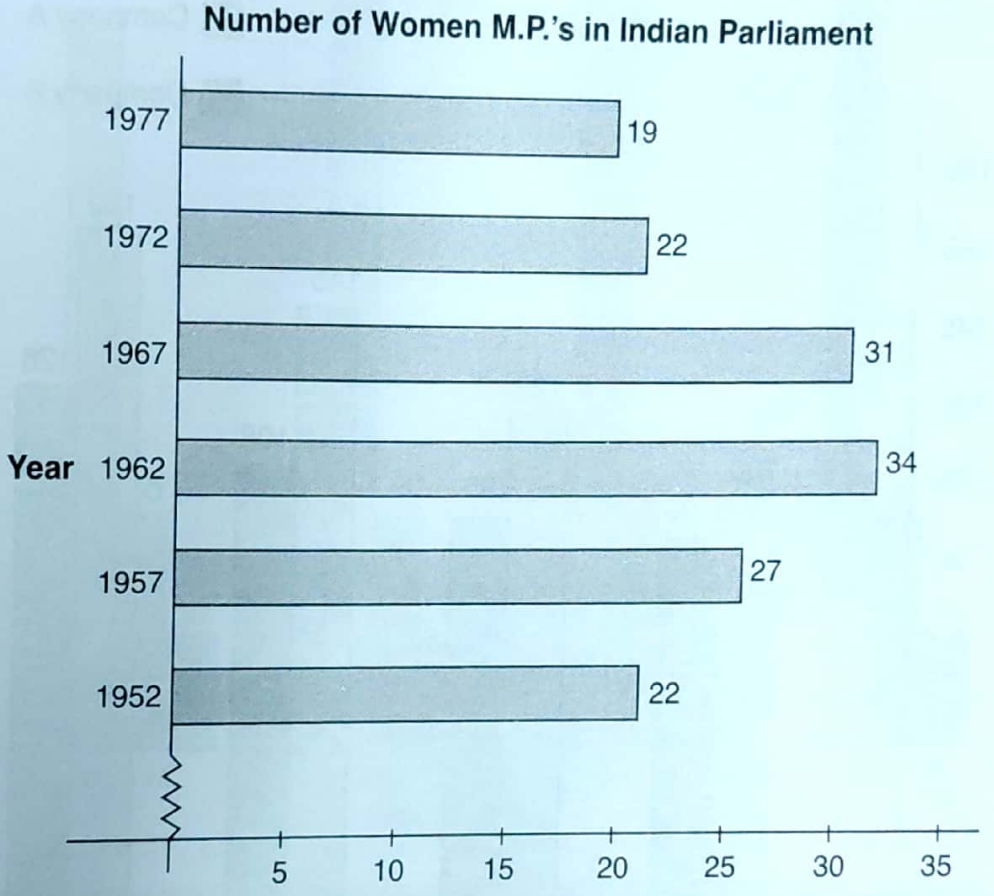
SOLUTION



PROBLEM 2. Number of M.P.'s in the parliament of India for various years is given below in the following table :

Year	*1952*	*1957*	*1962*	*1967*	*1972*	*1977*
No. of Women M.P.'s	22	27	34	31	22	19

SOLUTION



6.6. MULTIPLE BAR DIAGRAM

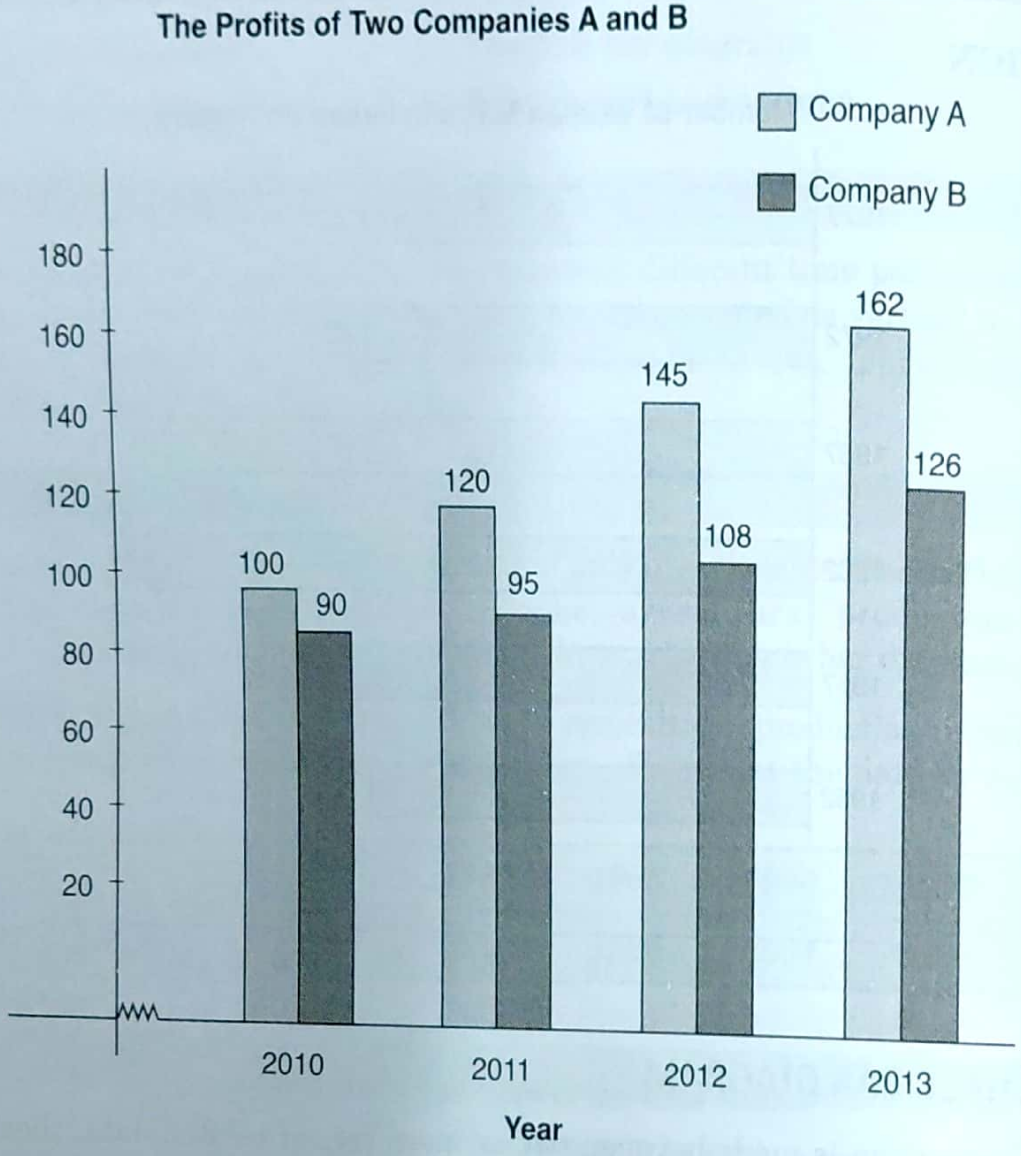
If the comparison is made between two or more sets of related data, then multiple bar diagram is a good choice of representation. The multiple bar diagram represents the data of two or more variables in the study. The construction of bar diagram with two or more variables is known as multiple bar diagram. In multiple bar diagram, different bars for a period are placed together leaving some gap between each set of bars.

PROBLEM 1. The profits of two companies A and B are given below in the following table :

Year	*Profits in ('000 Rupees)*	
	Company A	*Company B*
2010	100	90
2011	120	95
2012	145	108
2013	162	126

Represent the data with suitable bar diagram.

