Graphic Representation of Data: Meaning, Principles and Methods

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Read this article to learn about the meaning, principles and methods of graphic representation of data.

Meaning of Graphic Representation of Data:

Graphic representation is another way of analysing numerical data. A graph is a sort of chart through which statistical data are represented in the form of lines or curves drawn across the coordinated points plotted on its surface.

Graphs enable us in studying the cause and effect relationship between two variables. Graphs help to measure the extent of change in one variable when another variable changes by a certain amount.

Graphs also enable us in studying both time series and frequency distribution as they give clear account and precise picture of proble and eye catching.

General Principles of Graphic Repres

There are some algebraic principles which apply to all types of graphic representation of data. In a graph there are two lines called coordinate axes. One is vertical known as Y axis and the other is horizontal called X axis. These two lines are perpendicular to each other. Where these two lines intersect each other is called '0' or the Origin. On the X axis the distances right to the origin have positive value (see fig. 7.1) and distances left to the origin have negative value. On the Y axis distances above the origin have a positive value and below the origin have a negative value.

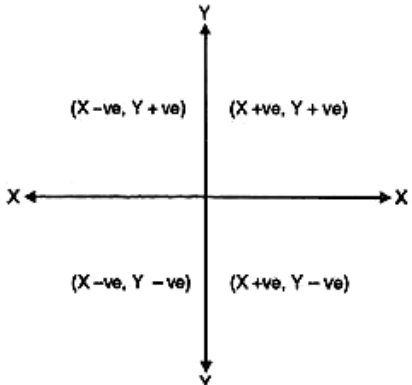

Fig. 7.1

Methods to Represent a Frequency Distribution:

Generally four methods are used to represent a frequency distribution graphically. These are Histogram, Smoothed frequency graph and Ogive or Cumulative frequency graph and pie diagram.

1. Histogram:

Histogram is a non-cumulative frequency graph, it is drawn on a natural scale in which the representative frequencies of the different class of values are represented through vertical rectangles drawn closed to each other. Measure of central tendency, mode can be easily determined with the help of this graph.

How to draw a Histogram:

Step—1:

Represent the class intervals of the variables al
along the Y-axis on natural scale.

Step—2:

Start X axis with the lower limit of the lowest class interval. When the lower limit happens to be a distant score from the origin give a break in the X-axis n to indicate that the vertical axis has been moved in for convenience.

Step—3:

Now draw rectangular bars in parallel to Y axis above each of the class intervals with class units as base: The areas of rectangles must be proportional to the frequencies of the corresponding classes.

Illustration No. 7.2

Plot the following data by a histogram.

c.i.	f
20—24	2
25—29	2
30—34	5
35—39	10
40—44	6
45—49	2
50—54	3

Solution:

In this graph we shall take class intervals in the X axis and frequencies in the Y axis. Before plotting the graph we have to convert the class into their exact limits.

c.i.	f
19.5—24.5	2
24.5—29.5	2
29.5—34.5	5
34.5—39.5	10
39.5—44.5	6
44.5—49.5	2
49.5—54.5	3

Histogram plotted from the data.

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c.i.	f
19.5—24.5	2
24.5—29.5	2
29.5—34.5	5
34.5—39.5	10
39.5—44.5	6
44.5—49.5	2
49.5—54.5	3

Histogram plotted from the data.

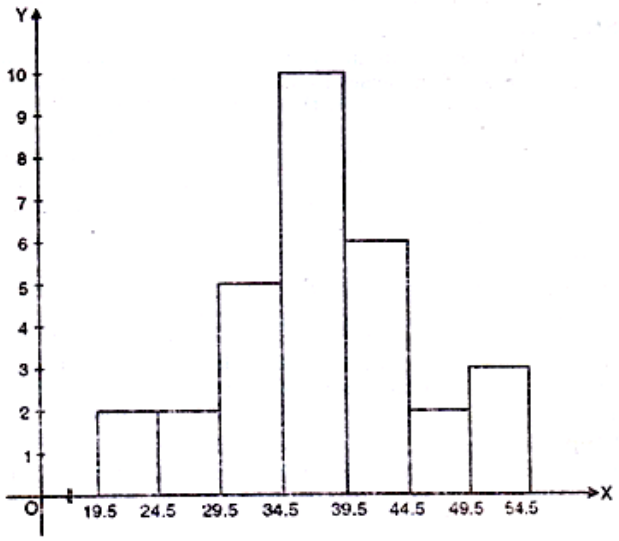

Fig. 7.2

Advantages of histogram:

