



INTRODUCTION

The use of tables, charts and graphs makes the explanation of economics simpler and quicker to understand. Visual aids convey more meaning and are helpful for students to comprehend the issues or economic analysis of economics. In this chapter, frequency distribution, mean, median and mode will be explained.

OBJECTIVES

At the end of this chapter, students should be able to:

- ◆ *Identify the basic tools of economic analysis;*
- ◆ *State their uses and importance;*
- ◆ *Construct frequency distribution;*
- ◆ *Calculate the mean, median and mode of any given set of data.*

2.1 Graphs

Graphs are diagrams showing statistical relationship between two variables. Graphs aid economists in their economic analysis and quantitative information presented in a tabular form can be plotted on a graph. There are different types of graphs which include line graphs, bar graphs, pie graphs and pictographs. Table 2.1 provides information on the price and quantity of yam which is used to plot on straight line graph as shown in Fig. 2.1.

TABLE 2.1 Price and Quantity of Yam

Price (₦)	Quantity Demanded
50	1
40	2
30	3
20	4
10	5

The straight line graph in Fig. 2.1 illustrates the relationship between two variables: price and quantity. It shows that as price falls quantity of yam demanded increases. In economics, graphs are usually called curves and they are commonly used in economic analysis. Graphs could be either simple or complicated.

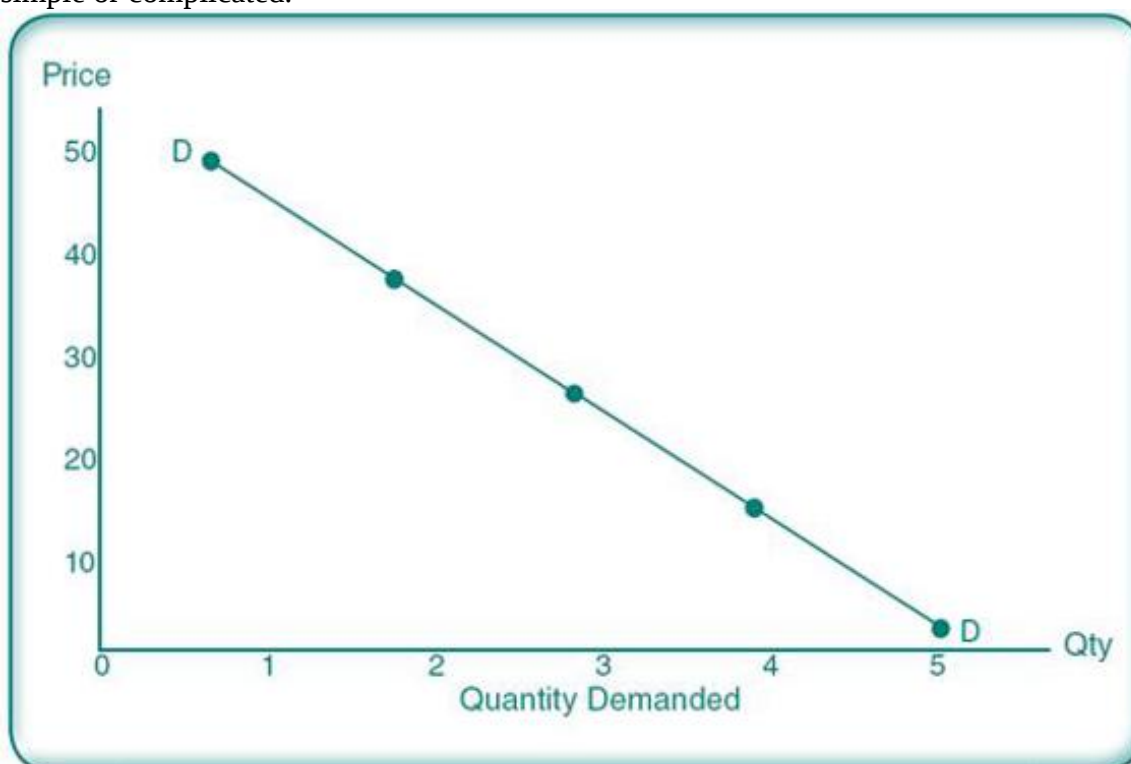


FIG. 2.1 A straight line graph showing the price and quantity of yam demanded.

Features of good graphs:

- A good graph should have a clear and comprehensive title.
- The graphs must be properly labelled.
- The vertical axis is called the Y axis (Price) while the horizontal axis is called the X axis (Quantity Demanded).
- The units of measurement of the graphs should be indicated.
- The source of data used in the graphs should be stated.

