

## **CHAPTER 12 STATISTICAL MAP AND DIAGRAM**

### **Objectives**

After studying this chapter, students should be able to:

- define statistical graphs.
- describe different types of graphs such as Bar graphs, line graphs, chart, etc.
- state advantages of graphs.
- describe flow charts, pictogram, dot map and choropleth map.

### **12.1 Meaning of graphs**

Statistical graphs are diagrams or drawings consisting of lines showing the relationship between the values of two quantities, variables or events.

### **12. 2 Types of Graphs**

- Bar graphs
  - Simple bar graph
  - Compound divided bar graph
  - Multiple bar graph
  - Histogram
- Line graphs
- Pie chart/graphs
- Flow charts
- Pictograms

### **Bar graph or chart**

A bar graph consists of a number of proportional bars of equal sizes and variable length. They may be simple, component or multiple bar graphs. It may equally be arranged vertically or horizontally. Information on temperature, rainfall, goods imported or exported, etc., can be presented using the bar graph.

- a. Simple bar chart: The simple bar chart is represented by tabulated data with evenly spaced bars, separated by gaps with the lengths of the bars being proportional to attributed frequencies. A simple bar chart is used when data given or involved is made up of only one item or component and are particularly

suitable where data represents values e.g. the total annual output of any commodity or the total rainfall in any given month which is quite separate and distinct from the preceding month and succeeding months.

### Procedure

- i. Provide a clear title for the bar-graph.
- ii. Examine the series of figures shown in the table.
- iii. With the use of graph paper, choose a suitable scale e.g 1cm: 1000 tones, barrels and note the highest and lowest tones of cocoa or barrels of oil produced horizontally.
- iv. The years are arranged along the horizontal line while the produce are arranged along the vertical line.
- v. The bar graph is then drawn with the year corresponding to the quantity of goods produced.

For example crude oil production in some states in Nigeria is shown in

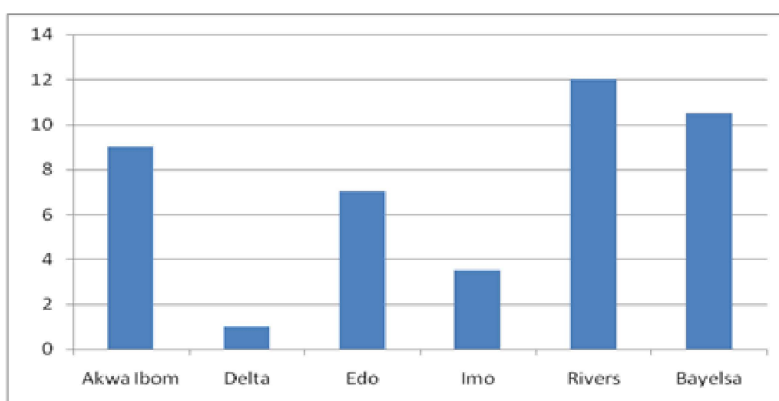
State	Barrels of Oil
Delta State	+10,000
Edo State	70,000
Imo State	35,000
Rivers State	120,000
Akwa Ibom State	-90,000

### Solution

From the figures given, using the scale 1cm: 10,000 barrels, the figures can be reduced to simple ones when divided by 1000.

The new value will now be:

State	Barrels of Oil
Delta State	1.0
Edo State	7.0
Imo State	3.5
Rivers State	12.0
Akwa Ibom State	9.0
Bayelsa	10.5



*Fig 12.1: Simple Bar Graph Showing Crude Oil Production in Some State*

From the graph shown above in Fig 1.1, the state with the highest crude oil production is Rivers with 120,000 barrels of oil while Imo has the least with 35,000 barrels.