1. It is easy to draw and simple to understand.

2. It helps us to understand the distribution easily and quickly.

3. It is more precise than the polygene.

Limitations of histogram:

1. It is not possible to plot more than one distribution on same axes as histogram.

2. Comparison of more than one frequency distribution on the same axes is not possible.

3. It is not possible to make it smooth.

Uses of histogram:

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1. Represents the data in graphic form.

2. Provides the knowledge of how the scores in the group are distributed. Whether the scores are piled up at the lower or higher end of the distribution or are evenly and regularly distributed throughout the scale.

3. Frequency Polygon. The frequency polygon is a frequency graph which is drawn by joining the coordinating points of the mid-values of the class intervals and their corresponding frequencies.

Let us discuss how to draw a frequency polygon:

Step-1:

Draw a horizontal line at the bottom of graph paper named 'OX' axis. Mark off the exact limits of the class intervals along this axis. It is better to start with c.i. of lowest value. When the lowest score in the distribution is a large number we cannot show it graphically if we start with the origin. Therefore put a break in the X axis () to indicate that the vertical axis has been moved in for convenience. Two additional points may be added to the two extreme ends.

Step-2:

Draw a vertical line through the extreme end of the horizontal axis known as OY axis. Along this line mark off the units to represent the frequencies of the class intervals. The scale should be chosen in such a way that it will make the largest frequency (height) of the polygon approximately 75 percent of the width of the figure.

Step-3:

Plot the points at a height proportional to the frequencies directly above the point on the horizontal axis representing the mid-point

Step-4:

After plotting all the points on the graph join these points by a series of short straight lines to form the frequency polygon. In order to complete the figure two additional intervals at the high end and low end of the distribution should be included. The frequency of these two intervals will be zero.

Illustration: No. 7.3:

Draw a frequency polygon from the following data:

Marks in Mathematics	40–45	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85–89	90–95	95–99
No. of students	1	3	2	4	5	6	10	8	5	6	2	1

Solution:

In this graph we shall take the class intervals (marks in mathematics) in X axis, and frequencies (Number of students) in the Y axis. Before plotting the graph we have to convert the c.i. into their exact limits and extend one c.i. in each end with a frequency of O.

Class intervals with exact limits:

c.i.	f.
34.5—39.5	0
39.5—44.5	1
44.5—49.5	3
49.5—54.5	2
54.5—59.5	4
59.5—64.5	5
64.5—69.5	6
69.5—74.5	10
74.5—79.5	8
79.5—84.5	5
84.5—89.5	6
89.5—94.5	2
94.5—99.5	1
99.5—104.5	0

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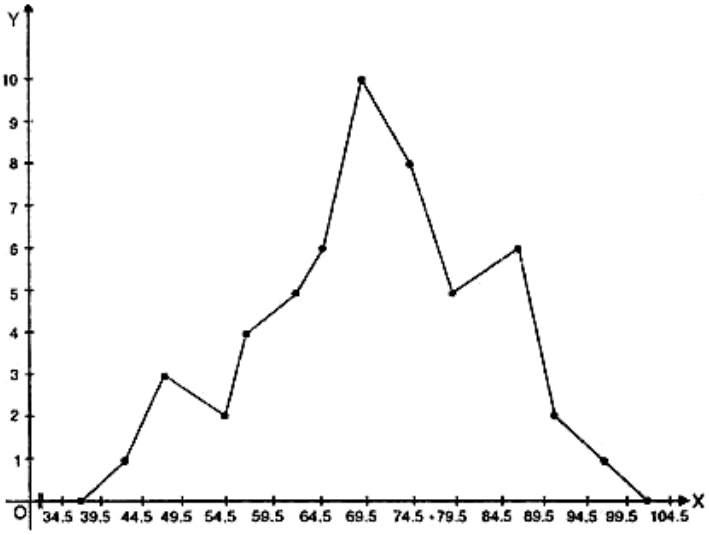

Fig. 7.3 Frequency polygon plotted from the data.

