

Diagrammatic Presentation of Data

SESSION

3

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3.1 INTRODUCTION

In Lab Session 2, you have learnt the classification of qualitative data, formation of discrete and continuous frequency distributions to classify the raw data so that we can extract the maximum information from the data. In Unit 14 of MST-001 (Foundation in Mathematics and Statistics), you have learnt how to construct different types of bar diagrams (such as simple, multiple and sub-divided bar diagrams). You have also learnt about the pie diagram, which can be used to represent data in an attractive and easily understandable way.

You will agree with the saying that a picture is worth a thousand words. Diagrammatic representation of data conveys information better than numerical data and helps in understanding facts at a glance. Therefore, in this lab session, you will learn how to construct different types of bar diagrams and pie diagram using Excel 2007 for pictorial representation of data.

In the next lab session, we shall discuss graphical representation of data in the form of frequency distributions.

Objectives

After performing the activities of this session, you should be able to:

- prepare the spreadsheet in MS Excel 2007;
- construct simple, multiple and sub-divided bar diagrams;
- construct pie diagram; and
- format the bar and pie diagrams.

Prerequisite

- Lab Session 1 of MSTL-001 (Basic Statistics Lab).
- Unit 14 of MST-001 (Foundation in Mathematics and Statistics).

Some authors use the word “chart” instead of “diagram”. You may use whichever term you like.

3.2**PROBLEM DESCRIPTION**

In this lab session, we state three problems to illustrate different kinds of diagrams:

1. A survey was conducted among 100 consumers to ascertain which flavour of juice was preferred by them. The data are recorded in Table 1.

Table 1: Choice of consumers regarding flavour of juice

Flavour of Juice	Number of Consumers
Orange	25
Apple	15
Mixed Fruits	33
Litchi	18
Pineapple	9

Draw a bar diagram for the given data.

2. A survey was conducted among 100 consumers to find out which brand (A, B or C) was preferred by them for various flavours of juices. The data are recorded in Table 2.

Table 2: Choice of consumers regarding brand and flavour of juice

Flavour of Juice	No. of Consumers		
	A	B	C
Orange	25	17	28
Apple	15	13	8
Mixed Fruits	33	23	14
Litchi	18	22	14
Pineapple	9	5	6

Draw the multiple and sub-divided bar diagrams to compare the three brands of different flavours of juices.

3. Crops of cereals, pulses, vegetables, fruits, flowers and other plants are planted in two fields A and B of 1000 sq. ft. each but the area under each crop is different for both fields. The data for area under each crop for both fields are given in Table 3. Draw the percentage bar and pie diagrams to compare the cropping patterns of the fields.

Table 3: Area under crops

Crops	Area under Crop (in sq. ft.)	
	A	B
Cereals	235	95
Pulses	180	50
Vegetables	320	360
Fruits	150	250
Flowers	80	165
Others	35	80

3.3**SIMPLE BAR DIAGRAM**

You have learnt in Unit 14 of MST-001 that the simple bar diagram is the most commonly used diagram. We can represent the data based on only one variable using a bar diagram. The bars can be drawn either vertically or horizontally. We briefly mention the main steps as follows:

- Step 1:** We draw the horizontal (X) axis and the vertical (Y) axis.
- Step 2:** We take the categories of the variable on the X-axis and the magnitude of the data along the Y-axis if we draw the bars vertically.
- Step 3:** We draw the vertical bars of the same width and the height of the bars represents the magnitude of the corresponding category. These bars are separated from each other by equal intervals.

We take the magnitude of the data along the horizontal axis (X-axis) if we draw the bars horizontally.

Steps in Excel

You have learnt about the manual plotting of simple bar diagram in Unit 14 of MST-001. Here we explain how MS Excel 2007 is used to plot a simple bar diagram to represent the data given in Problem 1 as follows:

- Step 1:** We enter the data given in Table 1 in Excel 2007 spreadsheet as shown in Fig. 3.1.