- (f) The variables represented on each axis should be stated.
- (g) The graphs should be numbered for easy identification.
- (h) The lines drawn on the graphs should be labelled.

Importance and advantages of graphs in economics:

- (a) Graphs help to show the relationship between two variables.
- (b) Economists use graphs for economic analysis.
- (c) Graphs give clearer and quicker impressions about quantitative information presented in a tabular form.
- (d) They are also used to introduce lessons.
- (e) Changes in variables or quantities are illustrated with the use of graphs.
- (f) Graphs make it easy to understand data presented in tables.

2.2 Charts

Charts are rough sketches used in representing statistical data. Charts are of various types. They include: bar charts, pie charts, component charts, histograms, and so on.

2.2.1 Bar Charts

Bar charts show the relationship between one variable and another. It is usually made up of bars. The length of the bars is usually drawn to be proportional to the magnitude of the data represented. A basic feature of a bar chart is that the body of the bars must not touch each other, and so there must be a gap or space between one bar and another. This is the basic difference between a bar chart and a histogram. There are different types of bar charts. They are simple bar charts, component bar charts and multiple bar charts.

2.2.1.1 Simple Bar Chart

The simple bar chart is used to represent tabulated data with evenly spaced bars. The scale can be marked off along the vertical or horizontal base lines. It is used when the data involves one category of the variables; for example, girls, boys, cars, and so on. It is drawn as shown in Fig. 2.2.

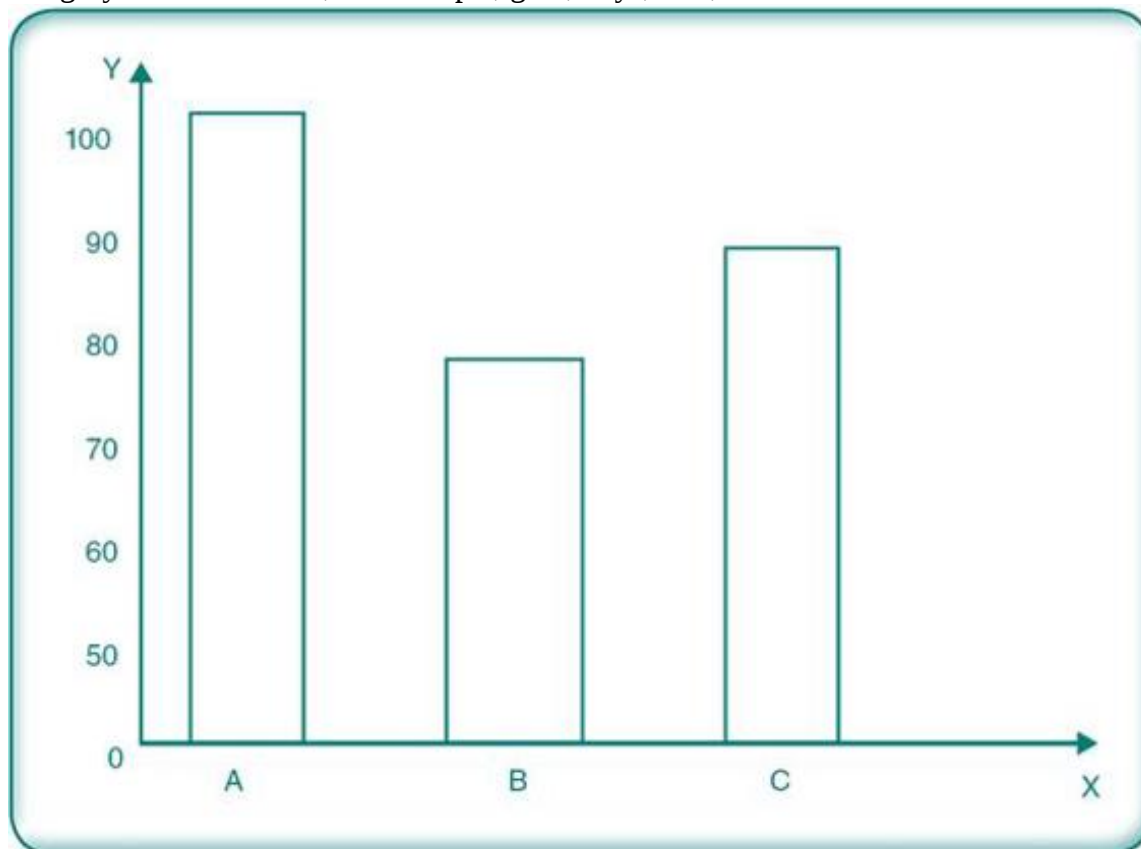


FIG. 2.2 A simple bar chart.

