Chapter:4

DIAGRAMMATIC PRESENTATION OF DATA

INTRODUCTION

A diagram is a drawing or a design to illustrate something. The government keeps collecting the information in the form of population census, socio economic survey , etc., from time to time . The information thus collected either by government or any other agency is called *tabulated data*. If this data is shown in numerical form, it will not attract the attention of people . Although tabulation is a good technique to present the data, but diagrams are an advanced technique to represent the data. A layman cannot understand tabulated data easily but with only a single glance at a diagram , one gets complete picture of the data presented. Diagrams refer to the various types of devices such as bars, circle, maps, cartograms, etc. An ordinary man can understand pictures and diagrams more easily than figures. The use of diagrams is becoming more and more popular because they are more appealing , attractive and meaningful.

Benefits of a Diagram

1. Diagrams are more attractive
2. It is economical in terms of money, time and labor
3. It is most suitable for comparison
4. They create more effects on the minds of the readers
5. They provide more information.
6. They are also helpful in statistical analysis.

Limitations of a Diagram

1. A diagram shows only approximate values
2. It is supplement to their presentation, but not an alternative to it.
3. It cannot represent all details.
4. It cannot be analyzed further.
5. Small differences in large measurements cannot be studied.

Guidelines for drawing a Diagram

1. It must have proper heading.
2. The drawing should be neat and clean.
3. Scale must be provided along with the drawing.
4. Footnotes should be given at the bottom of the diagram.
5. While choosing scale, size of the space must be kept in view.
6. Index must be given for identifying and understanding the diagram.

TYPES OF DIAGRAMS

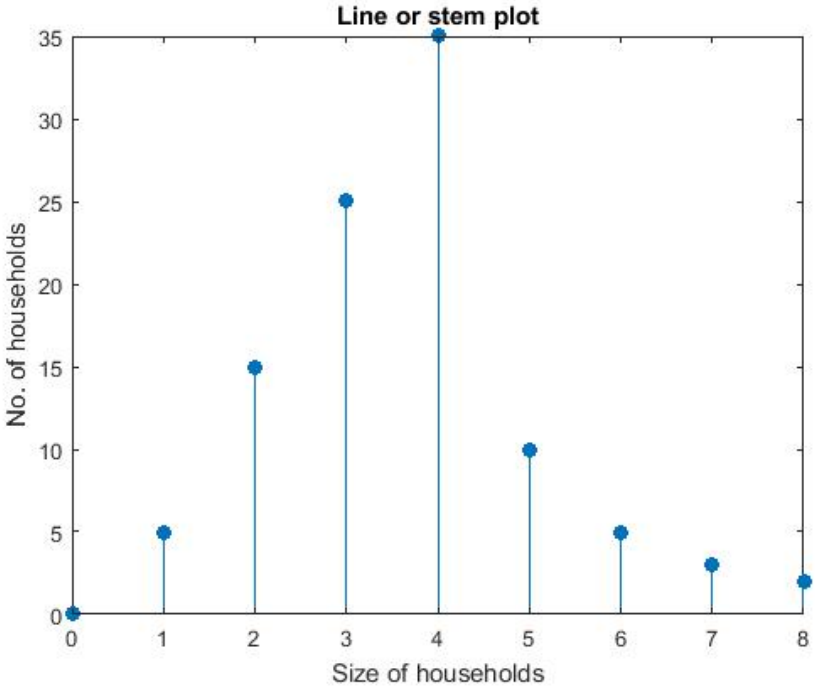
There are different types of diagrams by which statistical data can be presented.

1. Line Diagram

A line diagram is a diagram where statistical data is represented in the form of straight lines. This is the simplest of all the diagrams. On the basis of size of the figures , height of lines are drawn. The distance between the lines is kept uniform. It makes comparison easy.

Example:1 A survey of 100 households in a city was carried out to ascertain the size of the households. The results of the survey are tabulated in the following table. Draw a line diagram.

Size of the household(s)	No. of households (f)
1	5
2	15
3	25
4	35
5	10
6	5
7	3
8	2


Line or stem plot
No. of households
Size of households
0
5
10
15
20
25
30
35
0
1
2
3
4
5
6
7
8

Bar Diagrams

Statistical data are represented in the form of bars. Bar diagrams are one-dimensional diagrams because they take only one dimension, either horizontal or vertical. The width of the bars should be uniform throughout the diagram. The gap between the bars should be uniform throughout.

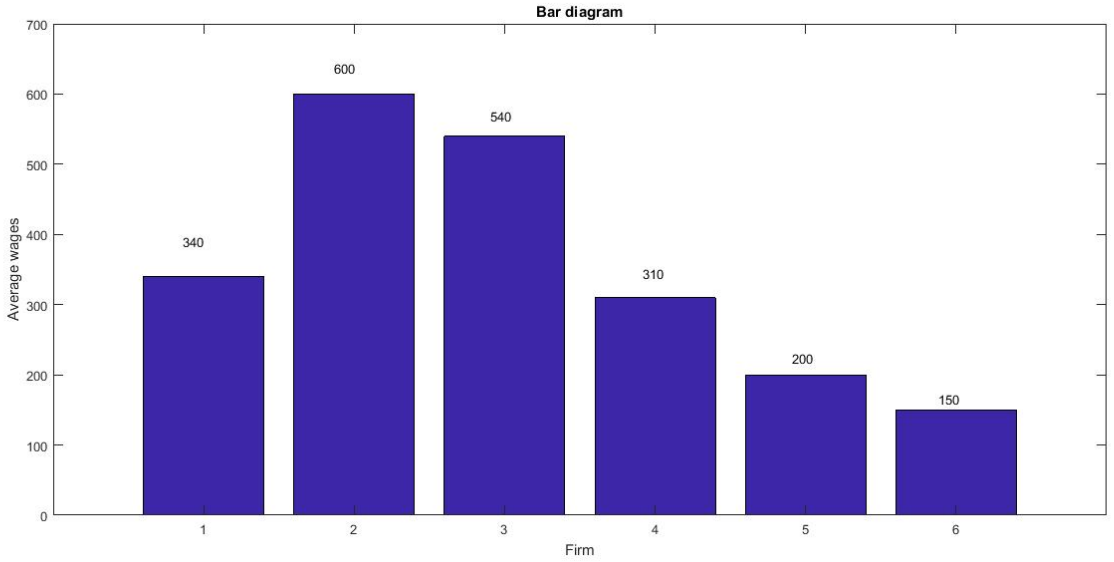
Bar diagram is further divisible into four types.

1. Simple bar diagram: A simple bar diagram can be constructed simply be creating bars either vertically or horizontally. The length of bars is equal to the size of data given. Each bar represents one item of the data. It is simple to draw and easy to understand. The distance between the bars is kept uniform and also the breadth of each bar is kept uniform.

Example:2 Average wages of some firms is given below. Represent this by a simple bar diagram.