Advantages of frequency polygon:

1. It is easy to draw and simple to understand.

2. It is possible to plot two distributions at a time on same axes.

3. Comparison of two distributions can be made through frequency polygon.

4. It is possible to make it smooth.

Limitations of frequency polygon:

1. It is less precise.

2. It is not accurate in terms of area the frequency upon each interval.

Uses of frequency polygon:

1. When two or more distributions are to be compared the frequency polygon is used.

2. It represents the data in graphic form.

3. It provides knowledge of how the scores in one or more group are distributed. Whether the scores are piled up at the lower or
evenly and regularly distributed throughout the

2. Smoothed Frequency Polygon:

When the sample is very small and the frequency distribution is irregular the polygon is very jig-jag. In order to wipe out the irregularities and **"also get a better notion of how the figure might look if the data were more numerous, the frequency polygon may be smoothed."**

In this process to adjust the frequencies we take a series of 'moving' or 'running' averages. To get an adjusted or smoothed frequency we add the frequency of a class interval with the two adjacent intervals, just below and above the class interval. Then the sum is divided by 3. When these adjusted frequencies are plotted against the class intervals on a graph we get a smoothed frequency polygon.

Illustration 7.4:

Draw a smoothed frequency polygon, of the data given in the illustration No. 7.3:

Solution:

Here we have to first convert the class intervals into their exact limits. Then we have to determine the adjusted or smoothed frequencies.

c.i. (with exact limit)	f	Smoothed frequency
34.5—39.5	0	0 + 0 + 1 ÷ 3 = .33
39.5—44.5	1	0 + 1 + 3 ÷ 3 = 1.33
44.5—49.5	3	1 + 3 + 2 ÷ 3 = 2.00
49.5—54.5	2	3 + 2 + 4 ÷ 3 = 3.00
54.5—59.5	4	2 + 4 + 5 ÷ 3 = 3.67
59.5—64.5	5	4 + 5 + 6 ÷ 3 = 5.00
64.5—69.5	6	5 + 6 +10 ÷ 3 = 7.00
69.5—74.5	10	6 +10 + 8 ÷ 3 = 8.00
74.5—79.5	8	10 + 8 + 5 ÷ 3 = 7.67
79.5—84.5	5	8 + 5 + 6 ÷ 3 = 6.33
84.5—89.5	6	5 + 6 + 2 ÷ 3 = 4.33
89.5—94.5	2	6 + 2 + 1 ÷ 3 = 3.00
94.5—99.5	1	2 + 1 + 0 ÷ 3 = 1.00
99.5—104.5	0	1 + 0 + 0 ÷ 3 = .33

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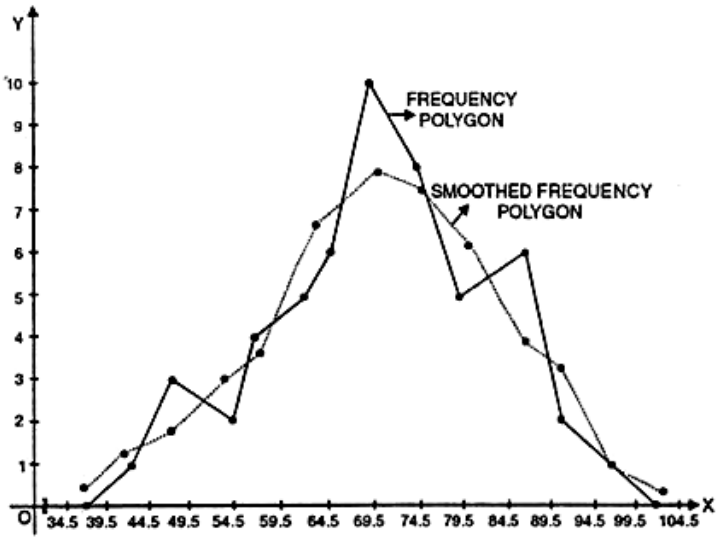

Fig. 7.4. Smoothed frequency polygon plotted from the data.