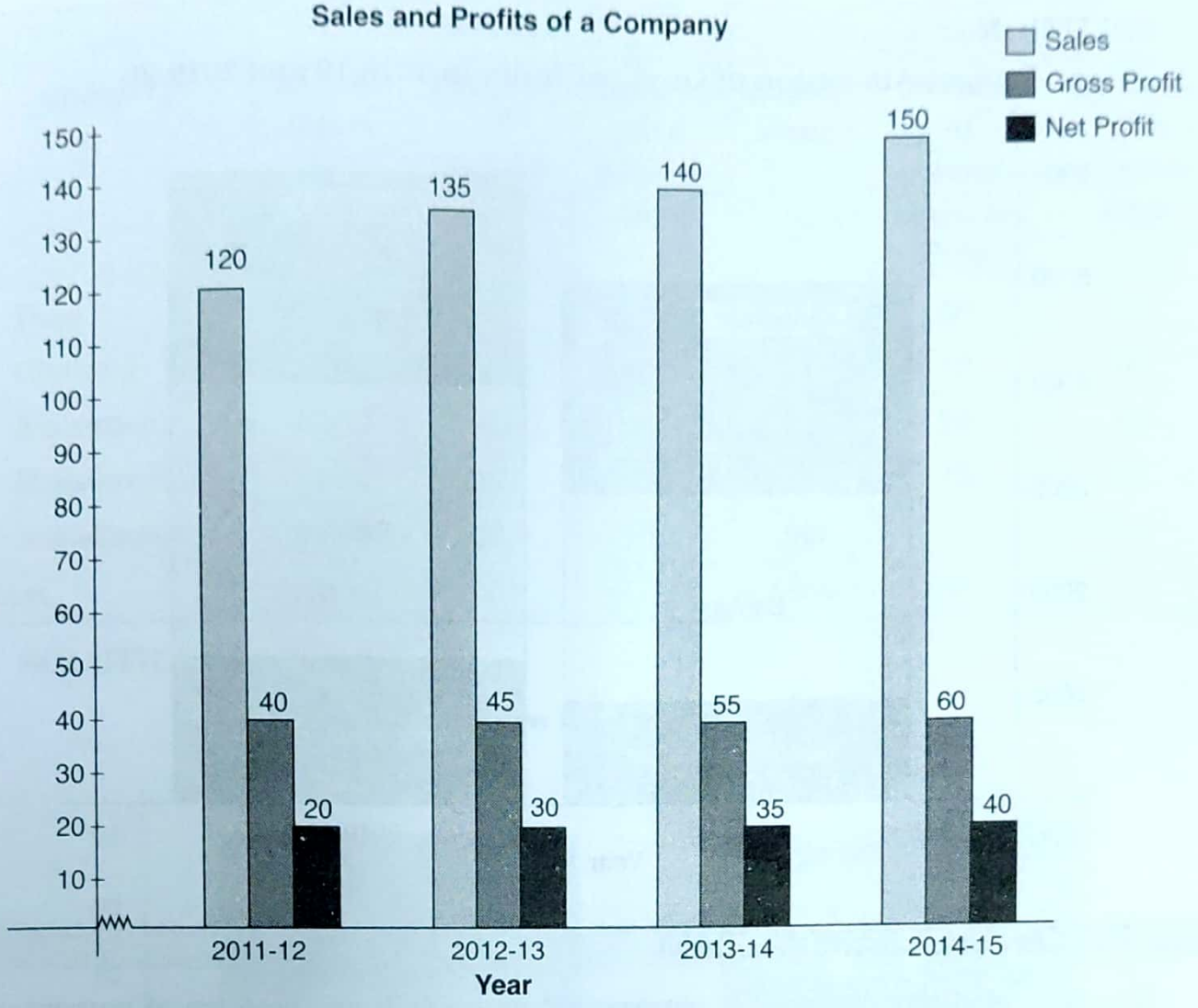
SOLUTION. The given data can be suitably represented by a multiple bar diagram. The diagram is shown below :



PROBLEM 2. The data given below in the following table relates to sales, gross profits and net profits of a company in lakhs of rupees. Draw a suitable bar diagram.

Year	*Sales (in lakhs of rupees)*	*Profits (in lakhs of rupees)*	
		Gross Profit	*Net Profit*
2011-12	120	40	20
2012-13	135	45	30
2013-14	140	55	35
2014-15	150	60	40

SOLUTION. The given data can be suitably represented by a multiple bar diagram. The diagram is shown below :



6.7. SUB–DIVIDED BAR DIAGRAM

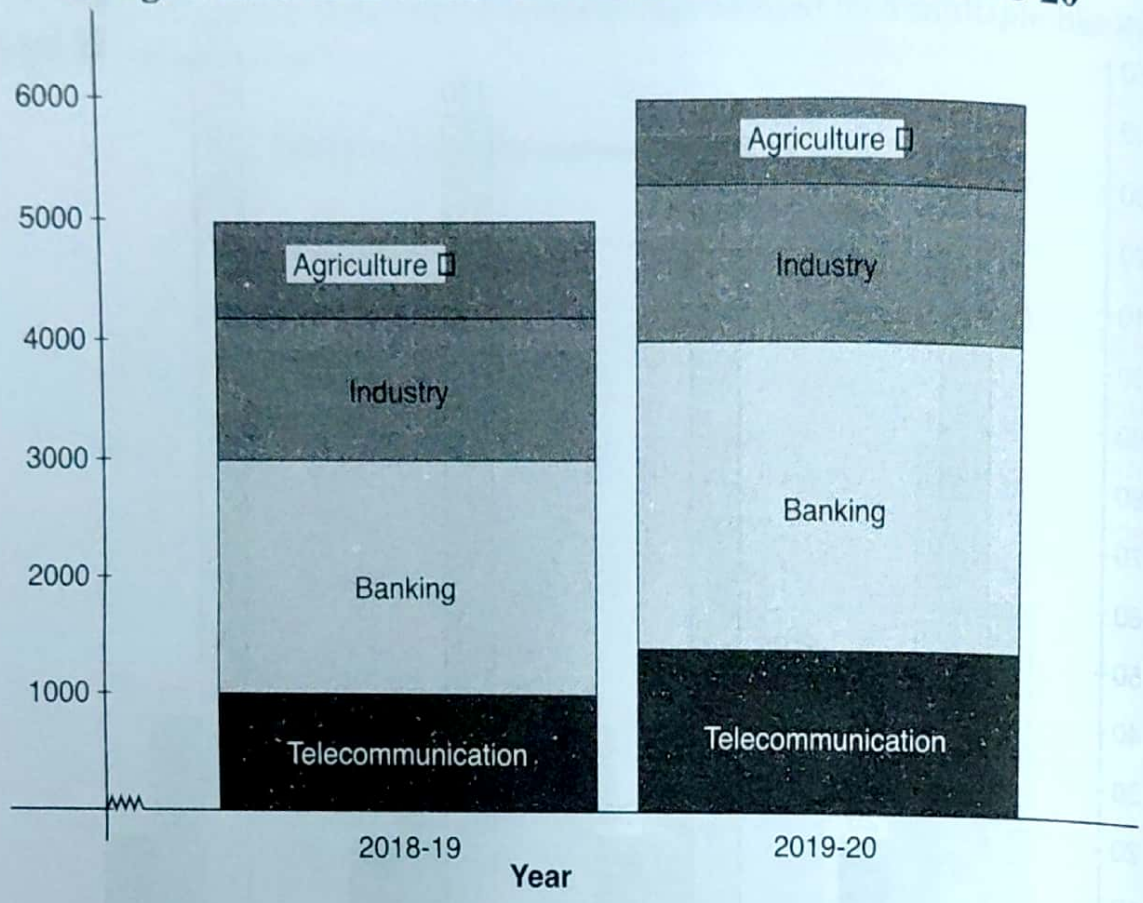
A sub-divided bar diagram is used if the total magnitude of the given variable is divided into various parts or components or sub-classes. First of all a simple bar diagram is drawn for the given data by considering the total magnitude. Then it is divided into various segments, each segment representing a given component of the total. If all the components or sub-classes of a given variable are represented in a single bar for each class, then such kind of representation of bar diagram is known as **Sub-divided bar diagram**.

PROBLEM 1. Draw sub-divided bar diagram to the following data relates to a special allocation of budget of Govt. of India in crores of rupees for various categories in the years 2018-19 and 2019-20.

Category	*Budget allocation (in crores of rupees)*	
	2018-19	*2019-20*
Agriculture	800	700
Industry	1200	1300
Banking	2000	2600
Telecommunication	1000	1400

SOLUTION

Budget Allocation of Govt.. of India in 2018-19 and 2019-20



6.8. PERCENTAGE BAR DIAGRAM

If sub-divided bar diagram is represented graphically in the form of percentages, then such bar diagram is known as percentage bar diagram. The most important purpose of percentage bar diagrams is to compare relative changes of various categories in the data. The total for each bar is taken as 100. The vale of each component is expressed as percentage of respective totals. Hence all the bars will be of the same height in percentage bar diagram. These diagrams are more useful for comparing two or more sets of data.