Firm	A	B	C	D	E	F
Average wages	340	600	540	310	200	150

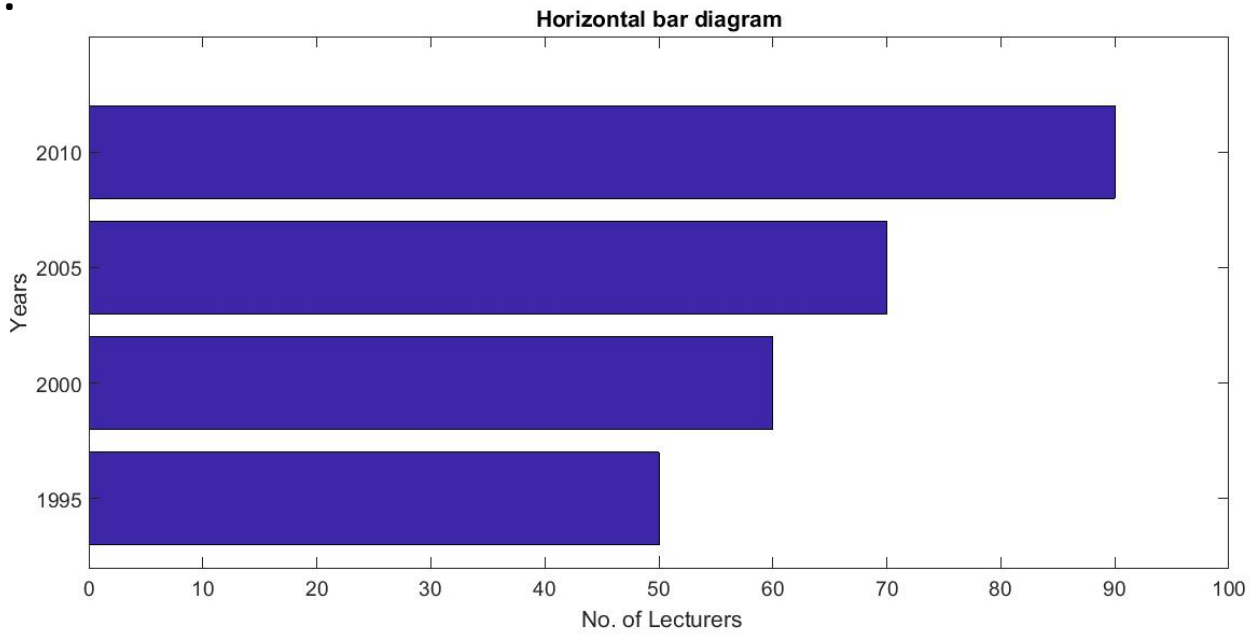
Solution:



Example:3 Present the following data by a horizontal bar diagram

Year	No. of Lecturers
1995	50
2000	60
2005	70
2010	90

Solution:

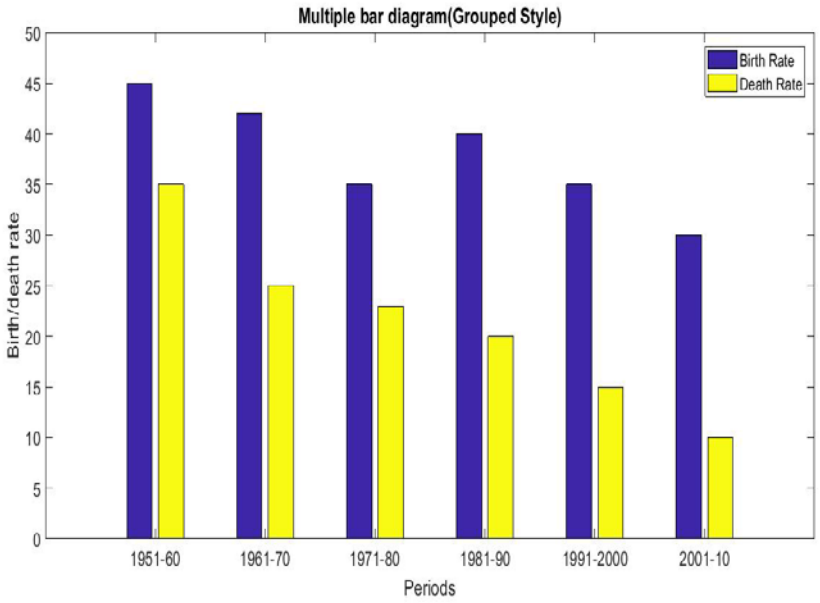


2. Multiple bar diagram: A multiple bar diagram contains two or more bars arranged side by side. The multiple bar diagram helps comparison between 2 or more variables. The bars are drawn side by side. In order to distinguish the bars, different colors , shades etc., may be used.

Example:4 Birth and death rate in India are given below. Draw a suitable diagram.

Period	1951-60	1961-70	1971-80	1981-90	1991-2000	2001-10
Birth rate	45	42	35	40	35	30
Death rate	35	25	23	20	15	10

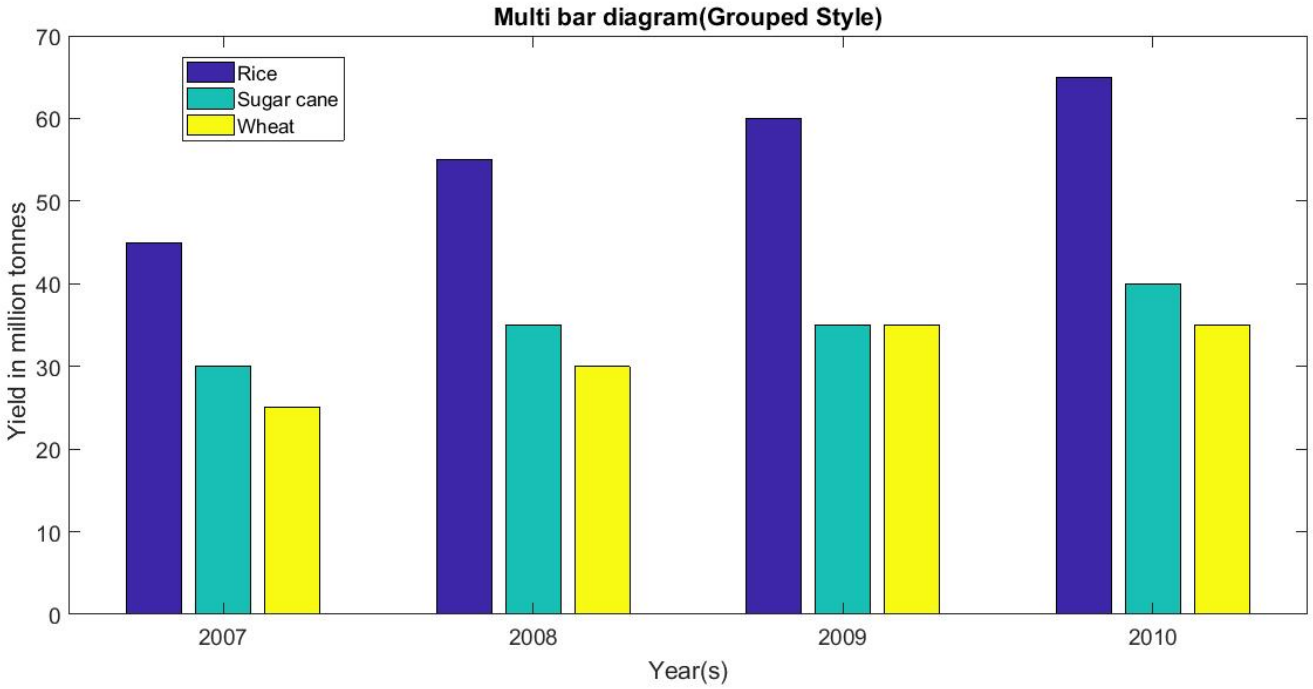
Solution:



Example:4.5 The data below is the yield in million tonnes from 2007 to 2010. Draw a multiple bar diagram.