	A	B	C
1	Flavour of Juice	No. of Consumers	
2	Orange	25	
3	Apple	15	
4	Mixed Fruits	33	
5	Litchi	18	
6	Pineapple	9	

Fig. 3.1: Partial screenshot of the spreadsheet for the given data.

- Step 2:** To obtain the bar chart, we

1. select Cells A2:B6 (see Fig. 3.2),
2. click on the **Insert** tab,
3. click on the **Column** option in the **Charts** group, and
4. select a chart subtype **Clustered Column** that we wish to use.

If the value of the variable is negative, the bar goes below the axis (other side of the axis).

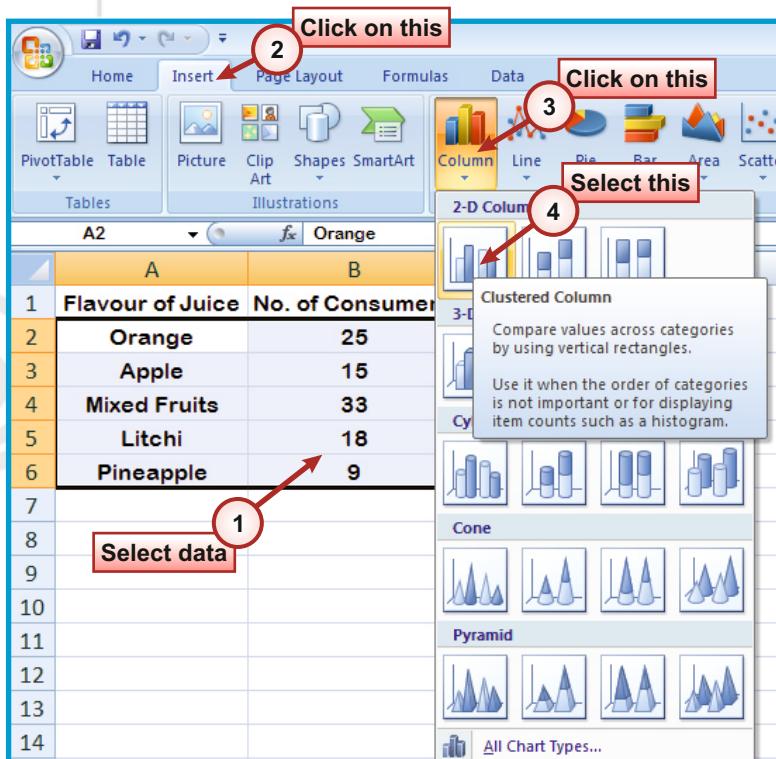


Fig. 3.2

Step 3: The resulting chart is shown in Fig. 3.3 and is called the bar chart. The five flavours given in Column A of Fig. 3.1 provide the five bars while the values in Column B present the height of each corresponding bar (Fig. 3.3).