PROBLEM 1. The expenditure details of two families are given below in the following table. Draw percentage bar diagram.

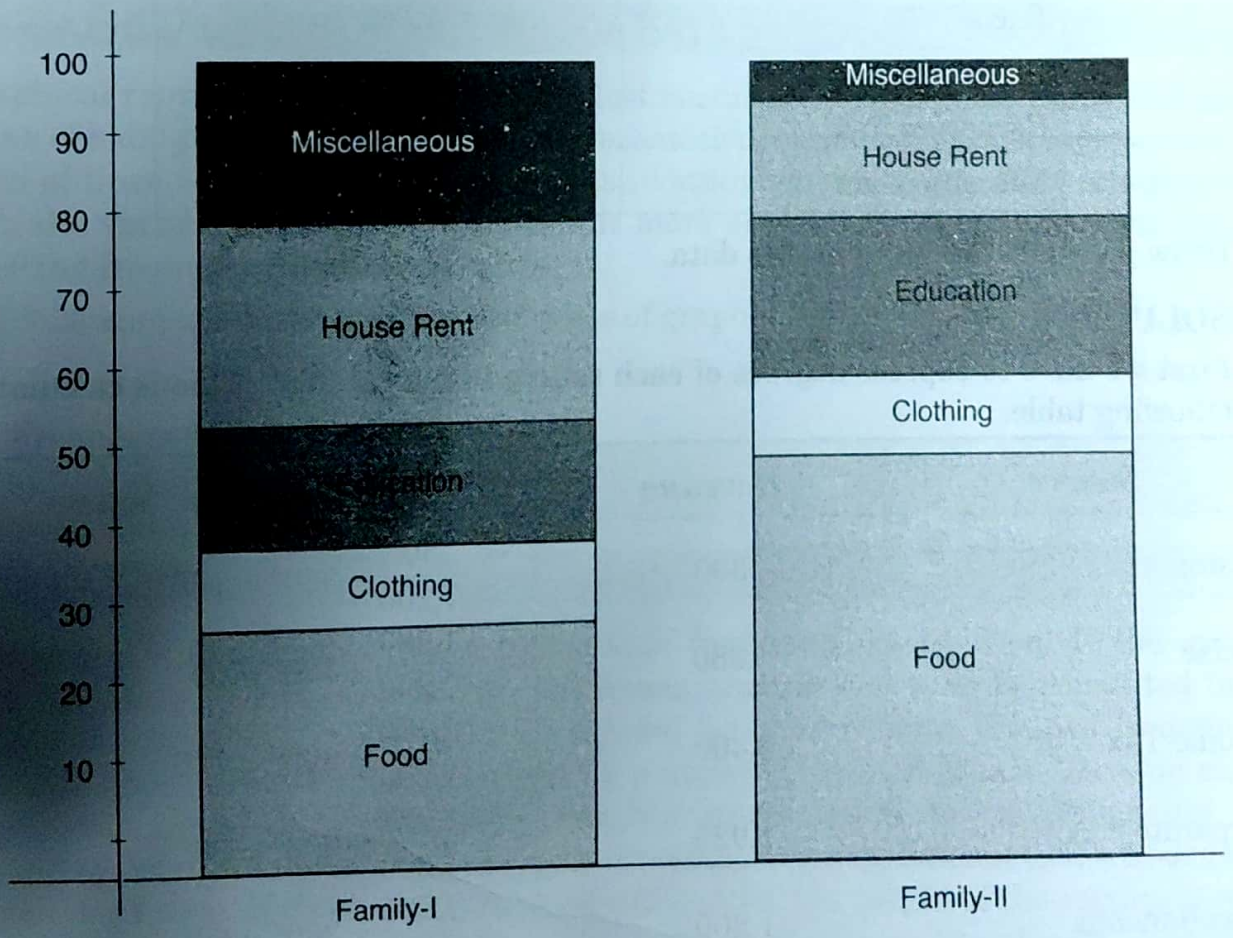
Category	*Expenditure (in Rs.)*	
	Family I	*Family II*
1. Food	3,000	6,000
2. Clothing	1,000	1,200
3. Education	1,500	2,400
4. House rent	2,500	1,800
5. Miscellaneous	2,000	600

SOLUTION. First we have to convert expenditure of various categories into percentages of the total expenditure, which are converted in the following table :

Category	Family I			Family II		
	Expen-diture	Percent of expend-iture to Total	Cumula-tive percen-tage	Expen-diture	Percent of expendi-ture to Total	Cumula-tive percen-tage
1. Food	3,000	30	30	6,000	50	50
2. Clothing	1,000	10	40	1,200	10	60
3. Education	1,500	15	55	2,400	20	80
4. House rent	2,500	25	80	1,800	15	95
5. Miscellaneous	2,000	20	100	600	5	100
Total	10,000	100		12,000	100	