Year	Rice	Sugar cane	Wheat
2007	45	30	25
2008	55	35	30
2009	60	35	35
2010	65	40	35

Solution:

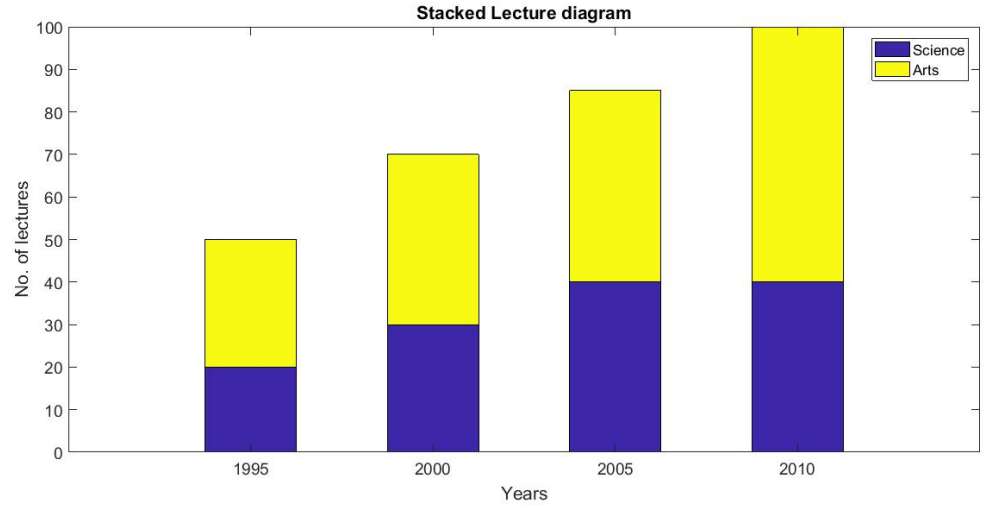


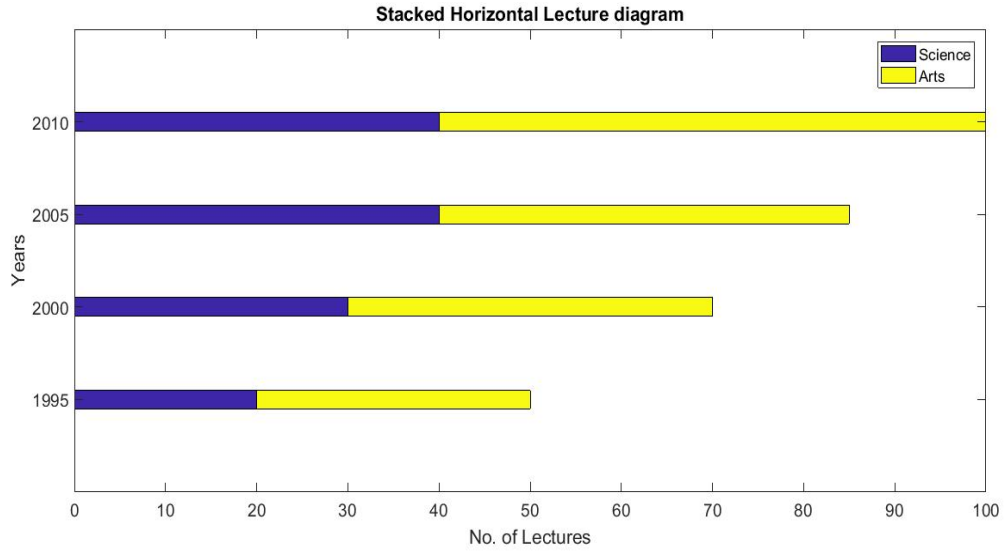
3. Subdivided bar diagram: Subdivided bar diagrams are also called component bar diagrams. In these diagrams , the bar is subdivided into various parts or components in proportion to the values given in the data. To distinguish different components from one another, different colors or shades may be given. The distance between the bars and the breadth of each bar is kept uniform.

Example:4.6 Represent the following data in a subdivided bar diagram.

Year	No of lecturers		Total
	Science	Arts	
1995	20	30	50
2000	30	40	70
2005	40	45	85
2010	40	60	100

Solution:


Stacked Lecture diagram
Science
Arts
No. of lectures
Years
0
10
20
30
40
50
60
70
80
90
100
1995
2000
2005
2010

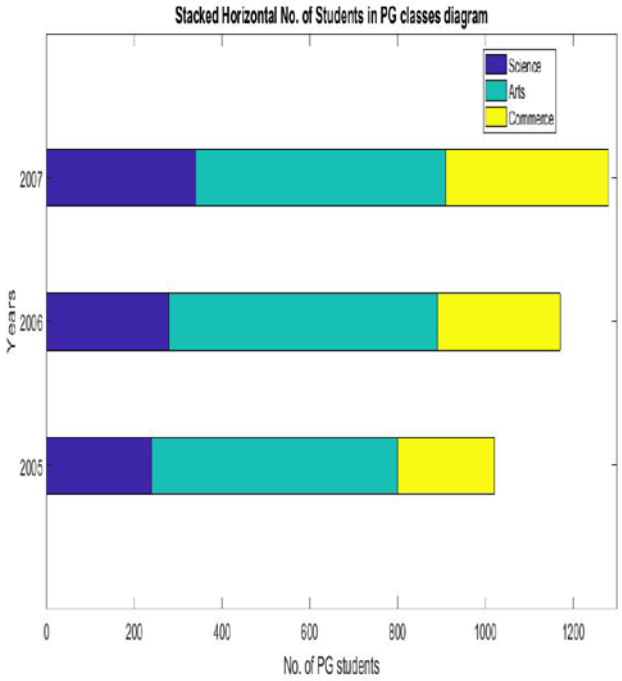

Stacked Horizontal Lecture diagram
Science
Arts
Years
No. of Lectures
2010
2005
2000
1995
0
10
20
30
40
50
60
70
80
90
100

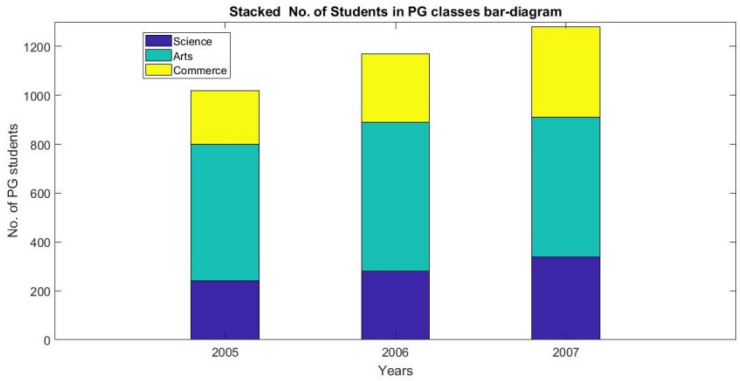
Example:7 Number of students in PG classes in a university is as follows:

Subject	2005	2006	2007
Science	240	280	340
Arts	560	610	570
Commerce	220	280	370

Draw a subdivided bar diagram to the above data.

Solution:





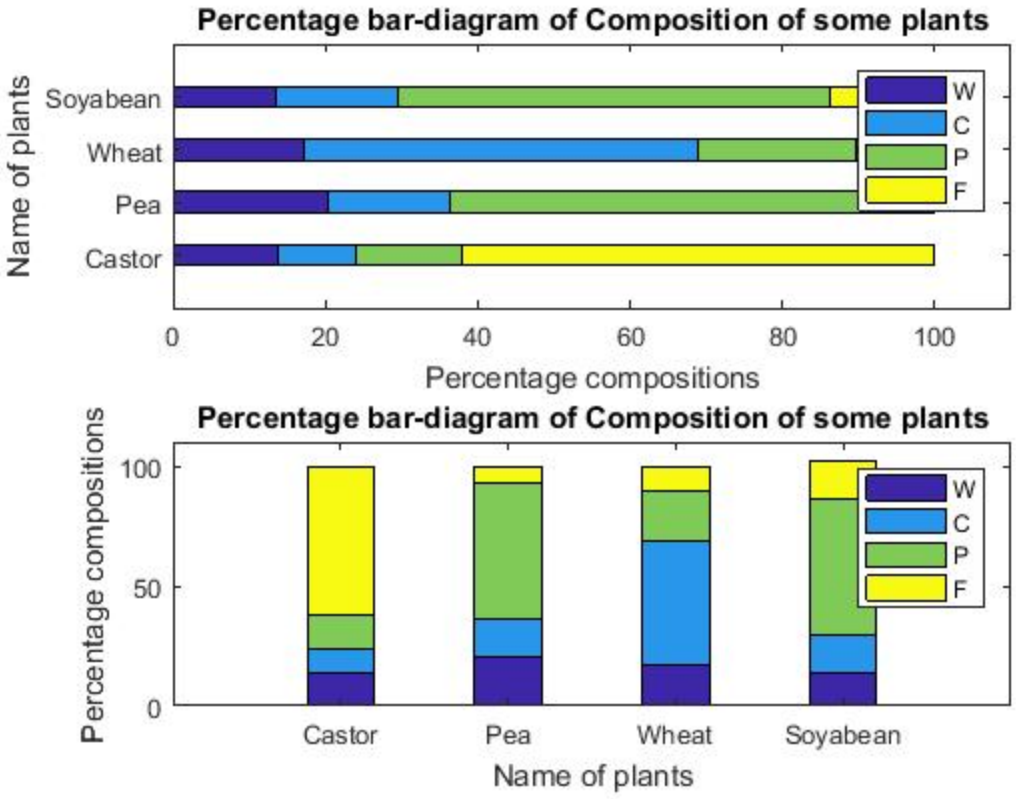
4. Percentage bar diagram: In percentage bar diagrams, the length of the bars is kept equal to 100 and the divisions of the bar correspond to the percentages of different components. This diagram is called a percentage divided bar diagram. It is clear from the given figure that each component of the bar diagram indicates the percentage production of the different items.

Example:8 Draw the percentage bar diagram for the following data.

Plants	Water content(g)	Carbohydrate(g)	Protein(g)	Fat(g)	Total weight(g)
Castor	4	3	4	18	29
Pea	9	7	25	3	44
Wheat	5	15	6	3	29
Soyabean	6	7	25	7	44

Sol: Conversion of absolute values into percentages

Planta	Water content(g)	Carbohydrate(g)	Protein(g)	Fat(g)	Total weight(g)
Castor Cf	(4/29)*100 =14% 14	(3/29)*100= 10% 24	(4/29)*100= 14% 38	(18/29)*10 0=62% 100	29-100%
Pea Cf	(9/44)*100 =21% 21	(7/44)*100= 16% 37	(25/44)*100 =56% 93	(3/44)*100 =7% 100	44-100%
Wheat Cf	(5/29)*100 =17% 17	(15/29)*100 =52% 69	(6/29)*100= 21% 90	(3/29)*100 =10% 100	29-100%
Soyabean Cf	(6/44)*100 =14 14	(7/44)*100= 15% 29	(25/44)*100 =56% 85	(7/44)*100 =15% 100	44-100%


Percentage bar-diagram of Composition of some plants
Name of plants
Soyabean
Wheat
Pea
Castor
W
C
P
F
0
20
40
60
80
100
Percentage compositions
Percentage bar-diagram of Composition of some plants
Percentage compositions
100
50
0
Castor
Pea
Wheat
Soyabean
Name of plants

PIE DIAGRAM

Pie diagram is also called area diagram. In a pie diagram , the statistical data is represented in a circle. It has a total area of 360^0 which can be divided into component parts on the basis of the given data. The circle is partitioned and shaded. It is extensively used in the presentation of statistical data.

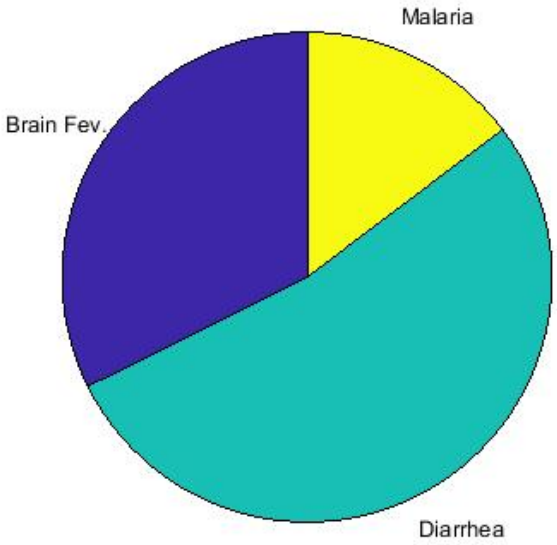
Example:4.9 Draw a pie diagram for he following data.

The number of deaths and Their Cause

Causes of death	Number
Brain fever	55
Diarrhea	90
Malaria	25

Sol:

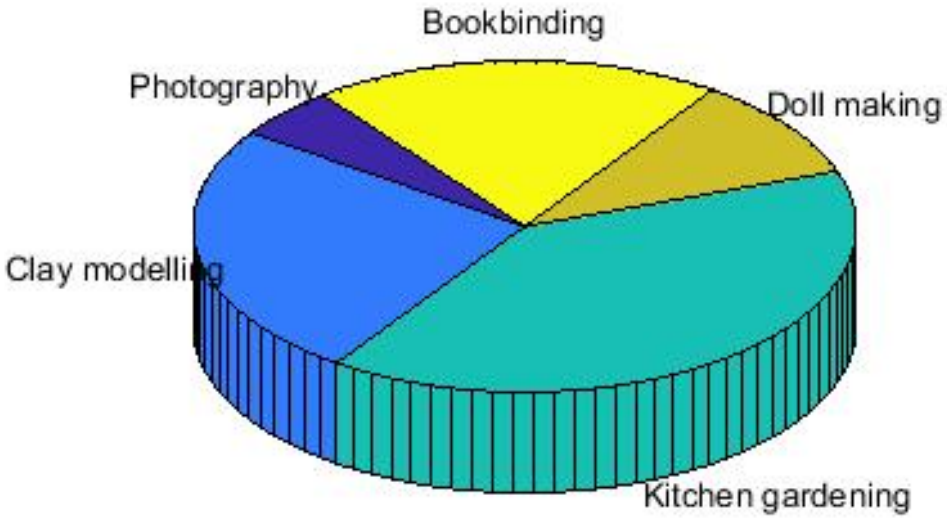
Causes of death	Number	Degrees
Brain fever	55	(55/170)*360= 116^0
Diarrhea	90	(90/170)*360= 191^0
Malaria	25	(25/170)*360= 53^0
	170	360



Example:10 Intermediate students of a college were asked to opt for different work experience. The details of these options are as under.

Areas of work experience	No. of students
Photography	6
Clay modelling	30
Kitchen gardening	48
Doll making	12
Bookbinding	24

Represent the above data through a pie chart.


Bookbinding
Photography
Doll making
Clay modelling
Kitchen gardening

Sol:

Areas of work experience	No. of students	Angle of the circle
Photography	6	(6/120)*360=18^0
Clay modelling	30	(30/120)*360= 90^0
Kitchen gardening	48	(48/120)*360= 44^0
Doll making	12	(12/120)*360= 36^0
Bookbinding	24	(24/120)*360= 72^0
	120	360^0

GRAPHIC PRESENTATION OF DATA

A graph is the geometrical image of a data. It is a mathematical image. The statistical data is converted into visual models to facilitate easy understanding . It is easier, more convenient and quicker to draw inferences from graphs than from frequency distribution. Comparison of data also becomes easier.

To understand the technique of making graphs, it would be helpful to learn the basic terminology, principles and conventions. For constructing graphs, we make use of graph paper. Statistical data represented on the graph paper is called graphic presentation of statistical data.

According to A.L. Boddington, ' The wandering of a line is more powerful in its effect on the mind than a tabulated statement; it shows what is happening and what is likely to take place, just as quickly as the eye is capable of working."

Importance of Graphs

1. **It is more effective than diagrams**
2. **It gives us the picture in condensed form.**
3. **It is free from mathematical calculations.**
4. **It is most suitable for comparison.**
5. **It is helpful in forecasting.**

Rules for Graphs

1. It must have proper heading.
2. Scale must be provided along with the graph.
3. If required, footnotes may be given.
4. While choosing scale, size of space must be kept in view.