2.2.1.2 Component Bar Chart

This is a chart showing the various components that made up each of the bars. It is used when the data involves more than one category or variables. **Example:** A farmer, Mr. A, produces maize and yam. The respective values of the crops produced for the period of 4 years are shown thus in Table 2.2.

TABLE 2.2 Farm Produce of Mr. A (2005–2008)

Year	Maize	Yam	Total
2005	10	20	30
2006	15	25	40
2007	10	30	40
2008	10	25	35

The component bar chart of Table 2.2 is drawn as shown in Fig. 2.3 below.

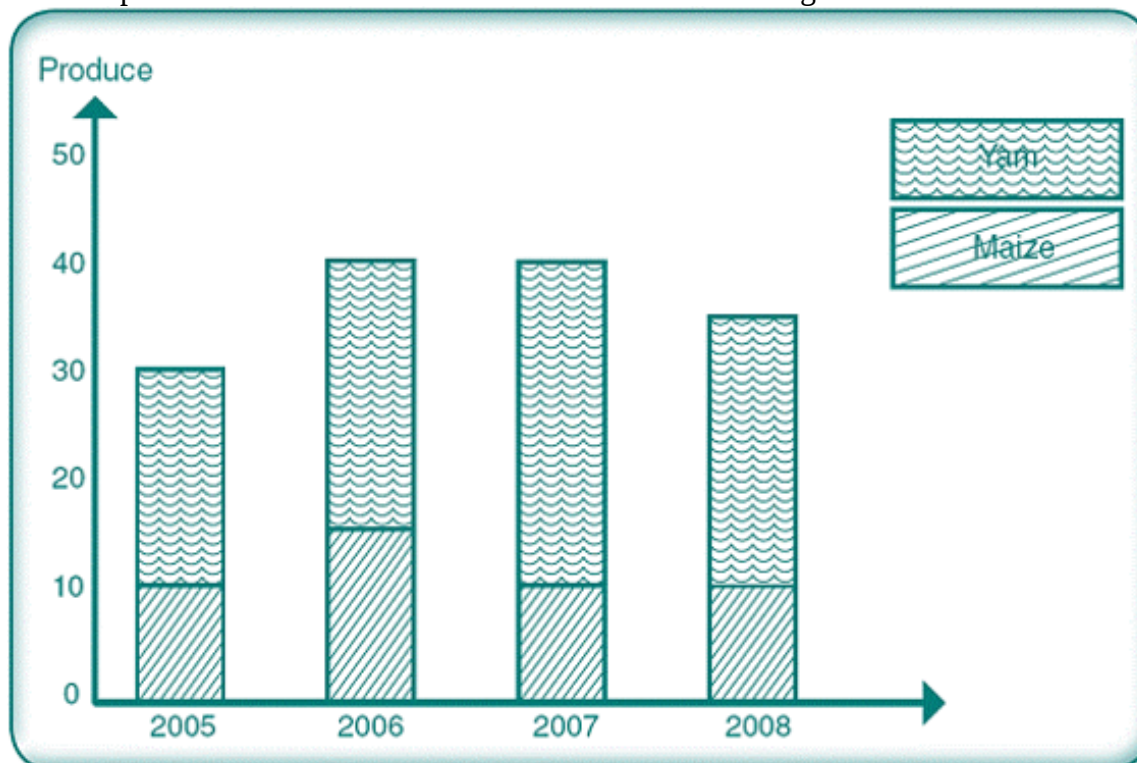


FIG. 2.3 Component bar chart value of crops produced by Mr. A between 2005 and 2008.

2.2.1.3 Multiple Bar Chart

This is used to show how two or more variables vary. As the name implies, it has multiple bars, each of which stands for a component variable. It is drawn as a separate bar adjoining each other. Fig. 2.4 shows an example of the multiple bar chart.