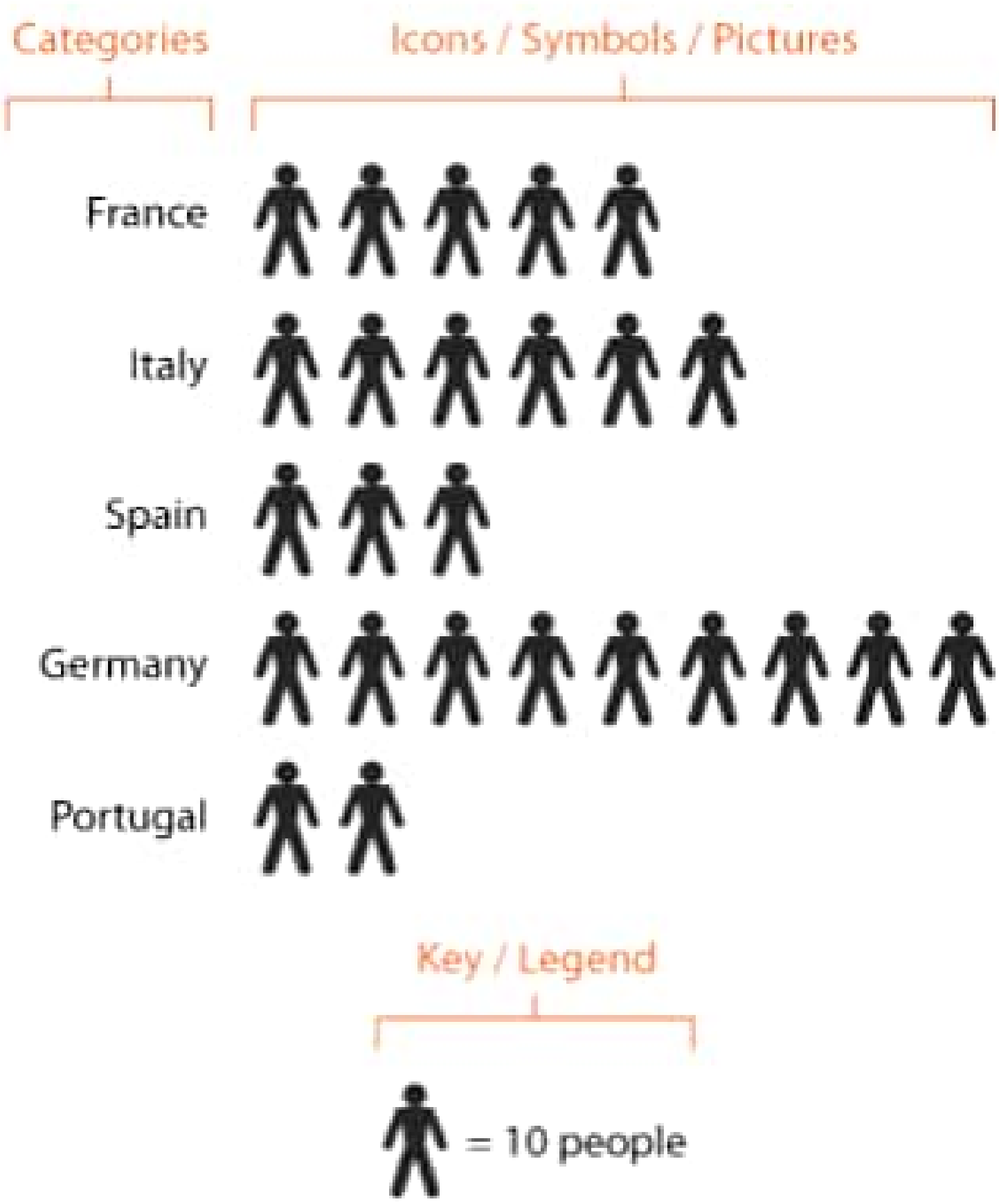
SOLUTION

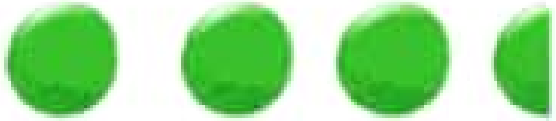
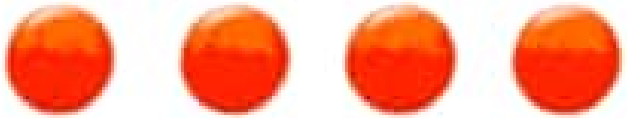
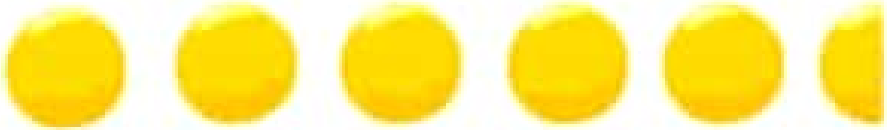
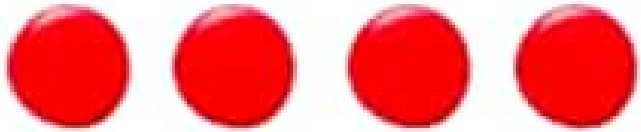
Expenditure Details of two families



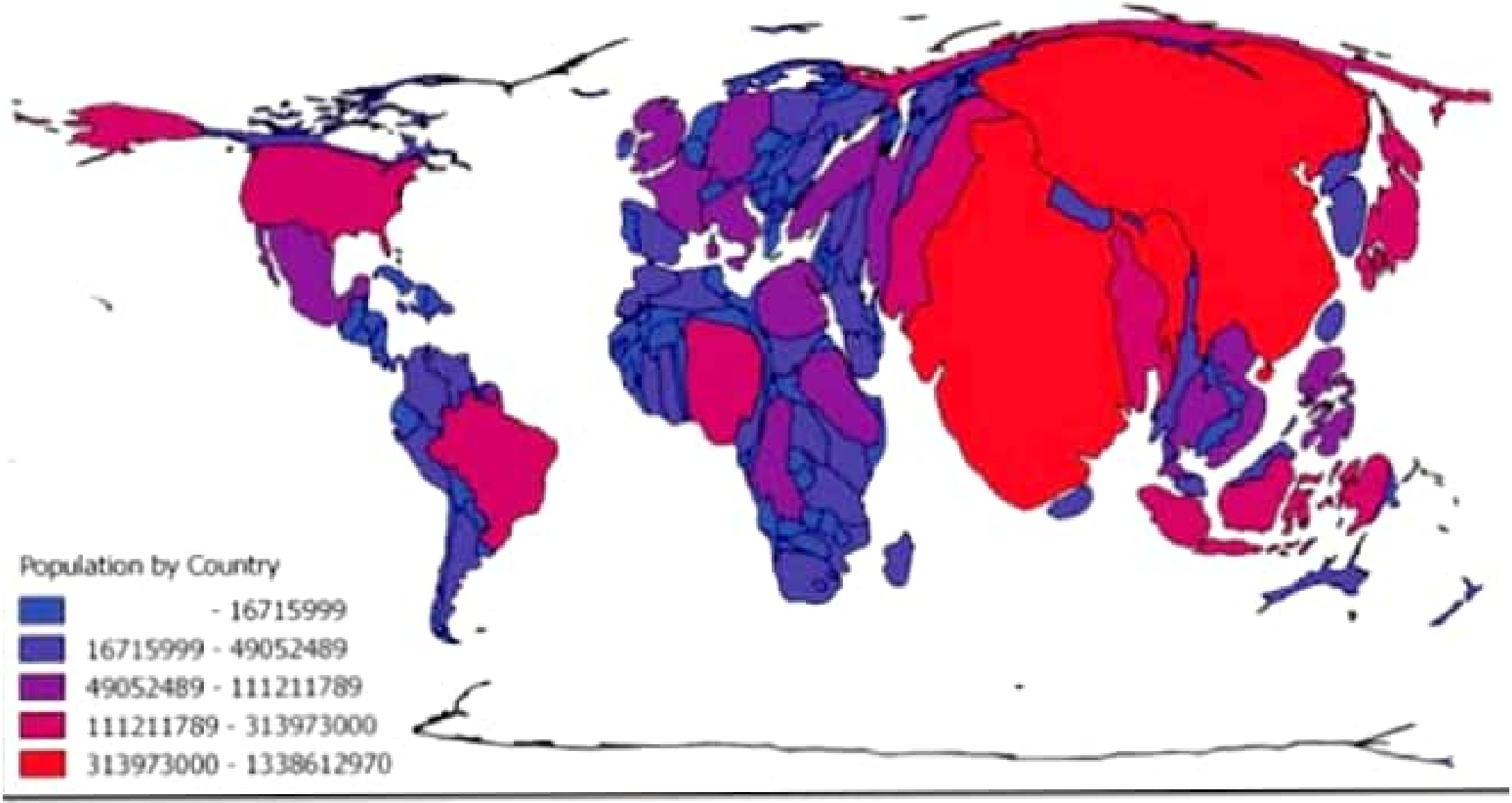
6.9. PIE DIAGRAM

Pie diagram is a diagrammatic representation of different categories of a variable in a circular form. The representation of all categories in different sectors of the circle in accordance with degree of the category is called pie diagram.



Colour	Number of Smarties	Frequency
Green		7
Orange		8
Blue		5
Pink		6
Yellow		11
Red		8
Purple		7
Brown		3
	Key  = 2 smarties	

Population Cartogram



India Population Cartogram

6.10. CONSTRUCTION OF PIE DIAGRAM

First of all we express the values of different categories of the variable as a percentage of total. Then we convert percentages of categories into degrees as represented as the total of 360°,. The degree of any category can be easily obtained by using the following formula :

$$\text{Degree of a category} = \frac{\text{Value of the category}}{\text{Total value}} \times 360°$$

Now represent all the categories in different sectors of the circle in accordance with the degree of respective categories. This kind of diagrammatic representation in circular form is known as pie diagram.

PROBLEM 1. The revenue sources of Government of India during a particular period is given below :

Source	***Revenue (in thousands of crores)***
Customs	300
Excise	1,380
Income Tax	2,400
Corporate Tax	1,920
Miscellaneous	1,200

Draw pie chart to represent this data.

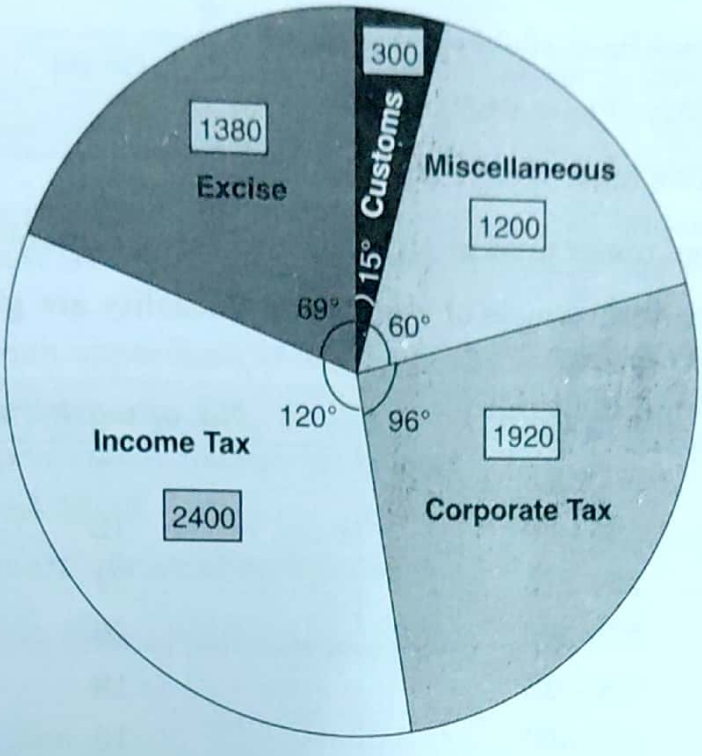
SOLUTION

First we have to express degrees of each source to a total 360°. This is calculated in the following table.