Graphs of Frequency Distribution

Statistical nature of grouped frequency distribution is represented graphically, it is called graph of frequency distribution. It can be represented graphically in four ways.

1. Histogram
2. Frequency polygon
3. Frequency curve
4. Ogive curve

1.Histogram: **The graph consisting of rectangles which are vertically adjacent to each other and constructed on the true limits of various classes of a frequency distribution , as width is called a histogram. When the size of all classes in the frequency distribution is same the classes are taken on x-axis and the frequencies on the y-axis and rectangles are drawn to a suitable scale on a graph paper. These can be of two types.**

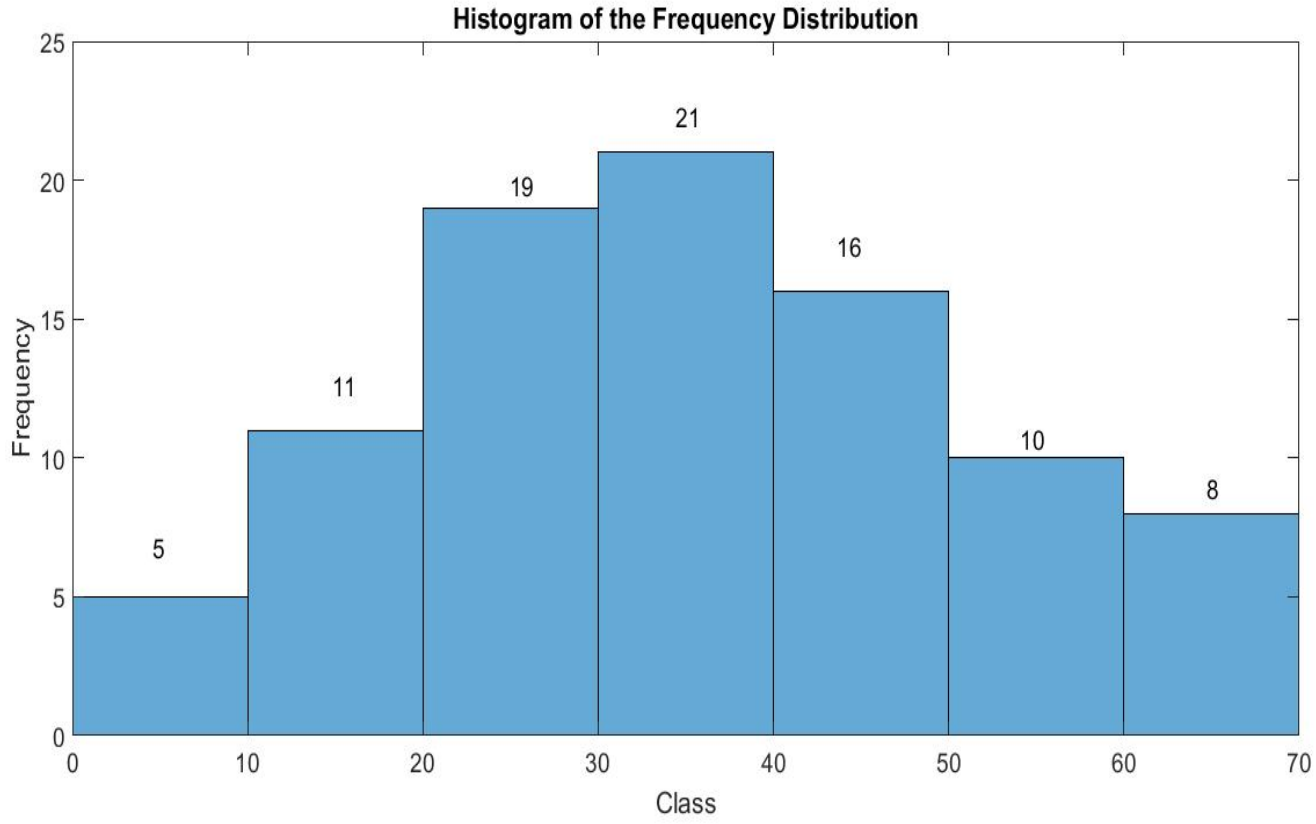
1. **Histograms with equal class intervals.**
2. **Histogram with unequal class intervals.**

Example:11 Draw a histogram for the following distribution.

Class	0-10	1-20	20-30	30-40	40-50	50-60	60-70
Freq.	5	11	19	16	10	8	

Sol:

Data given in the frequency distribution pertains to a continuous variable. All class intervals are equal. According to a suitable scale taking class intervals on the x-axis and frequencies on the y-axis, adjacent rectangles are constructed.

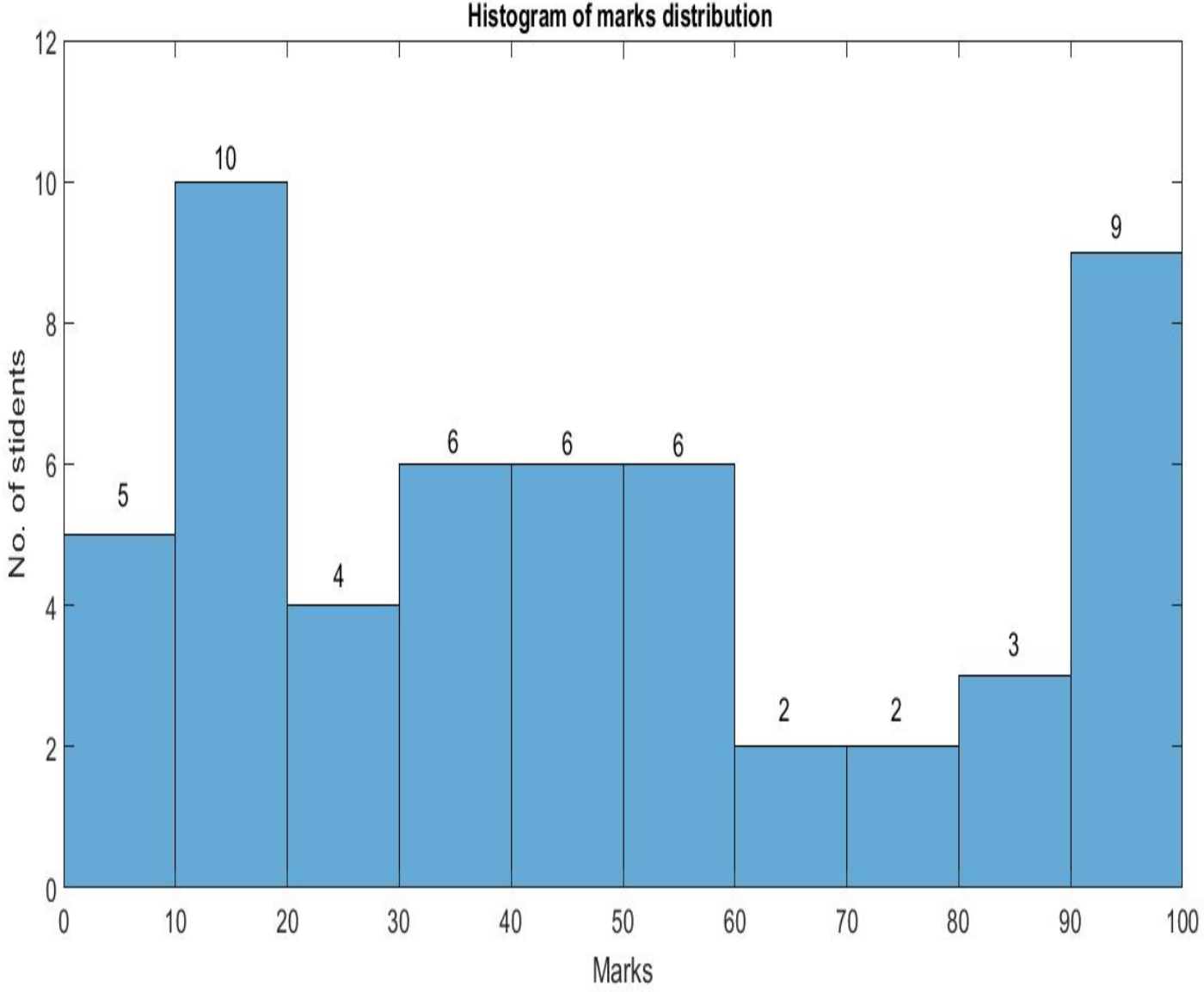

Histogram of the Frequency Distribution
Frequency
Class
0
5
10
15
20
25
0
10
20
30
40
50
60
70
5
11
19
21
16
10
8