TABLE 2.3 A Typical Table Showing the Population (Million)

Year	Population (Million)
2005	10
2006	20
2007	30
2008	40

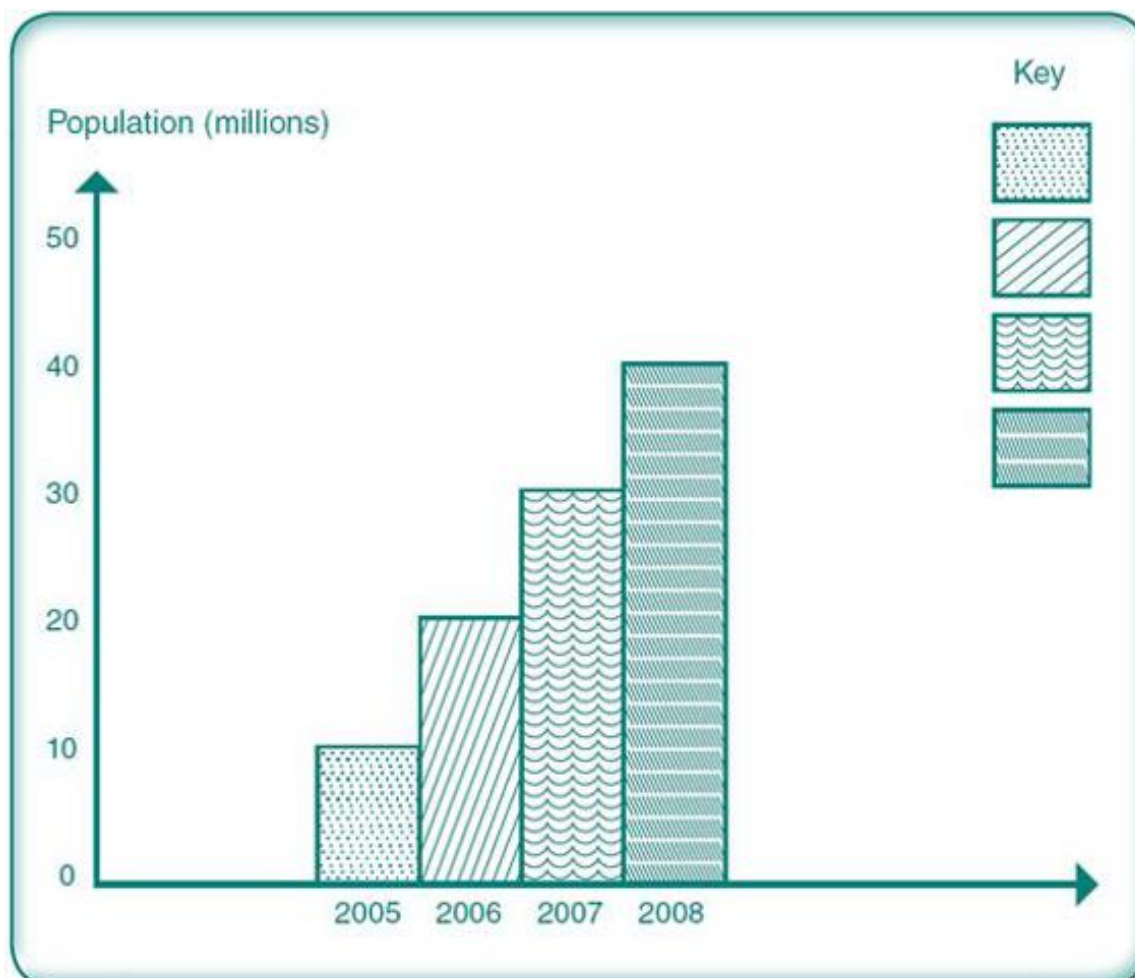


FIG. 2.4 Multiple bar chart showing the population distribution of a country (2005–2008).

2.2.2 Pie Chart

A pie chart is a 360-degree circular diagram. It is a circle divided into sections. The circle represents the total of the data being presented and each section is drawn proportional to its relative size. The steps involved in its calculation are as shown below.

TABLE 2.4 Table Showing Ownership of Industries in Nigeria

Ownership	No. of Industries
Foreign (F)	30
Joint (J)	20
Indigenous (I)	10
Total	60

The pie chart of the data in Table 2.4 can be constructed in two ways: using (i) percentage (ii) degrees.