### Component Bar Chart

A component bar chart is used when the data involved is of two variables. e.g. The population of males and females in some towns in Imo state in 2006 represented by the bar chart shown next page

Population of some towns in Imo State in 2006:

Towns	Male	Female	Total
Owerri	30,000	45,000	125,000
Orlu	45,000	30,000	75,000
Okigwe	35,000	30,000	65,000
Oguta	30,000	25,000	55,000

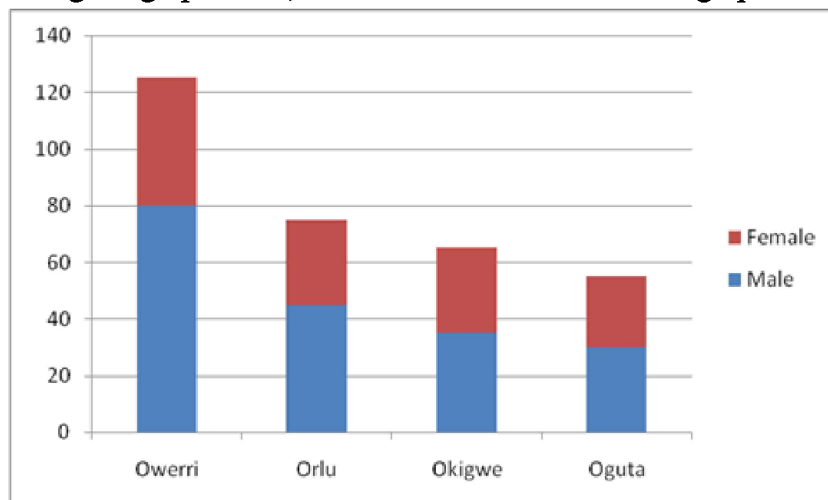
### Procedure

1. Use the same method of construction as above.
2. Divide all the figures by 1000.
3. What is derived at the end of the division is represented in the table below.

Towns	Male	Female	Total
Owerri	80	45	125
Orlu	45	30	75
Okigwe	35	30	65

Oguta	30	25	55
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Using the graph sheet, choose a suitable scale for the graph



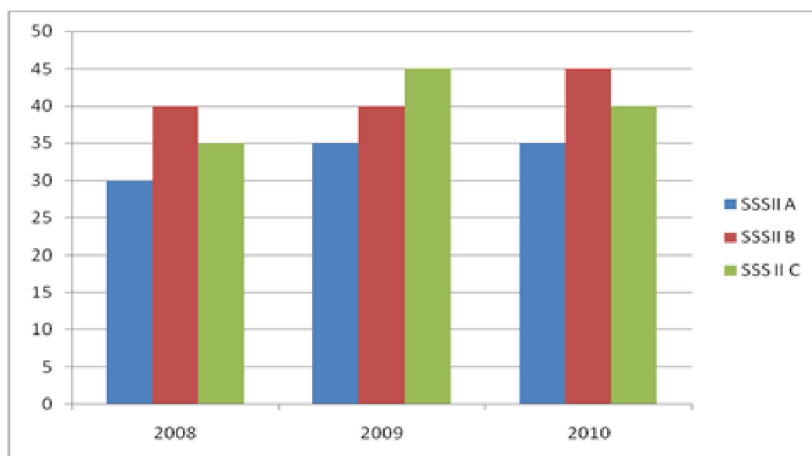
*Fig.12.2: A Component Bar Graph Showing Population of Some Towns in Imo State*

### Multiple Bar Charts

Multiple bar charts are used when there are more than two variables in a given data. This has multiple bars each of which stands for a component variable.

**Example:** Show the multiple bar chart of students performance in SSS two a, b and c in three consecutive years 2008, 2009, 2010 at Government Secondary School Owerri in Geography.