Source	***Revenue***	***Degrees of the Source***
Customs	300	$\frac{30}{7,200} \times 360° = 150°$
Excise	1380	$\frac{1,380}{7,200} \times 360° = 69°$
Income Tax	2,400	$\frac{2,400}{7,200} \times 360° = 120°$
Corporate Tax	1,920	$\frac{1,920}{7,200} \times 360° = 96°$
Miscellaneous	1,200	$\frac{1,200}{7,200} \times 360° = 60°$
Total	7,200	360°

$$\text{Degree of the source} = \frac{\text{Value of the source}}{\text{Total value}} \times 360°$$

Revenue Sources of Govt. of India



6.11. GRAPHICAL REPRESENTATION OF DATA

Graphical representation is one of the most useful way of analysing numerical data by means of a diagram. In the graphical representation, statistical data is represented in the form of lines or curves and it enables us in studying cause and effect relationship between the variables. This representation is more useful in studying both time series analysis and frequency distribution.

The following are some of important types of graphical representation.

1. Histogram
2. Frequency polygon
3. O-give curve

6.12. HISTOGRAM

Histogram is drawn only for a continuous frequency distribution. If the given grouped frequency distribution is not continuous, then first it is to be converted into continuous distribution. To draw the histogram for a continuous grouped frequency distribution, first we mark class intervals on a suitable scale on X-axis. Then on each class interval draw rectangles with heights proportional to the frequency of corresponding class interval so that the area of rectangle is proportional to the frequency of the class on Y-axis. If class are of unequal width, then the height of the rectangle will be proportional to the ratio of the frequencies to the width of the classes. Now the diagram obtained with continuous rectangles is called histogram of the given distribution.

If the given frequency distribution is not continuous, then we use the following formula to convert into a continuous grouped frequency distribution.

Upper class boundary of new class Interval

$$= \text{Upper class limit of old class interval} + \frac{d}{2}$$

Lower class boundary of new class interval

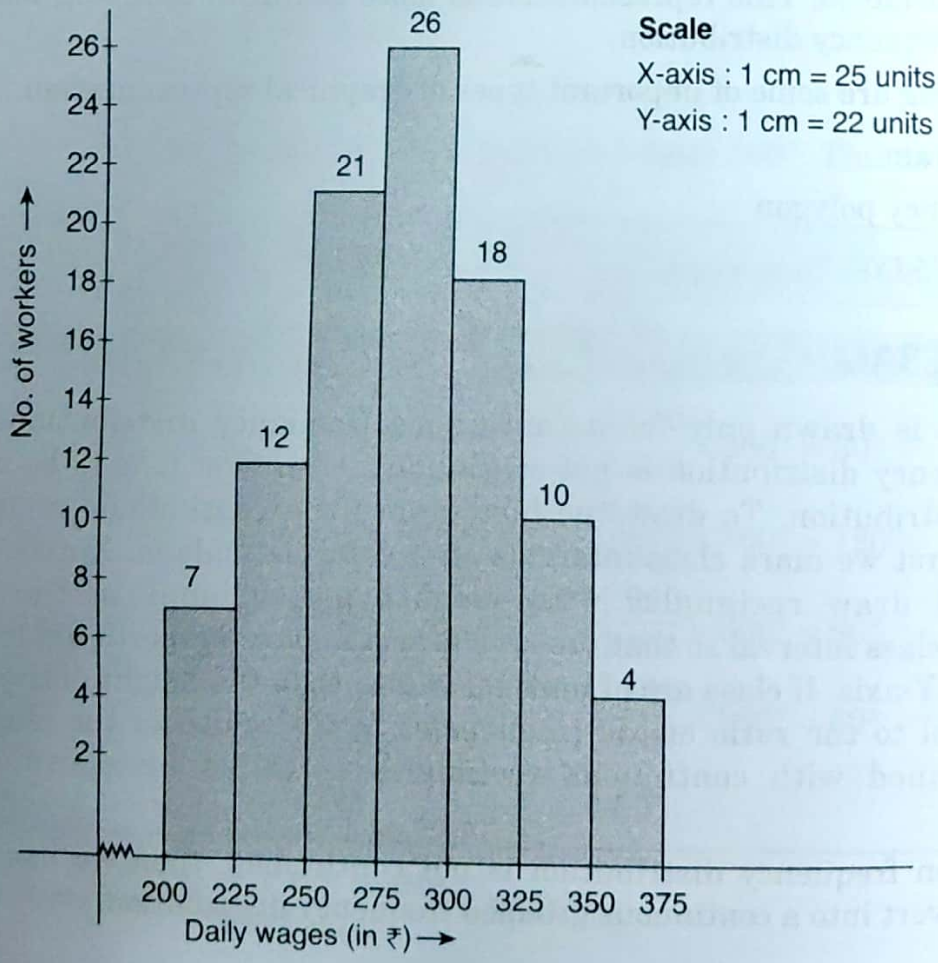
$$= \text{Lower class limit of old class interval} - \frac{d}{2}$$

where 'd' is gap between upper limit of any class and lower limit of the succeeding class.

PROBLEM 1. The daily wages of workers in a locality are given below. Construct histogram to represent the data.

Daily wage	*No. of workers*
200-225	7
225-250	12
250-275	21
275-300	26
300-325	18
325-350	10
350-375	4

SOLUTION. Since the data is a continuous grouped frequency distribution directly we can draw a histogram by plotting daily wages on X-axis and number of workers on Y-axis representing heights of the rectangles with number of workers.



PROBLEM 2. Draw histogram to the following data of marks obtained by students in a class.

Marks	*30-39*	*40-49*	*50-59*	*60-69*	*70-79*	*80-89*	*90-90*
No. of Students	5	8	13	24	12	6	2

SOLUTION. The given data is not continuous grouped frequency distribution hence we have to convert first this data into continuous grouped frequency distribution in the following way.

d = gap between upper limit of any class and lower limit of succeeding class

$= 40 - 39 = 1$

Now calculating new class intervals as follows :