(i) To calculate in degrees:

$$F = \frac{30}{60} \times 360 = 180^\circ$$

$$J = \frac{20}{60} \times 360 = 120^\circ$$

$$I = \frac{10}{60} \times 360 = 60^\circ$$

(ii) To calculate in percentage:

$$F = \frac{30}{360} \times 100 = 8.33\%$$

$$J = \frac{20}{360} \times 100 = 5.55\%$$

$$I = \frac{10}{360} \times 100 = 2.77\%$$

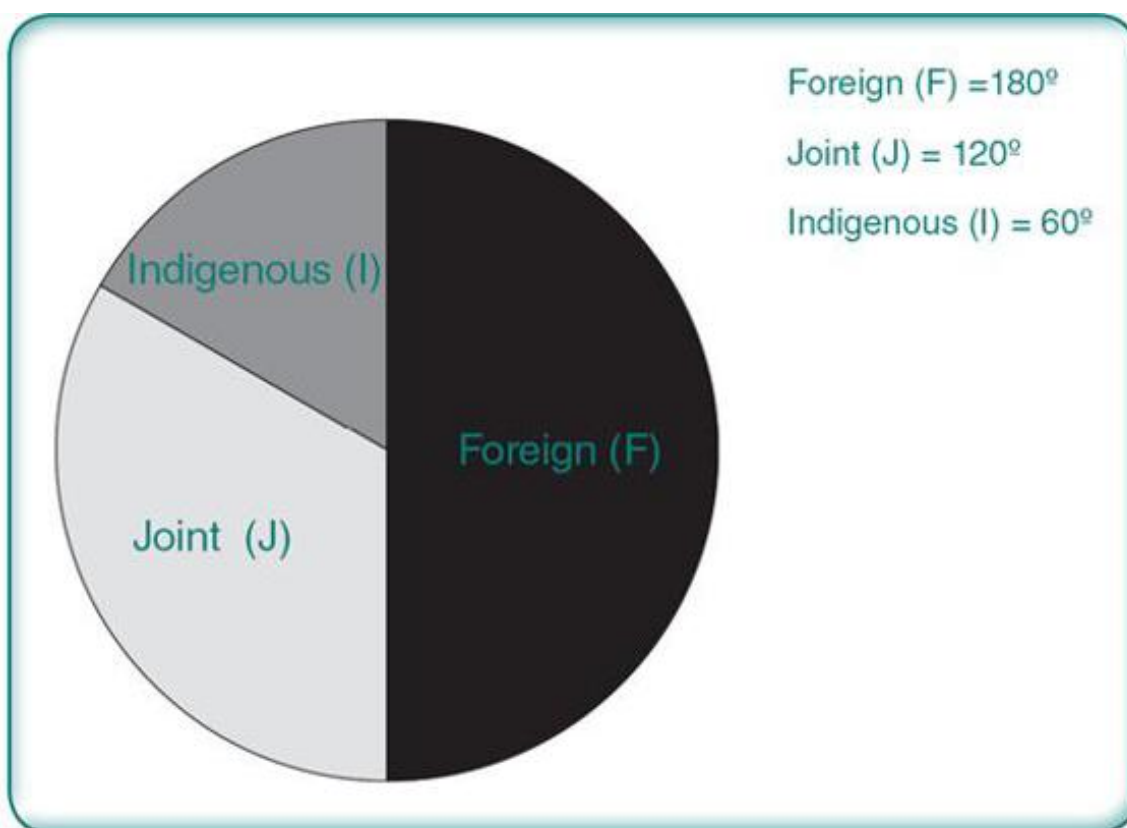


FIG. 2.5 A pie chart representing the ownership of industries in degrees.