Example:12 Prepare a histogram for the data(on equal class intervals)

Marks	0-10	10-20	20-30	30-60	60-80	80-90	90-100
No. of Students	5	10	4	18	4	3	9

Sol: Let the marks be denoted by class intervals(CI), the number of students by frequencies (f). We will convert it in equal interval series, adjusting also the frequencies. As class intervals 30-60 consists of 3 classes , we divide 18 by 3 to get 6 . As class interval 60-80 consists of 2 class intervals, we divide 4 by 2 to get 2.

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of Students	5	10	4	6	6	6	2	2	3	9


Histogram of marks distribution
No. of stidents
Marks
0
2
4
6
8
10
12
0
10
20
30
40
50
60
70
80
90
100
5
10
4
6
6
6
2
2
3
9

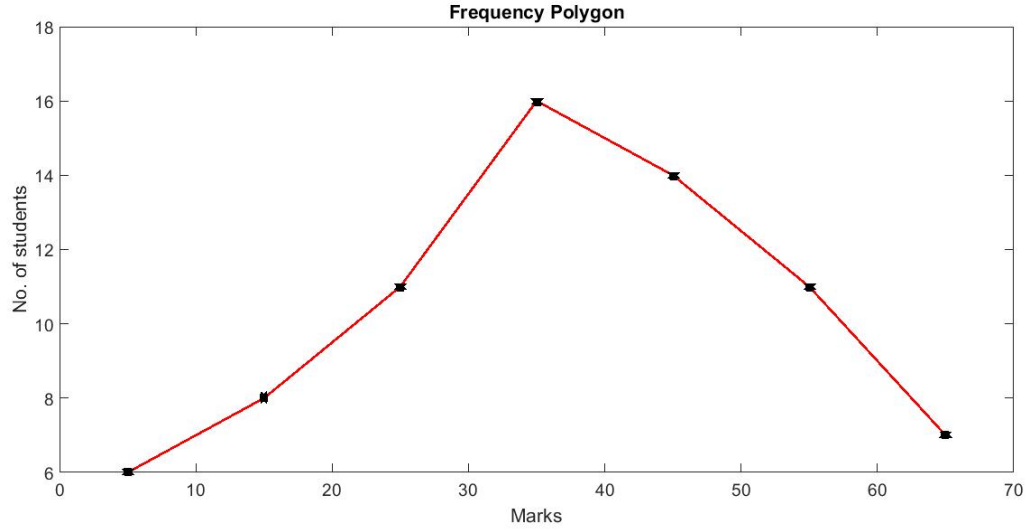
2. Frequency polygon: **A frequency polygon is a curve representing a frequency distribution. A frequency polygon is obtained when the midpoint of each rectangle in the histogram is joined by a straight line. Such a straight line is drawn on the assumption that the frequencies in any class are concentrated at the mid points of the class interval. The area of the polygon is equal to the area of the histogram because the area left out is just equal to the area included in it.**

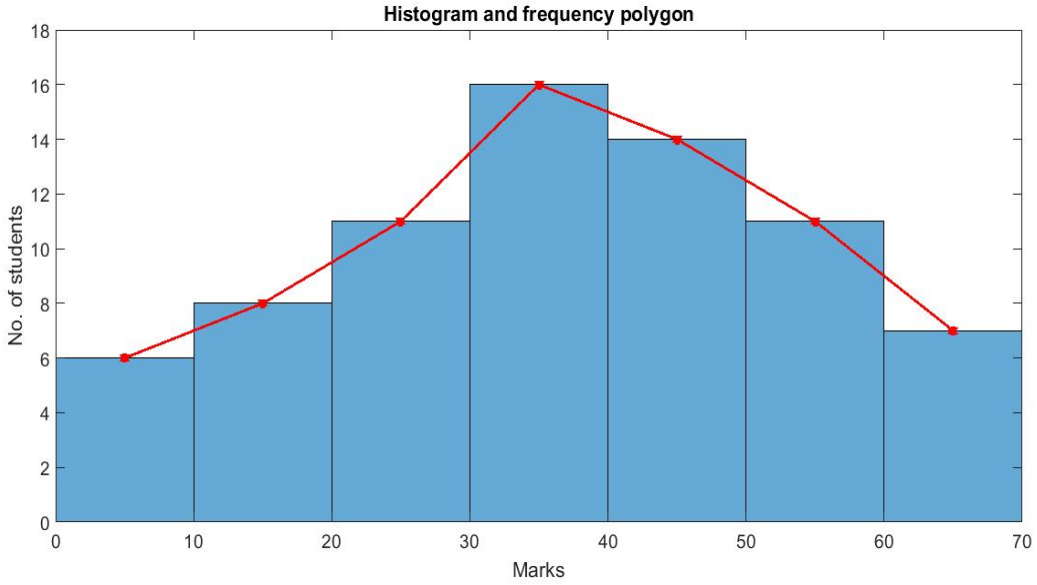
Example:13 draw a frequency polygon for the following data

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of students	6	8	11	16	14	11	7

Let the marks be denoted by class intervals and number of students by frequencies.