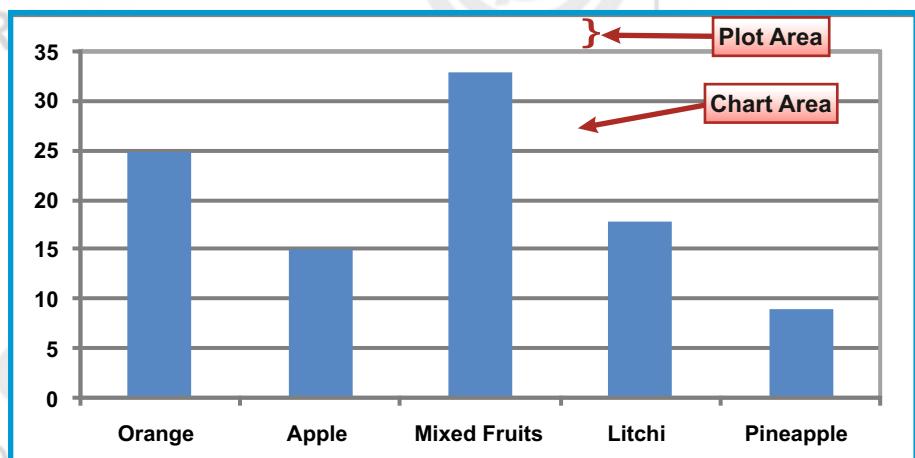


Fig. 3.3

Step 4: Fig. 3.3 shows the chart that we get by default using Excel. Using different features of Excel 2007 to format the chart, you can change the look of the chart. You may try to explore these features yourself to represent the chart in different and attractive ways. For example, you may like to

- ✓ eliminate the grid lines and the border around the chart,
- ✓ change the colour of the bars,
- ✓ change the background colour of the plot area and chart area,
- ✓ add the horizontal and vertical axis titles, etc., as desired.

We discuss some of these formats one at a time. Refer to Fig. 3.4.

To eliminate the gridlines, you should

1. click on the chart area shown in Fig. 3.4,
2. click on the **Layout** tab under **Chart Tools** (see Fig. 3.4), and
3. click on the **Gridlines** → **Primary Horizontal Gridlines** → **None** as shown in Fig. 3.4.

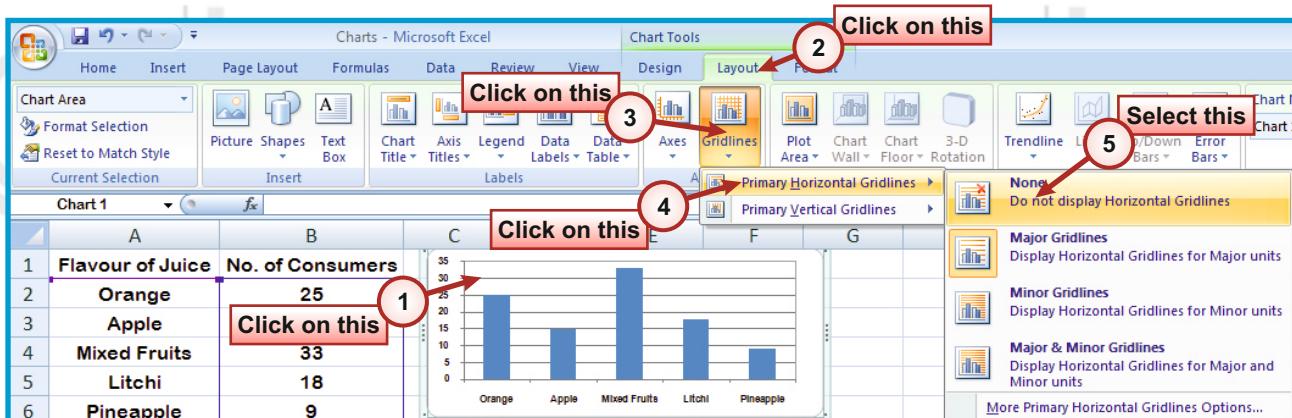


Fig. 3.4

Step 5: To change the colour of the bars, refer to Fig. 3.5. You should

1. click on the bars,

2. click on the **Format** tab under **Chart Tools**,
 3. click on the **Shape Fill**, and
 4. choose the colour you want. Here we have chosen the purple colour.
- For exploring more colours, you can also choose the option **More Fill Colors** (Fig. 3.5).