Students	2008	2009	2010
SSS II A	30	35	35
SSS II B	40	40	45
SS II C	35	45	40



**Fig. 12.3** Bar Chart Showing Students Population in SSS II A, B, and C.

### Line Graph

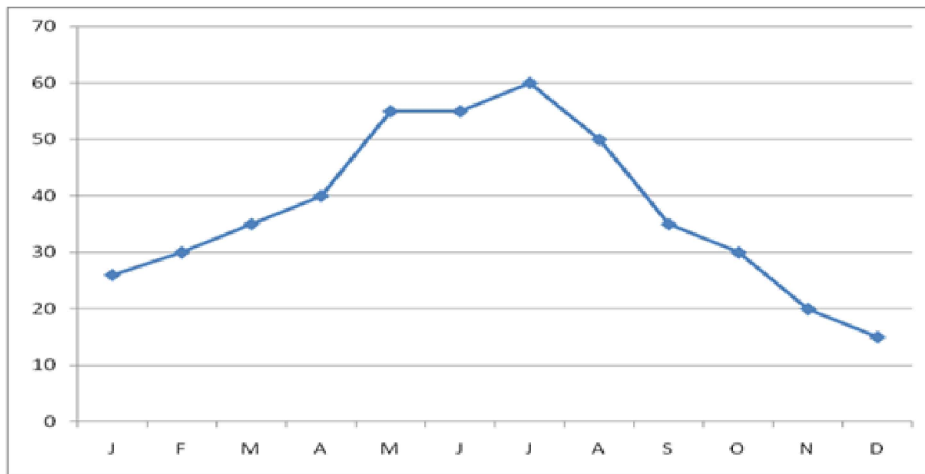
A line graph is used to join or connect the highest point of group of data such as rainfall, temperature, humidity and other information. Hence, it is used for data where emphasis is on continuous change or trend.

#### Procedure

1. Give the line graph a clear title.
2. Examine the series of figures shown on the table.
3. Note the maximum and minimum figures.
4. Using a graph paper, choose a suitable scale eg 1cm: 10cm<sup>3</sup>.
5. Note that months are arranged along the horizontal line while the figures in cm<sup>3</sup> are arranged along the vertical line.
6. The graph is then plotted and the maximum points of each month are joined together to give a line graph.

**Examples:** Table of rainfall figures for Ibadan for months January to December, 2000

Month	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall max Cm <sup>3</sup>	26	30	35	40	55	55	60	50	35	30	20	15



*Fig. 12.4: A multiple Bar Chart Showing Students Performance in SSS II A, B, and C.*

### **Advantages and Importance of Graph**

Graphs are important in the following ways

- i. Graph shows relationship between two variables.
- ii. Graphs make clearer and quicker impression about quantitative information illustrated in tabular form.
- iii. They interpret value of variables.
- iv. Graphs suggest connection between variables or events.
- v. Graphs make it possible for changes in variables on quantities to be expressed.
- vi. They provide basis for comparing variables provided in the same table.

### **Pie Chart**

A pie chart or graph is one of the most common statistical diagrams. It is shown by a circle of any convenient size which is divided into sectors, each of which is proportional to the quantity or value it represents.

#### **Procedure**

- Draw a circle of convenient size.
- Workout the percentage degree of the total which each component part represents.
- Divide the circle into sectors which the angles calculated in ii above subtend using a protractor.

- Write the percentage of each sector beside it.
- Use a key to show what each sector represents.
- Provide an appropriate title for the diagram.

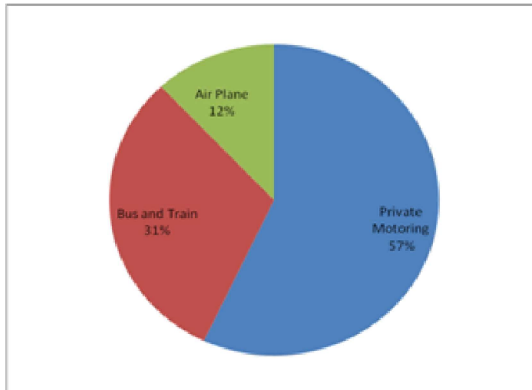
**Example:** Represent the information given below in form of a pie chart.

The information shows the transport means used by commuters in Imo state when they travelled to Abuja:

Type of transport	Number
Private motoring	1,560
Bus and train	840
Airplane	320
Total	2,720

Type of transport	Sector angle (degree)	Percentage
Private motoring	$\frac{1,560}{2,720} \times 360 = 206^{\circ}$	$\frac{1,560}{2,720} \times 100 = 57\%$
Bus and train	$\frac{840}{2,720} \times 360 = 111^{\circ}$	$\frac{840}{2,720} \times 100 = 31\%$
Airplane	$\frac{320}{2,720} \times 360 = 43^{\circ}$	$\frac{320}{2,720} \times 100 = 12\%$

*Using a protractor, the pie chart can now be drawn. This is shown in Fig. 12.5.*



**Fig. 12.5:** A pie chart showing transport means used by commuters in Imo state travelling to Abuja.

Pie charts are very useful when component parts of a whole are to be represented. Up to eight component parts can be accommodated but above this number, the chart loses

its effectiveness.