CI	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	6	8	11	16	14	11	7





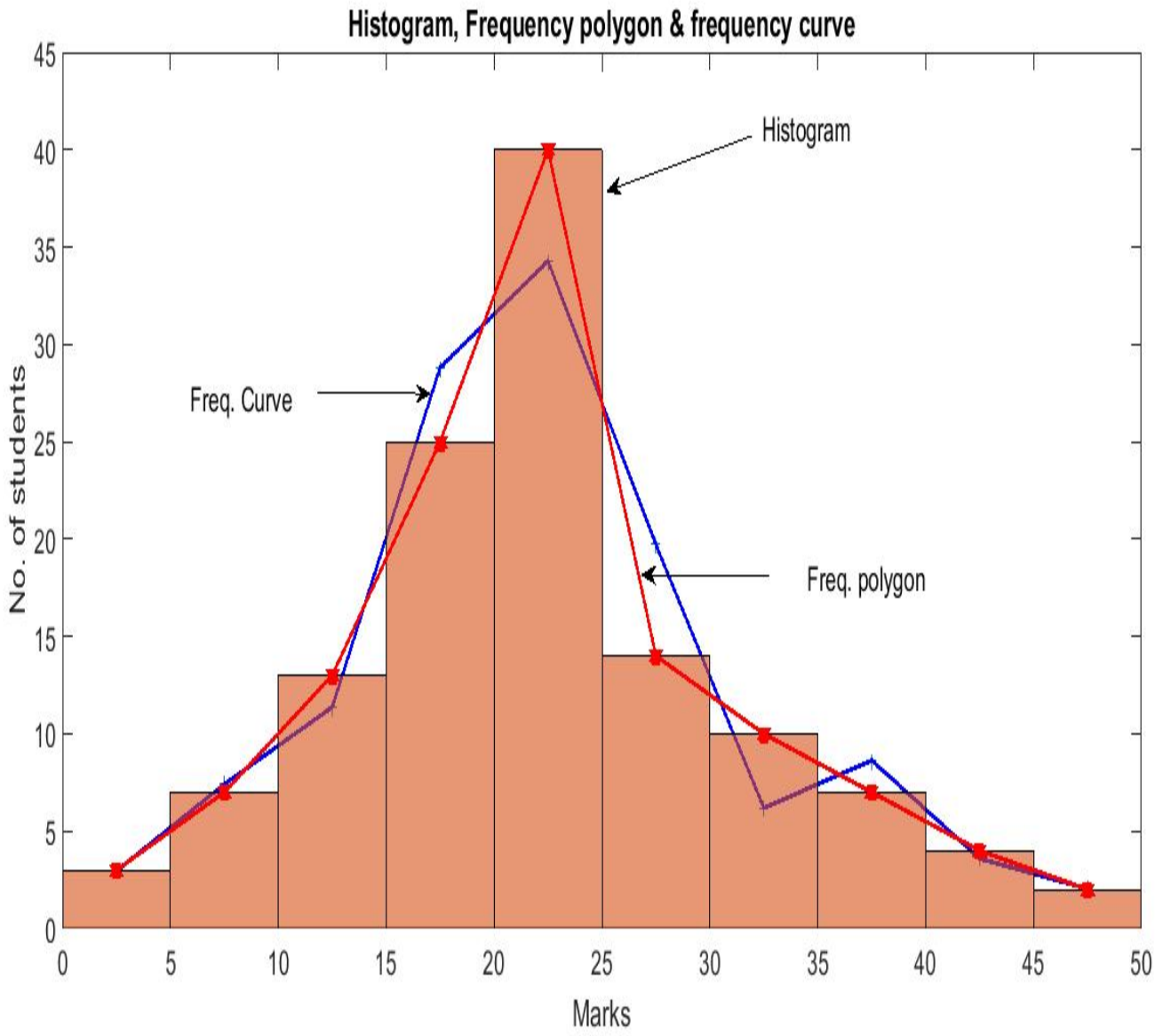
Histogram and frequency polygon showing marks and number of students.

3.Frequency curve: It is shown by free hand through the various points of the polygon in such a way that the area included is just the same as that of the polygon. The basic object of drawing a frequency curve is to present graphically the area covered by the histogram in a more symmetrical manner. It is also known as *smoothed frequency curve.*

Example:4.14 Draw a histogram , a frequency polygon and a smoothed frequency curve from the following data relating to marks secured in Statistics by students in a house test.

Marks	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
No. Students	3	7	13	25	40	14	10	7	4	2

*** Frequency curve here is plotted using 8-th order polynomial**


Histogram, Frequency polygon & frequency curve
Histogram
Freq. Curve
Freq. polygon
No. of students
Marks
0
5
10
15
20
25
30
35
40
45
50

4. Ogive curve: When cumulative frequencies are plotted on a graph, the frequency curve obtained is called *ogive frequency curve*.

There are two types of ogives (i) less than ogive and (ii) more than ogive.

For less than ogive, we cumulate the frequencies from above as usual and plot the point of upper limit of class interval against the value of corresponding cumulative frequency. These points are joined by lines or free hand curve. The lowest point is joined to the x-axis at the lower limit of the first class interval.

Example:15 Draw less than ogive curve for the following data.

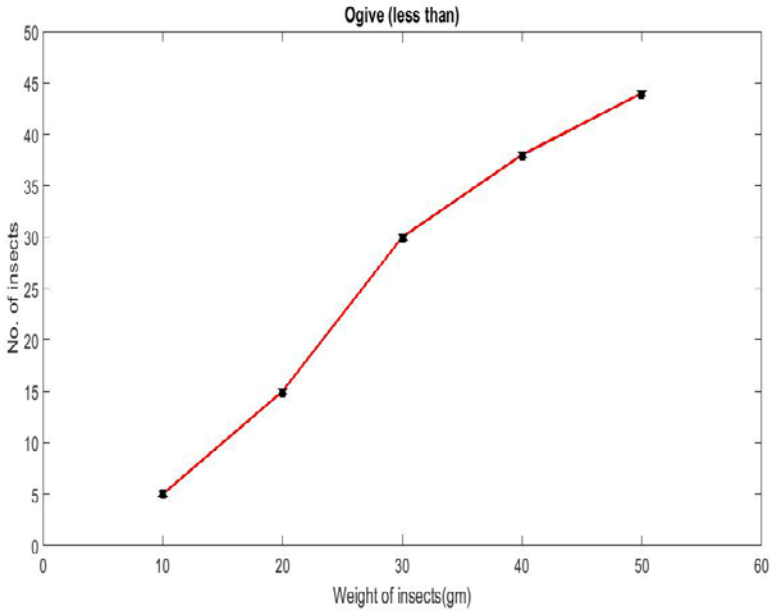
Wt.of insects	0-10	10-20	20-30	30-40	40-50
Freq.	5	10	15	8	6

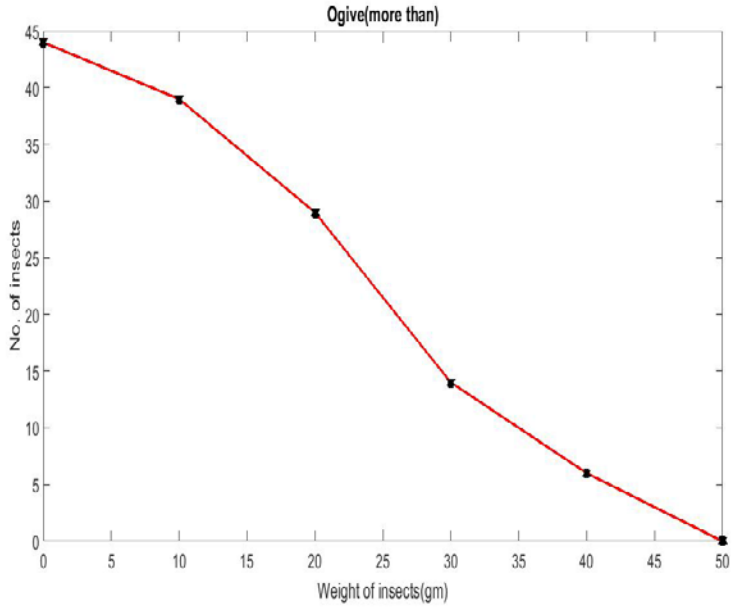
Sol:

Wt.of insects less than	10	20	30	40	50
Cum.Freq.	5	15	30	38	44

Wt.of insects more than	0	10	20	30	40	50
Cum.Freq.	44	39	29	14	6	0

In case of more than ogive, frequencies are cumulated from below. And each cumulated frequency is plotted against the lower limit of the corresponding class interval. The uppermost point is joined with y-axis at the upper limit of the class interval.