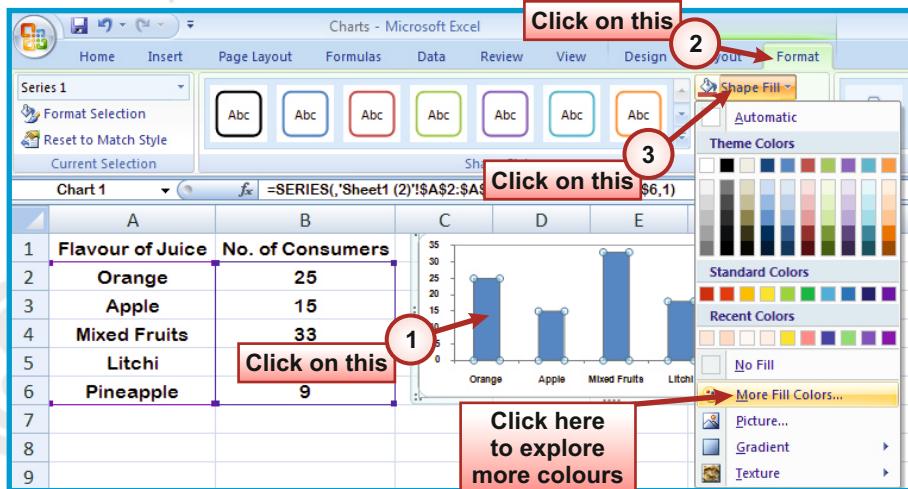


Fig. 3.5

Step 6: To change the colour of the plot area and the chart area, you should select the plot area and chart area of the chart one at a time and format them as explained in Step 5.

Step 7: To eliminate the border around the chart, refer to Fig. 3.6. You should

1. click on the chart,
2. click on the **Format** tab under **Chart Tools**,
3. click on the **Shape Outline**, and
4. choose **No Outline** option.

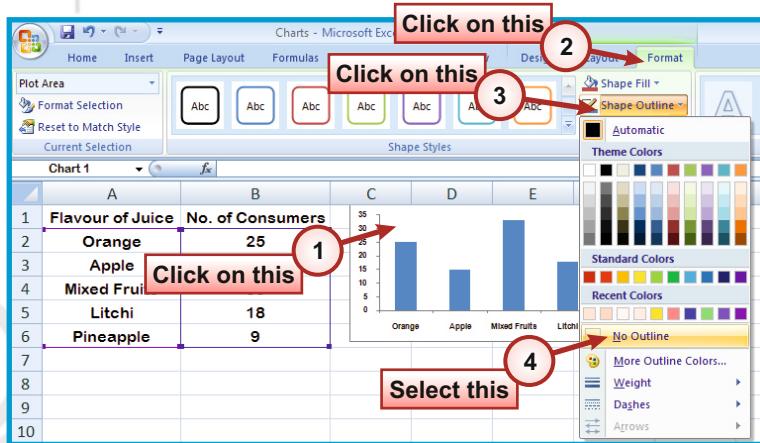


Fig. 3.6

Step 8: To add the horizontal axis title, you should

1. click on the chart,
2. click on the **Layout** tab under **Chart Tools** as shown in Fig. 3.7, and
3. click on the **Axis Titles** → **Primary Horizontal Axis Title** → **Title Below Axis**. You can type “Flavour of Juice” as the title of the horizontal axis or some other title of your choice.

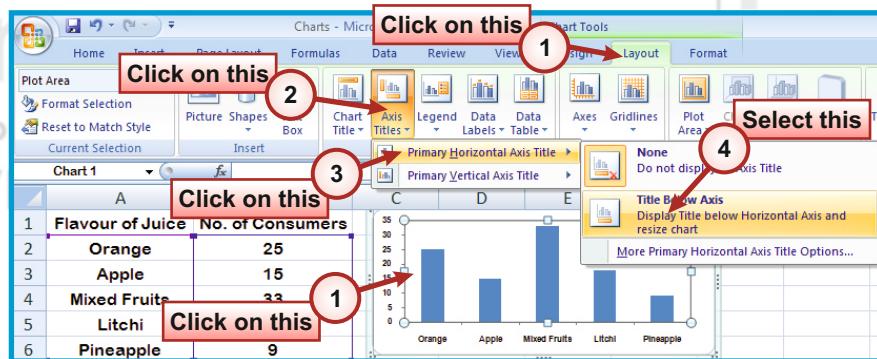


Fig. 3.7

Step 9: To add the vertical axis title, you should

1. click on the chart,
2. click on the **Layout** tab under **Chart Tools** (Fig. 3.8), and
3. click on the **Axis Titles** → **Primary Vertical Axis Title** → **Rotated Title**. You can type “Number of Consumers” as the title of the vertical axis or some other title of your choice.