3. Ogive or Cumulative Frequency Polygon:

Ogive is a cumulative frequency graphs drawn on natural scale to determine the values of certain factors like median, Quartile, Percentile etc. In these graphs the exact limits of the class intervals are shown along the X-axis and the cumulative frequencies are shown along the Y-axis. Below are given the steps to draw an ogive.

Step—1:

Get the cumulative frequency by adding the frequencies cumulatively, from the lower end (to get a less than ogive) or from the upper end (to get a more than ogive).

Step—2:

Mark off the class intervals in the X-axis.

Step—3:

Represent the cumulative frequencies along the Y-axis beginning with zero at the base.

Step—4:

Put dots at each of the coordinating points of th
frequencies.

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Step—5:

Join all the dots with a line drawing smoothly. This will result in curve called ogive.

Illustration No. 7.5:

Draw an ogive from the data given below:

Marks in History	0—9	10—19	20—29	30—39	40—49	50—59	60—69	70—79	80—89	90—99
No. of Students	3	5	9	12	18	17	10	3	2	1

Solution:

To plot this graph first we have to convert, the class intervals into their exact limits. Then we have to calculate the cumulative frequencies of the distribution.

c.i.	f	c.f. (cumulative frequencies)
0—9.5	3	3
9.5—19.5	5	8
19.5—29.5	9	17
29.5—39.5	12	29
39.5—49.5	18	47
49.5—59.5	17	64
59.5—69.5	10	74
69.5—79.5	3	77
79.5—89.5	2	79
89.5—99.5	1	80

Now we have to plot the cumulative frequencies in respect to their corresponding class-intervals.

Ogive plotted from the data given above:

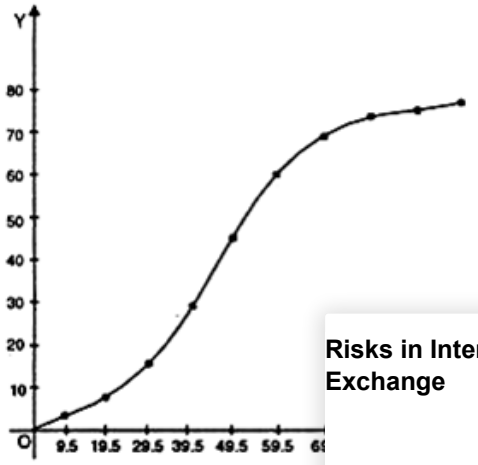

Fig. 7.5.

Uses of Ogive:

1. Ogive is useful to determine the number of students below and above a particular score.

2. When the median as a measure of central tendency is wanted.

3. When the quartiles, deciles and percentiles are wanted.

4. By plotting the scores of two groups on a same scale we can compare both the groups.

4. The Pie Diagram:

Figure given below shows the distribution of elementary pupils by their academic achievement in a school. Of the total, 60% are high achievers, 25% middle achievers and 15% low achievers. The construction of this pie diagram is quite simple. There are 360 degree in the circle. Hence, 60% of 360′ or 216° are counted off as shown in the diagram; this sector represents the proportion of high achievers students.

Ninety degrees counted off for the middle achiever students (25%) and 54 degrees for low achiever students (15%). The pie-diagram is useful when one wishes to picture proportions of the total in a striking way. Numbers of degrees may be measured off **"by eye"** or more accurately with a protractor.

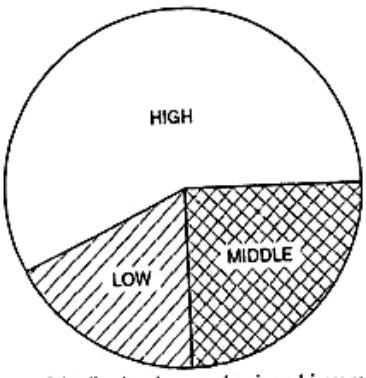

Fig. 7.6. Distribution by academic achievement of pupils in Class VI of a school.

Uses of Pie diagram:

1. Pie diagram is useful when one wants to pictu
way.

2. When a population is stratified and each strata is to be presented as a percentage at that time pie diagram is used.

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