### Flow Chart

Flow charts are used to illustrate information like transport, amount of flows in a traffic, passengers or goods carried or conveyed along different routes.

This requires drawing lines on both sides of and parallel to the route ways. The width of the band should be proportional to the volume of traffic or goods passing through each route, increasing abruptly where two routes converge.

### Procedure for Constructing a Flow Chart

- Examine the series of figures shown in the table.
- Choose a suitable scale.
- Use the scale to divide the values given.
- The result of the divided values gives the size of the flow chart.
- Draw the flow chart to join the receiving regions.

**Example:** By means of flow chart, represent the volume of import trade between Nigeria and USA, China and Japan and the major three towns receiving such goods from Apapa port in 2000 from the table below.

Import trade at Apapa port in 2000

Country of origin	Receiving region	Value of import (tons)
Japan	Apapa – Benin	30,000
USA	Apapa – Kano	40,000
China	Apapa – Port Harcourt	100,000

Scale 1mm = 10,000 tons

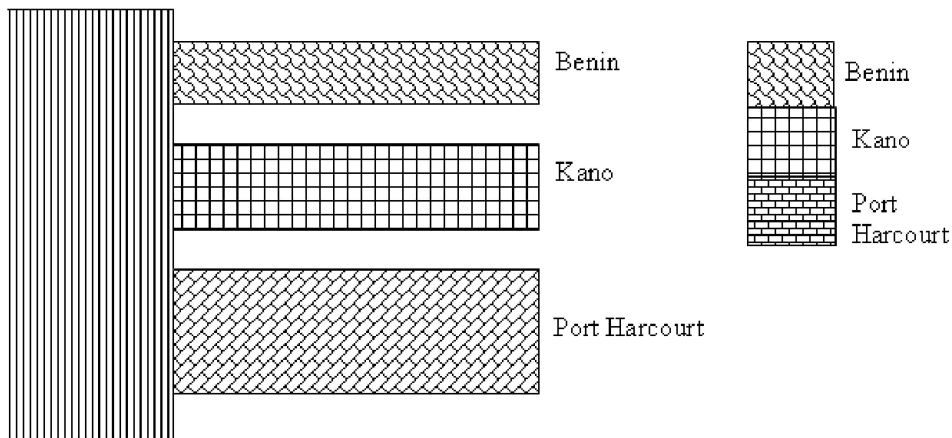
### Solution

$$\text{Apapa – Benin} = \frac{30,000}{10,000} = 3\text{mm}$$

$$\text{Apapa – Kano} = \frac{40,000}{10,000} = 4\text{mm}$$

$$\text{Apapa – Port Harcourt} = \frac{100,000}{10,000} = 10\text{mm}$$





**Fig.12.6:** Flow chart representing the volume of trade between Nigeria and other countries.

From the chart in Fig 12.6, Apapa-Port Harcourt route is the largest with 10mm while Apapa-Benin route is the smallest with 3mm.

### Pictogram

Pictograms are diagrams in the form of pictures which are used to present information to those who are unskilled in dealing with figures or to those who have only a limited interest in the topic depicted.