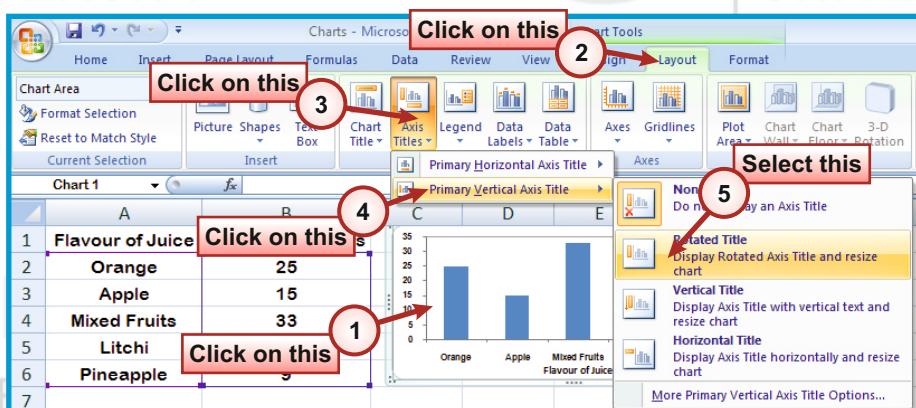


Fig. 3.8

Step 10: There are many other options in Excel 2007, which you may like to explore. If we format the chart as described in Steps 4 to 9, we get the simple bar diagram shown in Fig. 3.9.

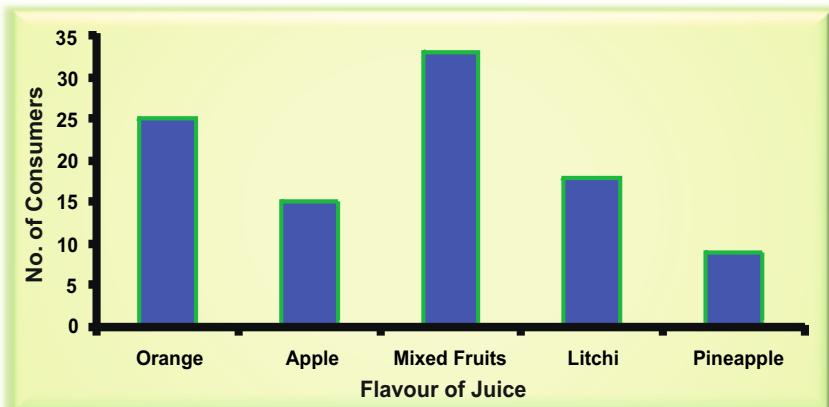


Fig. 3.9: Simple bar diagram

Step 11: Excel 2007 also provides the bar diagram in the 3D format. To obtain the 3D bar diagram, refer to Fig. 3.10. You should

1. select the data given in Cells A2:B6,
2. click on the **Insert** tab,
3. click on the **Column** option in the **Charts** group, and
4. select a chart subtype **3-D Clustered Column**.