For class interval 30-39

Upper class boundary of new class interval

$$= \text{Upper class limit of old class interval} + \frac{d}{2}$$

$$= 39 + \frac{1}{2} = 39.5$$

Lower class boundary of new class interval

$$= \text{Lower class limit of old class interval} - \frac{d}{2}$$

$$= 30 - \frac{1}{2} = 29.5$$

$\therefore$ New class interval for 30-39 is 29.5-39.5

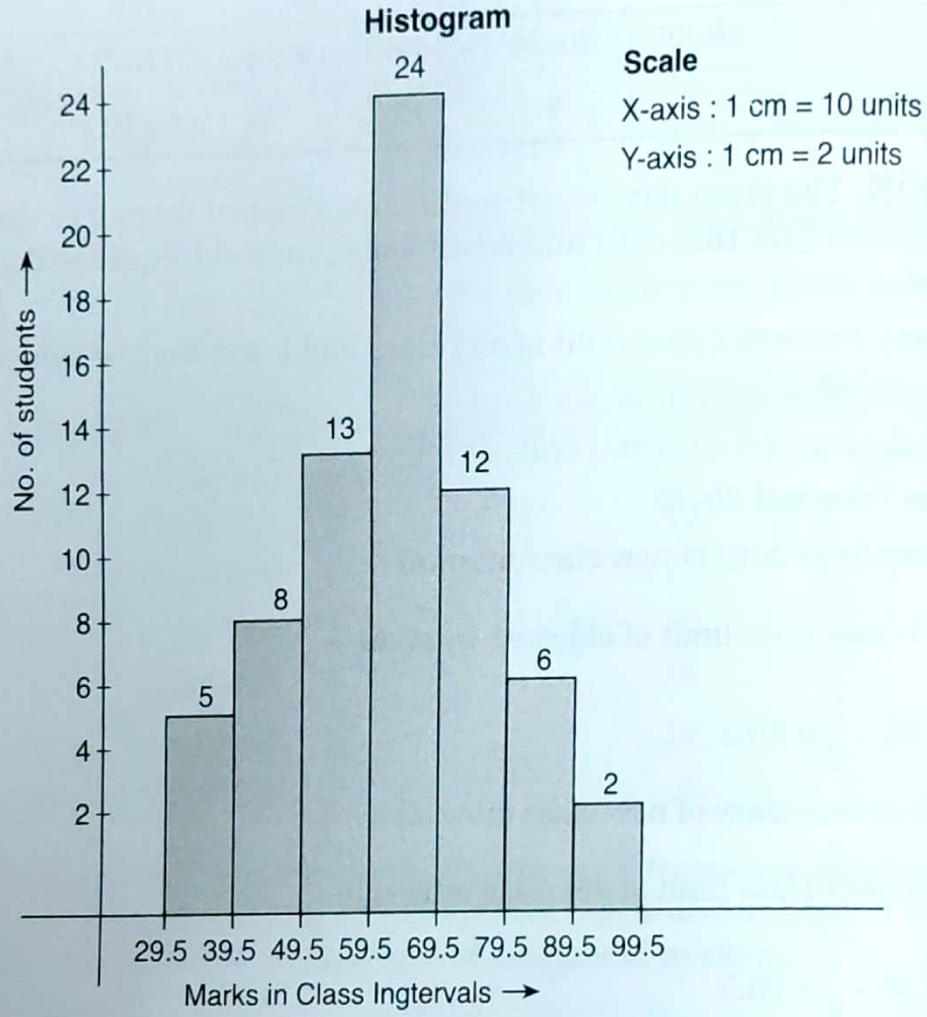
Similarly,

for class interval 40-49, new class interval is 39.5-49.5,
for class interval 50-59, the new class interval is 49.5-59.5,
for class interval 60-69, the new class interval is 59.5-69.5,
for class interval 70-79, the new class interval is 69.5-79.5,
for class interval 80-89, the new class interval is 79.5-89.5,
for class interval 90-99, the new class interval is 89.5-99.5,

$\therefore$ Now the converted continuos grouped frequency distribution is represented in the table below :

Marks	*No. of students*
29.5-39.5	5
39.5-49.5	8
49.5-59.5	13
59.5-69.5	24
69.5-79.5	12
79.5-89.5	6
89.5-99.5	2

Now, we can draw histogram for this continuous grouped frequency distribution as usual.



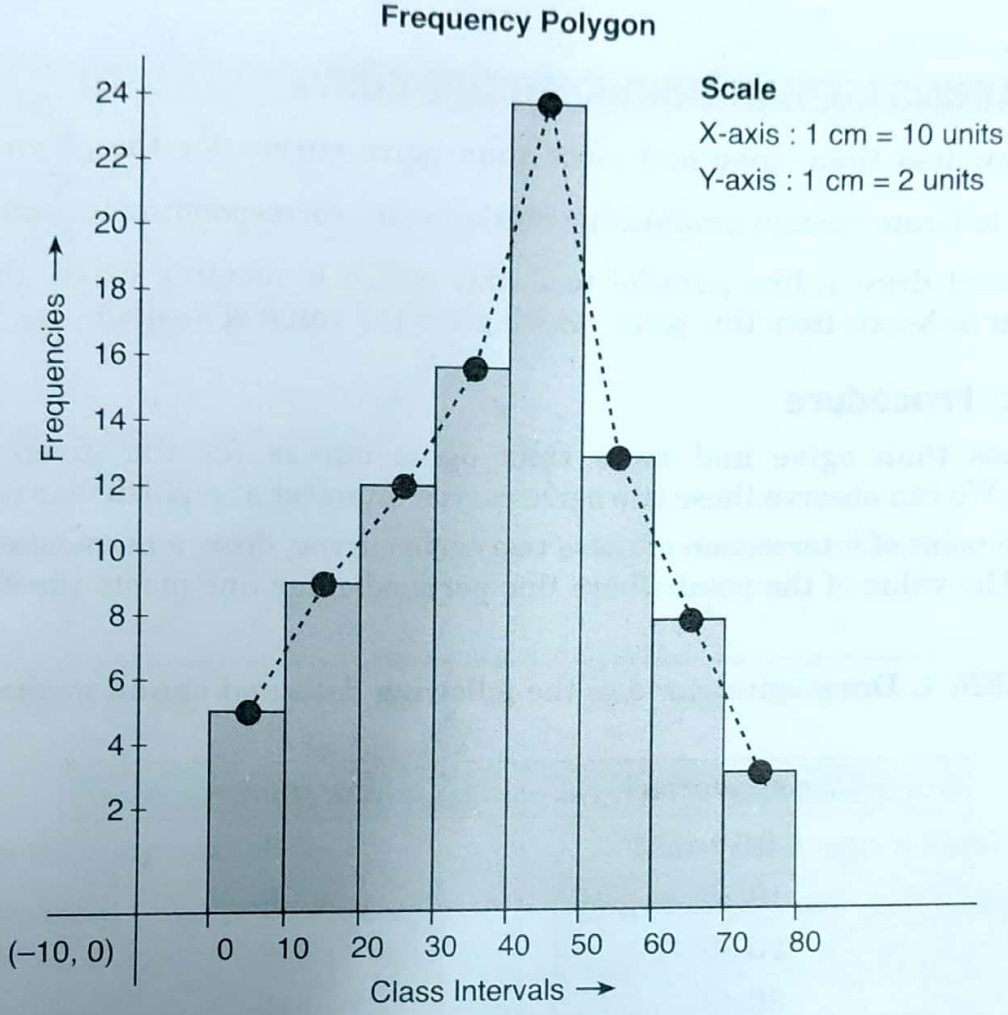
6.13. FREQUENCY POLYGON

To construct a frequency polygon, first we draw a histogram. For a continuous grouped frequency distribution, the histogram is drawn by considering class intervals on X-axis and corresponding frequencies on Y-axis. Now consider the values of the variable at mid values of the class intervals. For equal class intervals the frequency polygon can be obtained by joining the middle points of the upper sides of the adjacent rectangles of the histogram by means straight lines. If the class intervals are of small width, then the frequency polygon can be approximated by a smooth curve.

PROBLEM 1. Draw frequency polygon to the following data :

Class Interval	*Frequency*
0-10	5
10-20	9
20-30	12
30-40	16
40-50	24
50-60	15
60-70	8
70-80	3

SOLUTION. The given data is a continuous grouped frequency distribution. Therefore first we draw histogram and then by joining middle points of the upper sides we can obtain a frequency polygon.



6.14. OGIVE CURVE

Ogive curve is a graphical representation of cumulative frequencies of a distribution. In the construction of ogive curve, consider the class intervals on X-axis and plot corresponding cumulative frequencies on Y-axis against upper limit or lower limits of the respective class interval. The curve obtained by joining these points by means of drawing smooth free hand curve is called ogive curve or cumulative frequency curve.

There are two types of ogive curves, viz.,

1. less than ogive
2. More than ogive

Less than Ogive

Plot less than cumulative frequencies against the upper limits of the corresponding classes. The smooth free hand curve obtained by joining these points is called less than ogive curve.

More than Ogive

Plot more than cumulative frequencies against the lower limits of corresponding classes. The smooth free hand curve obtained by joining these points is called more than ogive curve.

6.15. OBTAINING MEDIAN THROUGH OGIVE CURVE

First draw less than ogive and more than ogive curves for the given frequency distribution. to locate median graphically, mark a point corresponding to $\frac{N}{2}$ along Y-axis. From this point draw a line parallel to X-axis which is meeting ogive. Draw a line perpendicular to X-axis from this point, which gives the value of median.

Alternative Procedure

Draw less than ogive and more than ogive curves for the given frequency distribution. We can observe these two ogive curves intersect at a particular point.