**Example:** The table below shows the output of bicycles for the year 2000 to 2004.

Year	Output
2000	1000
2001	2000
2002	3000
2003	5000
2004	2000

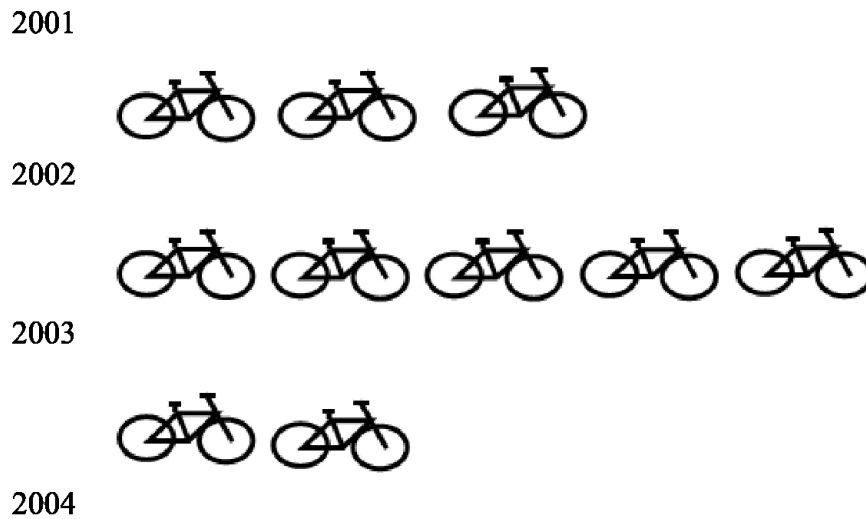
Represent this data in form of a pictogram.

This is shown below in Fig 12.7



2000





*Fig 12.7: Pictogram showing the output of bicycles for years 2000-2004*  
 In this pictogram, each bicycle represents an output of 1000.

### Dot Map

A dot map refers to the represented symbols or dots applied to areas and confirmed to only one type of symbol. It is a diagrammatic representation of a large quantity or volume of data by means of dots. Each dot, according to a chosen scale, then represents a specified quantity of a particular commodity, data or information.

### Construction of a Dot Map

There are several steps taken in the construction of a dot map.

#### Step 1

Determine the scale of the map. In doing this, examine the range of quantities indicated in the table of figures.

Question: Based on the statistics given below, construct a unit dot map to show the cultivated land area in Amadiama in Rivers state, Nigeria.

Zone	Cultivated land (Hectares)
1	8,201
2	12,114
3	20,004

4	36,120
5	4,100
6	24,200

### Solution

Looking at the range of the figures shown in the table above, the lowest figure is 4,100 hectares while 36,120 is the highest. A scale of 1 dot to 2,000 hectares of cultivated land will therefore be suitable. Proceed to calculate the number of dots that will represent the cultivated lands.

1. If 2,000 hectares is to represent 1 dot than 8,201 hectares =  $\frac{8,201}{2,000} = 4$  dots
2. 12,114 hectares =  $\frac{12,114}{2,000} = 6$  dots
3. 20,004 hectares =  $\frac{20,004}{2,000} = 10$  dots
4. 36,120 hectares =  $\frac{36,120}{2,000} = 18$  dots
5. 4,100 hectares =  $\frac{4,100}{2,000} = 2$  dots
6. 24,200 hectares =  $\frac{24,200}{2,000} = 12$  dots

### Step 2

Mark out the dots within the appropriate zone.

Zone	Cultivated land (hectares)
1	• • • •
2	• • • • • •
3	• • • • • • • • • •
4	• • • • • • • • • • • • • • • •
5	• •
6	• • • • • • • • • • • •

*Fig. 12.8: Dot line showing cultivated land area in Amadiama*

### Choropleth Map

A choropleth map involves the use of diagrams to represent certain figures, information or data of a particular issue in form of densities. Different symbols or

shadings are used to distinguish and represent the data provided on a particular issue.

### Procedure

- Examine the series of figures or data provided in the table.
- Choose a suitable scale in relation to the figures given.
- Use the scale to divide the values of figures given.
- Group the values of the same range into categories.
- Represent these categories in a choropleth map.

### Example:

The table below shows the population and land area of some towns in Rivers state in 2006. Represent this information in form of a choropleth map.

Town	Land area (Sq km)	Total population
Elele	12,500	274,000
Omoku	8,200	13,120
Ahuada	10,600	120,700
Omerelu	26,700	75,100
Okirika	15,100	100,300
Abua	6,000	19,200

**Example:** The table below shows the population of some towns in Owerri zone in 2006. Represent the information by means of a choropleth map.