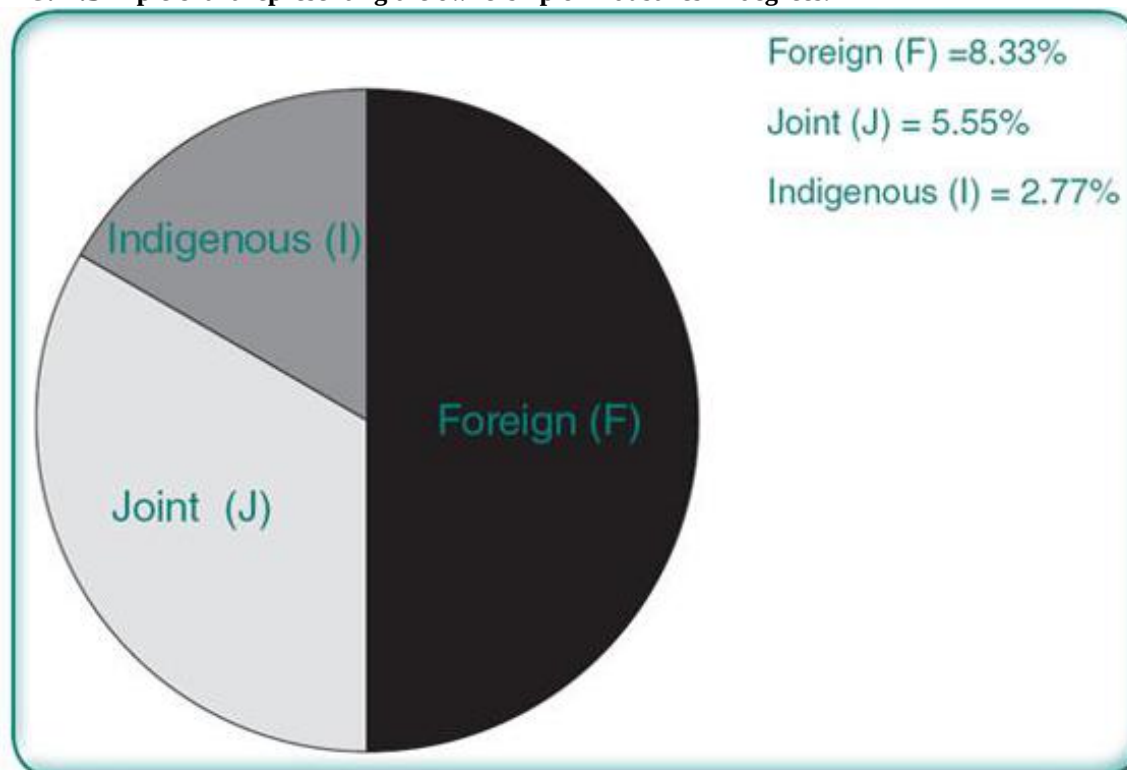


FIG. 2.6 A pie chart showing the ownership of industries in percentage.

2.3 Tables

Tables are an orderly layout of figures in rows and columns. They are aimed at presenting large quantity of data in a condensed pattern.

Tables serve as the most commonly used tools in economic analysis.

There are three types of tables used in statistical work, namely;

1. Source or reference tables
2. Working tables
3. Summary or text tables

2.3.1 Source or Reference Tables

A source table is one in which further analysis could be made. The working table is a sheet on which initial calculations are done before the final tables are arrived at. A summary table is usually found in books to support arguments presented so as to ensure easy reference.

Guidelines in constructing a table are as follows:

- (a) The purpose of constructing the table must be understood.
- (b) The table must be given a clear heading.
- (c) The table should be simple.
- (d) The table should be numbered if they are many.
- (e) The table should contain only the essential information.
- (f) The source of the data if known should be stated.
- (g) The units of measurement used in the table should be stated.
- (h) The subheadings for the columns and rows used should be clearly stated.

Importance and advantages of tables in economics are as follows:

- (a) Tables help in systematic arrangement of data in columns and rows.
- (b) They make data or quantitative information easy to understand.
- (c) Tables make comparison of figures easy.
- (d) They help and make interpretation of data easy.
- (e) Tables present complex quantitative information in a neat form.
- (f) Figures are easily located in tables.
- (g) Many figures are presented in tables.
- (h) Tables avoid repetitions.
- (i) Tables show associations and relationship between variables.
- (j) Tables provide information used in drawing graphs and charts.

2.4 Construction of Frequency Distribution

When a variable is classified according to the number possessing the same value of the variable, the classification is known as a frequency distribution. A frequency distribution is the number of times each value or group of values of a variable occurs. A cumulative frequency is that formed by adding each frequency to the sum of the previous one.

2.4.1 Frequency Distribution

The class of a frequency distribution is the group into which a set of ordered observed values of a variable falls. For example, we summarise the scores in statistics of 80 students where the maximum mark possible was 100 as given in the frequency Table 2.5:

TABLE 2.5 Students' Scores in Statistics

Scores	Class Interval	Frequency	Cumulative Frequency
11	10–19	1	1
21,22,23,23,24,25,27,28	20–29	8	9
31,33,34,34,35,35,35,36,36,37,38,39	30–39	12	21
40,40,41,42,42,42,43,43,44,44,44,45,46,46,47,47,48,49,49,49	40–49	20	41

(continued)

Scores	Class Interval	Frequency	Cumulative Frequency
50,50,51,52,52,52,53,53,54,55,55,55,56,56,57,58,58,59	50–59	18	59
61,61,62,63,63,63,64,64,67,68	60–69	10	69
71,72,73,73,75,76,78	70–79	7	76
83,85,86,88	80–89	4	80

2.5 Measures of Central Tendency

Measures of central tendency are averages. They are single figures which summarise the mass of data presented in a distribution. The measures of central tendency include the mean, the median and the mode.