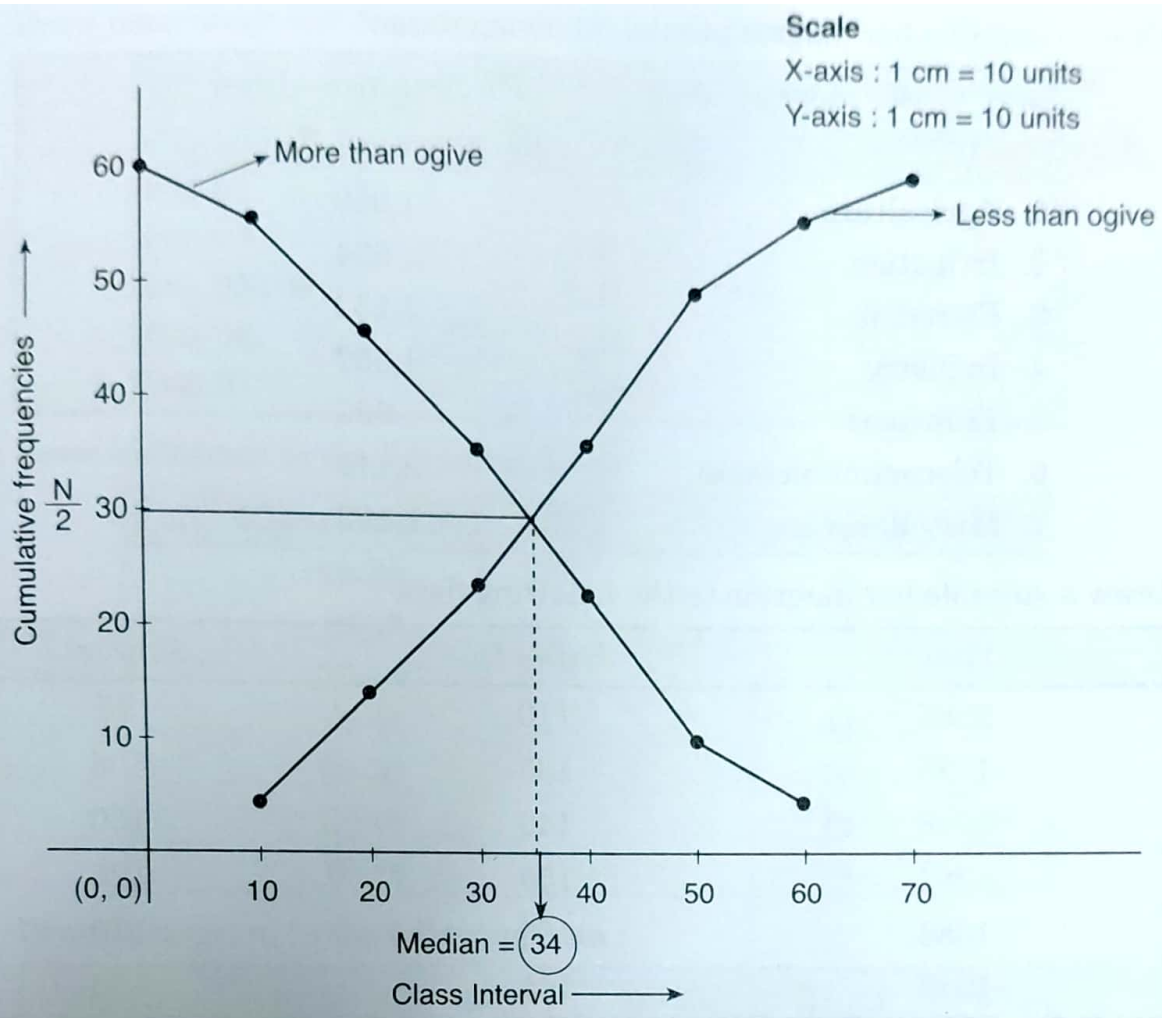
From the point of intersection of these two ogive curves, draw a perpendicular line to the X-axis. The value of the point where this perpendicular line meets the X-axis gives the median.

PROBLEM 1. Draw ogive curve to the following data and obtain median from the ogive curve.

Class Interval	*Frequency*
0-10	4
10-20	8
20-30	11
30-40	15
40-50	12
50-60	6
60-70	4

SOLUTION

C.I.	*f*	*Less than c.f.*	*More than c.f.*
0-10	4	4	60
10-20	8	12	56
20-30	11	23	48
30-40	15	38	37
40-50	12	50	22
50-60	6	56	10
60-70	4	60	4
	N = 60		



Less than ogive Table

Upper limits of C.I.	*Less than c.f.*
10	4
20	12
30	23
40	38
50	50
60	56
70	60

More than ogive Table

Lower limits of C.I.	*More than c.f.*
0	60
10	56
20	48
30	37
40	22
50	10
60	4

∴ **Median obtained through the ogive curve is 34 approximately.**

Scales of Measurement

4.1. SCALES OF MEASUREMENT

In general, the statistical data cannot be obtained or measured in similar form or in same pattern. The data obtained in statistical enquiry in various forms are called different scales of measurement. There are four scales of measurement which are used in the collection of statistical data of any statistical enquiry.

1. Nominal Scale
2. Ordinal scale
3. Interval Scale
4. Ratio Scale

4.2. NOMINAL SCALE

Nominal scale is used for labeling the variables into different classifications and does not involve a quantitative value. This scale is used for collecting the qualitative data. In this scale, numbers associated with the variables serve as tags or labels to classify or identify the objects in the statistical study. The order of the variable is not important in this scale. For example, the variable of the study is sex, then it can be given two labels, 'M' for male, 'F' for female (or Male-1, Female-2). For another example, the place of residence, it can be given that '1' for urban, '2' for semi-urban, '3' for rural etc.

4.3. ORDINAL SCALE

the ordinal scale describes order of the variables in a statistical investigation. This scale is used to represent the qualitative or categorical data. Ordinal represents order. In the nominal scale, the variables can be categorised only with labels or tags, whereas in the ordinal scale, it can be grouped and ranked.

Examples :

1. Ratings of different companies.

   1 — for 10 pints
   2 — between 7-9 pints
   3 — between 4-6 points
   4 — between 1-3 points

2. Satisfaction of services in a hotel

Not satisfied	–	1
Satisfied	–	2
Fully satisfied	–	3

3. Performance of the students

Below average	–	1
Average	–	2
Above Average	–	3
Good	–	4
Excellent	–	5

4.4. INTERVAL SCALE

The interval scale contains properties of nominal and ordinal scales of measurement. Interval indicates difference between two objects of variable. In addition to the nominal and ordinal scales, the interval scale measures the difference between the variables. the difference can be added or subtracted from each other, but cannot be multiplied or divided. In interval scale, zero is not absolute, is arbitrary means it represents presence of the variable (example time). the interval scale is mostly used together information or feedback based on satisfaction levels, agreement etc. Interval scale is used for question type surveys with choice of options in numbers so that certain statistical methods are applied. The measures of central tendency like mean, median and mode can be calculated in this scale.

Examples :

1. In banking system, if a question asked "I do not like queue system", the choice of answers provided are :

Strongly disagree	–	1
Disagree	–	2
Neutral	–	3
Agree	–	4
Strongly Agree	–	5

This kind of scale is called attitude scale.

2. The temperature scales are also best examples of interval scale.

4.5. RATIO SCALE

The ratio scale is defined as one of the best variable measurement scale contains all properties of nominal, ordinal and interval scales of measurement along with the unique feature absolute zero. In the ratio scale, zero means total absence of variables. The ratio scale does not have negative values. In this scale, the variables can be orderly added, subtracted and also multiplied and divided. The measures of central tendency like mean, median, mode, harmonic mean, geometric mean and dispersion measures, coefficient of variation also can be calculated for the data obtained in ratio scale.

Examples :

1. The best examples of ratio scales are heights, weights, sales, revenue, money, length, etc.
2. In the ratio scale, the questions and their choice of answers can be prepared in the following way :

   (*i*) **Question :** "What is your experience in the company" ?

   Choices :

   (1) less than 5 years
   (2) 5-10 years
   (3) 10-15 years
   (4) 15-20 years
   (5) More than 20 years.

   (*ii*) What is your weight in kgs ?

   (1) Less than 50 kgs.
   (2) 50-60 kgs.
   (3) 60-70 kgs.
   (4) 70-80 kgs.
   (5) More than 80 kgs.