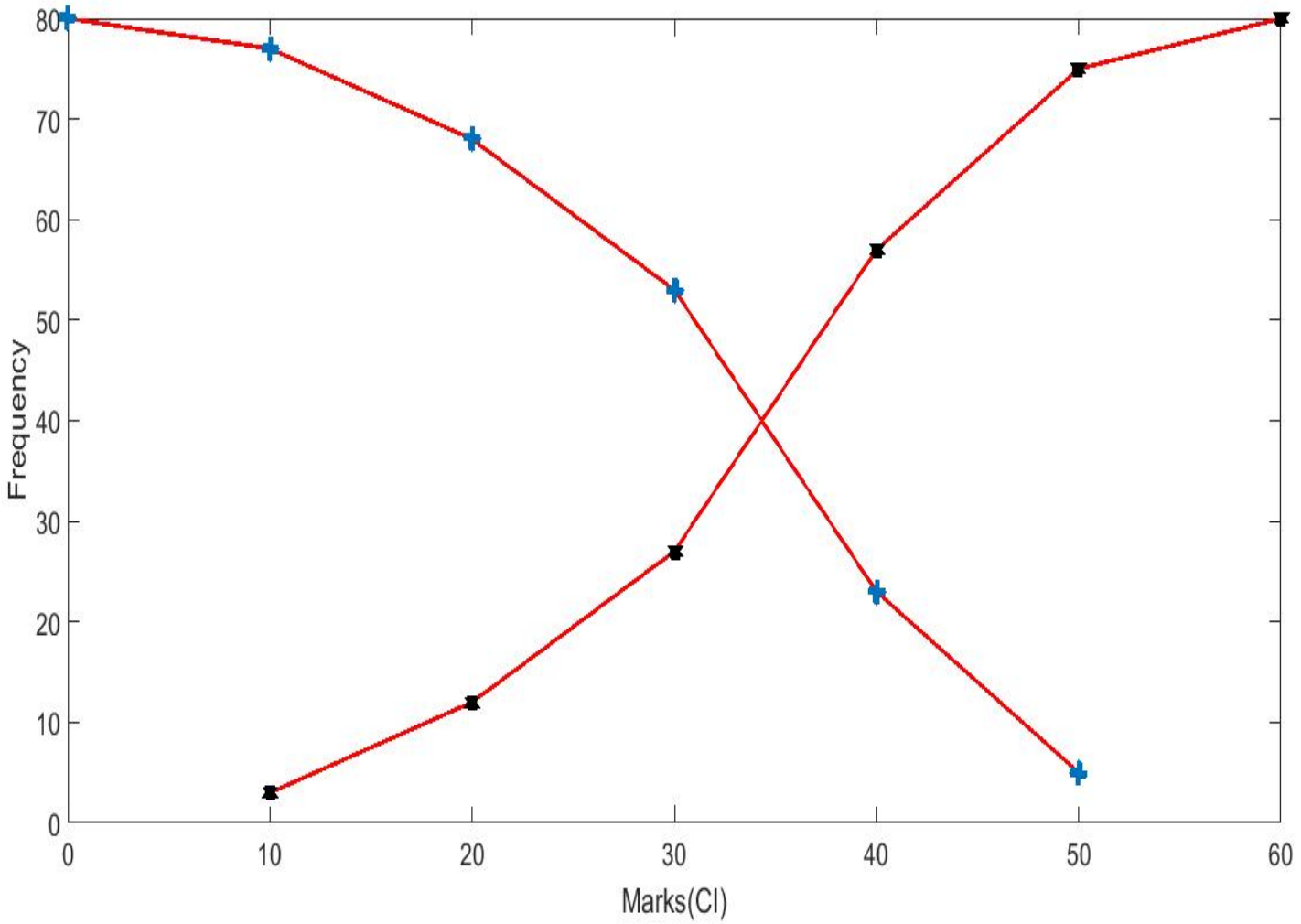


Example:17 Draw less than and more than cumulative frequency curve for the following :

Marks	0-10	10-20	20-30	30-40	40-50	50-60
Freq.(f)	3	9	15	30	18	5

Sol:

Marks less than(UL)	f_i less than $c.f$	Marks less than(LL)	f_i more than $c.f$
10	3	0	80
20	12	10	77
30	27	20	68
40	57	30	53
50	75	40	23
60	80	50	5


Frequency
Marks(CI)
0
10
20
30
40
50
60
70
80

Locating Median Graphically

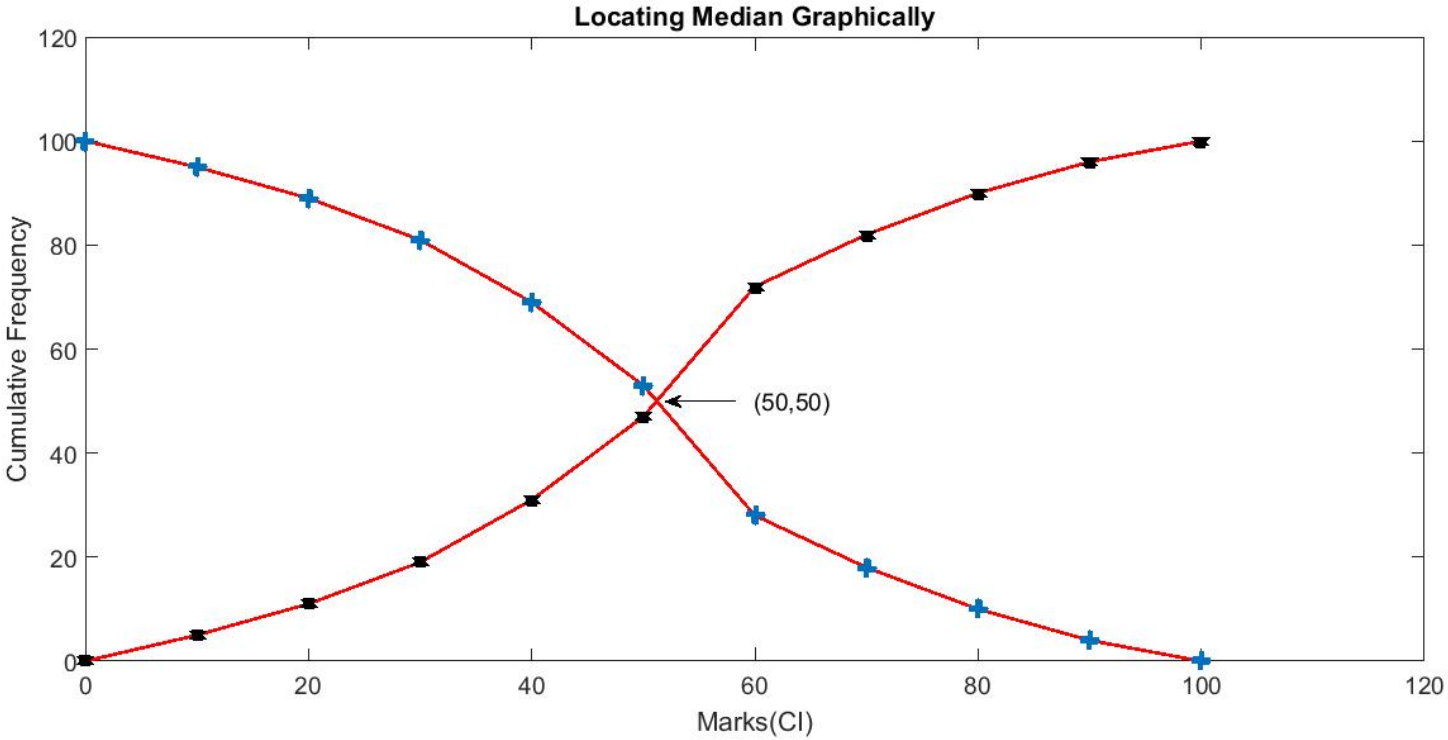
One ogive is drawn by " more than cumulative frequency method" and other by " less than cumulative frequency method". From the intersection of these two ogives , a perpendicular line is drawn on the x-axis. The point where the perpendicular line touches the x-axis is the median value to the given frequency data.

Example:18 The marks of 100 students are distributed as follows. Draw an ogive curve and find the median value. Check the value by direct calculation.

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of students	5	6	8	12	16	25	10	8	6	4

Sol:

CI	Less than c.f	More than c.f	CI	Less than c.f	More than c.f
0	0	100	60	72	28
10	5	95	70	82	18
20	11	89	80	90	10
30	19	81	90	96	4
40	31	69	100	100	0
50	47	53			


Locating Median Graphically
Cumulative Frequency
Marks(CI)
(50,50)
0
20
40
60
80
100
120

END