The population of towns in Owerri zone in 2006.

Town	Population
Avu	8,040
Amakohia	25,000
Obubua	4,300
Ikenegbu	20,000
Obimze	14,000
Mbazua	6,500

### Solution

- Choose a suitable scale by considering the lowest. The scale chosen is 1:2,000.
- Then use the scale to divide the population of the various towns in Owerri zone.

$$\text{Avu} = \frac{8,040}{2,000} = 4.02$$

$$\text{Amakohia} = \frac{31,000}{2,000} = 15.5$$

$$\text{Abubua} = \frac{4,300}{2,000} = 2.15$$

$$\text{Ikenegbu} = \frac{20,000}{2,000} = 10$$

$$\text{Obimze} = \frac{14,000}{2,000} = 7$$

$$\text{Obazua} = \frac{6,500}{2,000} = 3.25$$

$$\text{Ozara} = \frac{18,000}{2,000} = 9$$

Arrange the table after using the scale

Town	Population
Avu	4.02
Amakohia	15.5
Obubua	2.15
Ikenegbu	10
Obimze	7
Obazua	3.25
Ozara	9

From the statistical information, Amakohia has the highest population. To derive the scale therefore, use the number of shadings to which you were confined to divide the highest population i.e 15.5 or 16 approximately. This is  $16:4 = 4$ .

Therefore, the scale will then read 1-4, 5-8, 9-12, 13-16.

Finally, use different types of shading to represent each of the populations reflected in the scale. The key to each shading must be indicated.

### Proportional Circles

Proportional circles are circles whose areas are drawn proportional to the quantities they represent. They are used as diagrams to illustrate population distribution and to show economic production and distribution.

#### Procedure

- Examine the series of figures given in the table.

- Choose a suitable scale.
- Work out the values given, by dividing the values by the scale to provide the diameter of the various circles.
- With the aid of a ruler (to measure the diameter) and a pair of compasses (to draw the circle), the various sizes of the circles in relation to the quantities produced are derived.

**Example:** Using the table below, determine the production of rice and represent such production by a proportional circle.

Rice production in Nigeria for the year 2000

State	Production in tonnes
Benue	200
Enugu	120
Sokoto	80
Benin	40

**Solution**

Choose a suitable scale: 1mm to 5 tons

Benue -  $\frac{200}{5} = 40\text{mm}$

Enugu -  $\frac{120}{5} = 24\text{mm}$

Sokoto -  $\frac{80}{5} = 16\text{mm}$

Benin -  $\frac{40}{5} = 8\text{mm}$

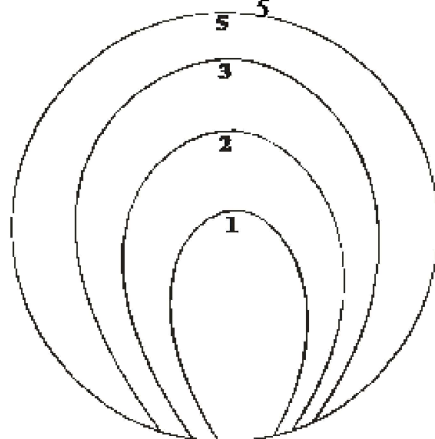


Fig. 12.10: Proportional circle showing rice production in Nigeria

### Summary

- Graphs are diagonal or drawings consisting of lines showing relationships between values of two quantities, variables or events.
- Types of graph include: bar graph, line graph, flow chart, pie chart, pictograph, etc.
- Proportional circles are important than dot map because it is easy to draw and there are no calculations.
- Line graph are lines used for data where emphasis is on continuous change.