Finally to summarise, nominal scales are used to label or describe the values. Ordinal scales are used to provide information about the specific order of the variable. The interval scale is used to understand the order and differences between the variables. The ratio scales gives more information about identity, order and difference along with the presence of absolute zero value.

□ □ □

Frequency Distribution and Its Types

5.1. FREQUENCY DISTRIBUTION

A frequency distribution is an arrangement of number of observations with similar related values of a variable in the order of magnitude with the corresponding frequencies in the form of a statistical table. According to Croxton and Cowdon "Frequency distribution is a statistical table which shows the set of all distinct values of the variable arranged in order of magnitude, either individually or in groups, with their corresponding frequencies side by side."

Examples: 1. The following frequency distribution represents the profits (in crores of rupees) of 20 companies in India.

Profit of a company in crores of ₹	*No. of companies (frequency)*
50	2
60	3
70	5
80	6
90	3
100	1

2. The frequency distribution of marks of 100 students in an examination is given below.

Marks in the examination (C.I.)	*No. of students (frequency)*
30-40	4
40-50	11
50-60	20

60-70	24
70-80	26
80-90	10
90-100	5

5.2. BASIC TERMS OF A FREQUENCY DISTRIBUTION

Now we shall discuss some basic terms to form a frequency distribution.

Tally Mark

A vertical bar (|) is put against the number when it occurs is called a tally mark. The fifth occurrence of value of the variable is represented by putting a cross tally (/) on the first four tallies. This procedure of counting continued till the end (last value of the data). The tally mark facilitates counting the frequency of value of a variable in a systematic manner. The tally marks are used only in preliminary work and not appear in the final representation of a frequency distribution.

Frequency

The number of times a value of the variable occurs in the data is called the frequency of that value of the variable. The frequency is denoted by f.

Example. If 26 students got 68 marks in an examination ,then frequency of the value 68 is 26. *i.e.,* 68 occurs 26 times, *i.e.,* $f = 26$.

Class Internal (C.I.)

If the data is large, then the number of observations can be classified into several groups according to the size of value. Each of these groups defined by an interval is known as Class Interval (C.I.). The class interval is usually specified by two extreme values called class limits. the smaller one is termed as lower limit and the larger one is termed as upper limit of the class interval.

Example. If 200 students appeared for an examination and marks obtained between 50 to 100, then the class intervals can be classified into 50-60, 60-70, 70-80, 80-90 and 90-100.

Class Boundaries

If d is the gap between upper class limit of one class and lower class limit of the next class, then the class boundaries are calculated by

$$\text{Lower class boundary} = \text{lower class limit} - \frac{d}{2}$$

$$\text{Upper class boundary} = \text{Upper class limit} + \frac{d}{2}$$

Example. If class intervals are :

10 – 19

20 – 29

30 – 39 etc.

then $d = 20 - 19 = 1$

Now class boundaries of the C.I. 10 – 19 are :

$$\text{Upper class boundary} = \text{Upper class limit} + \frac{d}{2}$$

$$= 19 + \frac{1}{2} = 19.5$$

$$\text{Lower class boundary} = \text{Low class limit} - \frac{d}{2}$$

$$= 10 - \frac{1}{2} = 9.5$$

$\therefore$ New class interval is 9.5 – 19.5

Like in this way, we can calculate all class intervals.

Mid Value of Class Interval

The value exactly at the middle of the class interval is called mid value of the class interval.

$$\text{Mid value of the C.I.} = \frac{(\text{Lower class limit} + \text{Upper class limit})}{2}$$

Example. If the class interval is 10-20, then mid value of the class interval 10-20 is $\frac{10 + 20}{2} = 15$.

Width of the Class Interval

The difference between upper and lower class boundaries of a class interval is known as width of the class interval. It is denoted by 'h'

h = Upper class boundary – Lower class boundary

Example. If the class intervals are 0-10, 10-20, 20-30, 30-40, etc., then the width of the class interval h is calculated by

$h = 30 - 20 = 10$ (by considering C.I. 20-30)

5.3. TYPES OF FREQUENCY DISTRIBUTION

The frequency distribution may be formed into two ways depending on the nature of data. Hence there are two types of frequency distributions, *viz.*,

1. Discrete (or) Ungrouped Frequency Distribution
2. Continuous Frequency Distribution

1. Discrete (or) Ungrouped Frequency Distribution

If the frequency refers to a given discrete value, then the corresponding frequency distribution is known as Discrete frequency distribution or Ungrouped frequency distribution.

Examples:

1. The number of companies in a country.
2. The number of plots in a field.
3. The following discrete frequency distribution shows number of children in 50 families in a locality.

Number of children	*Frequency (Number of families)*
0	2
1	13
2	30
3	5

2. Continuous Frequency Distribution

If the frequency refers to a continuous variable, then the corresponding frequency distribution is known as continuous frequency distribution. There are some variables which take any fractional value, in such cases, it is good practice to consider the values of the variable in class intervals. This kind of formation gives us continuous frequency distribution.

Examples:

1. The heights of group of 70 persons are given in the following continuous frequency distribution

C.I. (Heights of persons) (in feet)	*Frequency (No. of persons)*
4-5	8
5-6	20
6-7	25
7-8	15
8-9	2

2. The ages of 30 policy holders in a company are given in the following continuous frequency distribution.

Age (C.I.)	*No. of policies (Frequency)*
20-30	18
30-40	5
40-50	3
50-60	2
60-70	2

Note: The class interval 20-30 in the continuous frequency distribution indicates, this includes age 20 and not includes age 30. Similarly C.I. 30-40 includes age 30 and not includes age 40. etc. This is known as exclusive type classification (since upper limits are excluded).

5.4. FORMING OF A FREQUENCY DISTRIBUTION

If the raw data is collected from large number of individuals regarding a single characteristic. Then the simple way of understing such data is construction in the form of frequency distribution only. To prepare the frequency distribution, first we use tally mark for every observation. This determines frequency of each value of the variable. Next we have to form the class intervals with suitable width if necessary by observing discrete or continuous variables. A statistical table with class interval (if so) and frequencies forms a frequency distribution.

PROBLEMS

PROBLEM 1. Construct discrete frequency distribution to the following data :

The blood pressure of 20 patients are given below :

70, 82, 58, 60, 72, 70, 82, 94, 94, 94, 60, 94, 100, 72, 82, 94, 100, 58, 70, 60.

SOLUTION. Variable is blood pressure, it is a discrete variable, hence we can form discrete frequency distribution for this data. First arranging in ascending order of magnitude.

Blood Pressure	*Tally Mark*	
58	II	(2)
60	III	(3)
70	III	(3)
72	II	(2)
82	III	(3)
94	𝍸	(5)
100	II	(2)

∴ The Discrete frequency distribution for the given data is :

Blood Pressure	*Frequency*
58	2
60	3
70	3
72	2
82	3
94	5
100	2

PROBLEM 2. The marks in English of 50 students in an examination are collected and given below.

46, 58, 32, 49, 60, 72,81, 36, 46, 49, 89, 61, 54, 64, 83, 76, 94, 38, 85, 66, 74, 86, 62, 59, 84, 37, 56, 73, 67, 57, 85, 51, 70, 69, 78, 67, 38, 68, 73, 86, 96, 87, 54, 66, 55, 99, 73, 83, 61, 59.

Formulate this data into continuous frequency distribution.

SOLUTION. The variable is marks in the subject English, to form a continuous frequency distribution, consider class intervals 30-40, 40-50 and upto 90-100 by taking width of the class interval $h = 10$ in exclusive classification *i.e.*, for example, in the C.I. 30-40, marks 30 included and 40 is not included in this C.I.

C.I. (marks in English)	*Tally marks*	
30-40	𝍸	(5)
40-50	𝍸	(4)
50-60	𝍸 𝍸	(9)
60-70	𝍸 𝍸	(11)
70-80	𝍸 𝍸	(8)
80-90	𝍸 𝍸	(10)
90-100	𝍸	(3)

$\therefore$ The continuous frequency distribution for the given data is

Marks in English (C.I.)	*No. of students (Frequency)*
30-40	5
40-50	4
50-60	9
60-70	11
70-80	8
80-90	10
90-100	3