2.5.1 The Mean

The mean is also referred to as the average. There are different types of mean. These include geometric, arithmetic, harmonic and the quadratic mean. The arithmetic mean is the sum of the values divided by the number of observations. The arithmetic mean is the most common and widely used among the three averages. Symbolically, the arithmetic mean is represented by

\bar{x} , pronounced 'x bar'. The formula for arithmetic mean

$$\bar{X} = \frac{\sum X}{N}$$

where:

\bar{X} = Arithmetic Mean

Σ = Stands for a Greek letter, pronounced "SIGMA" which means sum of.

X = The values of series of figures in the given data

ΣX = Sum of the values of series of figures in the given data

N = Number of figures or elements.

Example: Find the arithmetic mean of the following numbers: 4, 7, 8, 6, 9 and 2.

Solution: First, we add up the numbers thus: $4 + 7 + 8 + 6 + 9 + 2 = 36$

Number of items / observations = 6

$$\bar{X} = \frac{\Sigma X}{N} = \frac{36}{6} = 6$$

$$\bar{X} = \frac{36}{6} = 6$$

If elements or observations repeat themselves, we apply frequencies. Frequencies are the number of times such values occur. The formula of arithmetic mean for grouped data will be:

$$\bar{X} = \frac{\Sigma fx}{N}$$

where:

\bar{X} = Arithmetic mean

Σ = Sum of notation

f = Corresponding frequency

x = Observed number

N = Number of elements or observations.

Example: Find the arithmetic mean of the number of tubers of yam sold from Table 2.6.

TABLE 2.6 Number of Tubers of Yam Sold

Number of Tubers of Yam Sold	Frequency
12	1
13	2
18	2
22	4
24	5

$$\bar{X} = \frac{(12 \times 1) + (13 \times 2) + (18 \times 1) + (22 \times 4) + (24 \times 5)}{5}$$

$$\bar{X} = \frac{12 + 28 + 36 + 88 + 12}{14}$$

$$\bar{X} = 17.2$$

Merits of arithmetic mean

- (a) It is easy to calculate.
- (b) It determines the exact value.
- (c) It is easy to understand.
- (d) Its calculation is clear and precise.
- (e) It is the best known average.
- (f) It makes use of all the data in its calculation.
- (g) It provides a good measure of comparison.

Demerits of arithmetic mean

- (a) It cannot be obtained graphically.
- (b) It is difficult to determine without calculation.
- (c) It may lead to distorted results.
- (d) If one or more values are missing, it cannot be calculated.
- (e) Some facts may be concealed.

2.5.2 The Median

This is the middle number when the numbers in the distribution are arranged in order of magnitude. The median is a set of numbers arranged in either ascending or descending order. It is the arithmetic mean of the two middle numbers of a set of numbers arranged in either ascending or descending order of magnitude. If the number of scores involved is an odd number, the median will be the middle number.

Example: Find the median of the following scores: 7, 10, 8, 6, 3, 12, 4

Solution: The scores can be ranked in ascending or descending order of magnitude.

- (a) Ascending order: 3, 4, 6, 7, 8, 10, 12. The middle number here is the fourth number which is 7.
- (b) Descending order: 12, 10, 8, 7, 6, 4, 3. The median is still 7 the middle number.

When the observation involves an even observation the arithmetic mean of the two middle numbers becomes the median, though the observations would have been arranged in ascending or

descending order of magnitude.

Example: Find the median of the following numbers: 5, 6, 8, 9, 10, 12, 15, 17, 20, 23.

Solution: The two middle numbers are 10 and 12.

The median of this set of observation is the mean of the two middle numbers as shown below:

$$\text{Median} = \frac{10 + 12}{2} = \frac{22}{2} = 11$$

Advantages of the median

- (a) The median could be determined by observation.
- (b) It can be obtained graphically.
- (c) It is easy to understand.
- (d) It is easy to compute.
- (e) It does not use all the values in the distribution.
- (f) It gives clear idea of the distribution of the data.
- (g) It is not affected by the extreme items or values.

Disadvantages of the median

- (a) The median is not useful in further statistical calculations.
- (b) It is not easy to arrange data in order of magnitude when a large population is involved.
- (c) It ignores extreme values.
- (d) It throws some information in the distribution away.
- (e) It is less or not amenable to mathematical computation.

2.5.3 The Mode

The mode is defined as the most common score or the score with the highest frequency in the distribution. Before determining the mode of a set of observations, the numbers would have been arranged in either the ascending or the descending order of magnitude.