### Revision Questions

#### Objective

1. \_\_\_\_\_ are diagonal or drawings consisting of lines showing relationship between values of two quantities, variables or events.
  - A. Statistical graph
  - B. Chart
  - C. Diagrams
  - D. Drawings
2. The following are types of graphs EXCEPT
  - A. Bar graph
  - B. Line graph
  - C. Histogram
  - D. Equation
3. \_\_\_\_\_ consists of a number of proportional bars of equal sizes and variable length.
  - A. Line graph
  - B. Bar graph
  - C. Variables
  - D. Chart
4. The graph used for data where emphasis is on continuous change is a
  - A. pie chart
  - B. bar chart

- C. line graph
- D. temperature

Use the table below to answer the following questions

Types of transport	Number using
Private motoring	1,560
Bus and train	840
Air plane	320

5. The sector angle for private motoring is
  - A.  $111^{\circ}$
  - B.  $43^{\circ}$
  - C.  $20^{\circ}$
  - D.  $206^{\circ}$
6. The sector angle for bus/train and air plane is
  - A.  $20^{\circ}$  and  $206^{\circ}$
  - B.  $111^{\circ}$  and  $13^{\circ}$
  - C.  $0^{\circ}$  and  $360^{\circ}$
  - D.  $111^{\circ}$  and  $206^{\circ}$
7. \_\_\_\_\_ are diagrams in the form of pictures which are used to present information to those who are unskilled.
  - A. Pictogram
  - B. Bars
  - C. Values
  - D. Lines
8. \_\_\_\_\_ involves the use of diagrams to present certain figures, information or data about a particular issue in form of densities.
  - A. Pictogram
  - B. Line graph
  - C. Choropleth map
  - D. Pie chart

Use the table below and answer questions 9 and 10.



Zones	Cultivated land (hectares)
1	8,201
2	12,114
3	20,004
4	36,120
5	14,100

Using a scale of 1 dot to 2000

9. What is the number of dots in zone 1?

- A. 6 dots
- B. 7 dots
- C. 4 dots
- D. 2 dots

10. What is the number of dots in zone 5?

- A. 4dots
- B. 10dots
- C. 6dots
- D. 2dots

### Essay

1. Use the table below and construct a simple bar graph.

State	Barrels of oil
Delta state	1.0
Edo state	7.0
Imo state	3.5
Rivers state	12.0
Bayelsa state	10.5

**Table 1:** Barrels of oil produced by different states

2. The table below shows the quantity of yams (in kg) produced by four yam producing states in Nigeria between 1995 and 1998.

State	1995	1996	1997	1998
A	300,000	400,000	500,000	600,000

B	500,000	500,000	600,000	700,000
C	600,000	700,000	800,000	800000
D	700,000	600,000	500,000	400,000

**Table II:** Quantity of yams in kilogrammes produced between 1995 and 1998.

Use the table to answer the following questions:

- Calculate the total quantity of yams produced in the four states during periods 1995 – 1998.
- Construct a pie chart to show the quantity of yams produced by each state in 1998.
- State two advantages of a pie chart. SSCE 2000

- The table below shows the direct premium income of non-life insurance businesses in Nigeria in a particular year. Use the data to answer the questions that follow:

Type	Value in Naira	Percentage Value
Fire	24,532,000	12.1
Accident	13,770,000	68
Motor	94,442,000	7?
Marine	49,536,000	24.5
Miscellaneous	20,040,000	?
Total	202,320,000	100

- Calculate the missing percentages for motor and miscellaneous premium incomes.
- Construct a percentage bar graph to illustrate the above statistics.
  - State two disadvantages of a percentage bar graph.
- Suggest an alternative method of representing the statistics. (SSCE 2004)

- Use the table below and answer the questions that follow:

Volume of rail passenger traffic in five Nigerian cities in 1973

Cities	Rail passenger traffic
Ibadan	5,000,000
Enugu	3,000,000
Maiduguri	2,500,000
Port harcourt	1,500,000
Minna	1,000,000

- (a) Represent the statistics with proportional circles.
- (b) Outline two advantages of representing data with proportional circle. (SSCE 2006)

5. The table below shows rainfall figures in Ibadan for months January to December.

Month	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall (Maxcm <sup>3</sup> )	26	30	35	40	55	55	60	50	35	30	20	15

- (a) Plot a line graph of rainfall distribution in the area.
- (b) What are the advantages of using graphs to geographers?