Example: Find the mode of the following distribution: 5, 7, 4, 5, 8, 5, 9, 4, 7, 5, 6, 9.

Solution: Arrange the distribution in ascending order of magnitude as follows: 4, 4, 5, 5, 5, 5, 6, 7, 7, 8, 9, 9. From the above numbers, the mode is 5. This is because 5 occurred four times in the distribution. Further, frequency table can be used to locate the mode.

Example: Find the mode from the distribution: 2, 4, 8, 5, 4, 3, 6, 7, 4, 2, 8, 4, 3, 5, 4, 2, 4.

Solution: Let us assume we have a frequency table as shown below.

Number	Tally	Frequency
2	///	3
3	//	2
4	### /	6
5	//	2
6	/	1
7	/	1
8	//	2

The mode in the above table is 4 because it is the number with the highest frequency. Where two different scores have the highest frequency, it is called bimodal.

Importance of the mode

- (a) It is easy to calculate.
- (b) It is used when deciding on the particular commodities or services to be produced.
- (c) It denotes the most profitable value in the data.
- (d) It is not affected by extreme values.

Demerits of the mode

- (a) The mode is a very poor average.

- (b) It is difficult to determine when there is more than one mode.
- (c) It is not an ideal measure of central tendency.
- (d) All the values in the distribution are not considered.

2.6 Uses of Measures of Central Tendency

Statistics such as the mean, median and mode are used to obtain information about population from a sample set of observed values. The mean is useful for predicting future results when there are no extreme values in the data set.

Summary

There are basically three types of bar charts, namely;

1. Simple bar charts;
2. Component bar charts; and
3. Multiple bar charts.

A pie chart is a circle divided into sections. This circle represents the total of the data being presented and each section is drawn proportional to the relative value of the data it represents.

Mode of a distribution is the value with the highest occurrence in a given distribution.

Median is the middle value of a given set of data when the observation is arranged in ascending or descending order of magnitude.

Arithmetic mean is the sum of all the items in a group divided by the number of items in the group.

Class Activities

Students should visit the Internet and bring to the class their findings about features of bar, pie and histogram charts for discussion in the classroom.

Revision Questions

Objective Questions

1. Which of the following is not an advantage of tabular presentation of data?
 - (a) Enables easy location of required figures.
 - (b) Makes comparison of figures easy.
 - (c) Occupies more space than mathematical equation.
 - (d) Shows whether the figures are increasing or decreasing. **(SSCE 2003)**
2. The pie chart below represents the total population of a school of 1200. The shaded area of 60° shows the population of the underaged pupils. What is the population of the matured students?
 - (a) 600 (b) 800
 - (c) 1000 (d) 120 **(SSCE 2002)**
3. The most frequently occurring value in a given data is the:
 - (a) Mode
 - (b) Median
 - (c) Mean
 - (d) Range **(SSCE 2002)**
4. Which of the following is a measure of central tendency?
 - (a) Percentage
 - (b) Graph
 - (c) Variance
 - (d) Median **(SSCE 2000)**

Use the table below to answer questions 5 and 6.

Scores (x) 0 2 4 5 6 7 8

Frequency (f) 7 11 6 7 7 4 3

5. In the distribution above, the mode is:

- (a) 2 (b) 3 (c) 4
- (d) 5 (e) 6

Essay Questions

1. What is the mode and when is it suitable to use the average? State its disadvantages. **(SSCE**

1989)

2. The raw scores of 20 students of the Utopia High School, who took part in an examination in economics, are given below. The pass mark is 40%.

38	28	70	43
39	20	64	66
12	46	52	53
20	34	48	69
18	20	64	34

(a) What is the mean score of the students' marks?

(b) How many students passed the examination?

(c) How many students scored below the mean score. (SSCE 1990)

3. What is the median? State its merits and demerits. (SSCE 1991)

4. The values of different types of accounts held in Nigerian banks for the period 1984 to 1988 are as follows (in Nm):

Year	Savings	Current	Fixed deposit
1984	100	65	40
1985	120	75	45
1986	120	70	60
1987	180	100	145
1988	200	130	50

Present the data given above in the form of a component bar chart. (SSCE 1992)

Glossary

Charts: Rough sketches used in representing statistical data.

Frequency: The number of times an object or figure occurs in a given observation.

Graph: Shows the relationship between two or more variables.

Mean: Sum of all the items in a group divided by the number of items in that group.

Median: The middle value when the values are arranged in the order of magnitude.

Mode: The value that occurs most in a given distribution.

Tables: Orderly layout of figures in rows and columns.