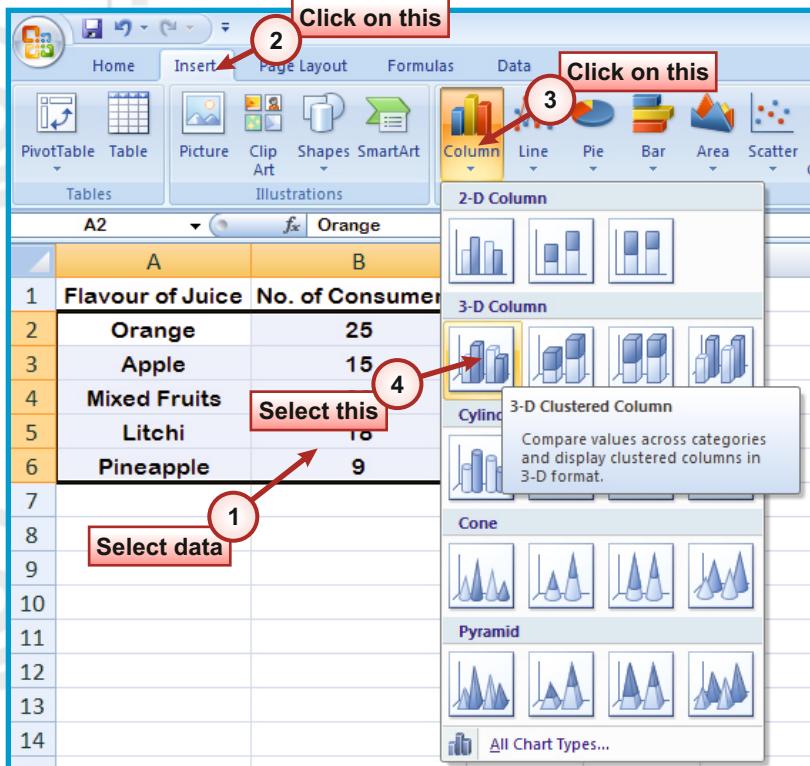


Fig. 3.10

Step 12: If we format the 3D simple bar diagram as explained in Steps 4 to 9, we get the pictorial representation shown in Fig. 3.11.

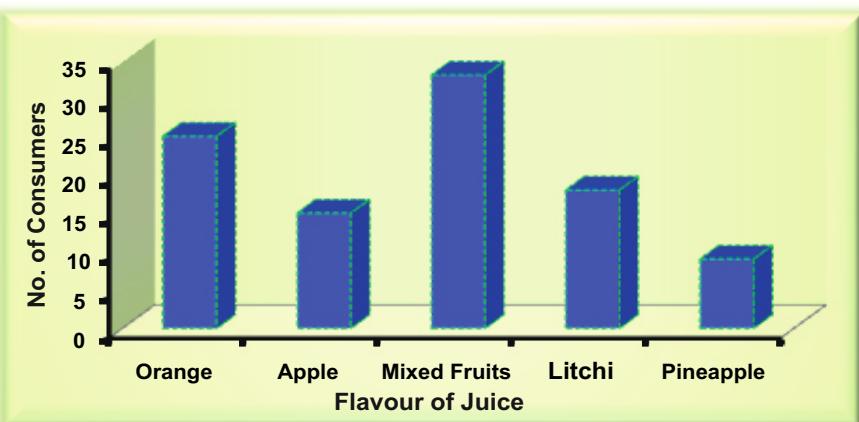


Fig. 3.11

3.4 MULTIPLE BAR DIAGRAM

You have learnt in Unit 14 of MST-001 that we use the multiple bar diagram to compare two or more interrelated variables and also the magnitudes of the variables in two or more aspects or categories. The method of plotting the multiple bar diagram is the same as the one for a simple bar diagram. Here we have separate adjacent bars to represent the categories of each variable. We briefly mention the main steps as follows:

- Step 1:** We draw the horizontal (X) and the vertical (Y) axes.
- Step 2:** We take the categories of the variables on the X-axis and the range of the data on the Y-axis.
- Step 3:** For each category of all variables, we draw vertical bars corresponding to their data ranges. In multiple bar diagram, the bars

corresponding the same category of the variables are placed adjacent to each other.

Step 4: We use different colours, patterns, etc., to distinguish the bars representing different variables.

Steps in Excel

In Problem 2, we have three brands of juice (A, B and C) and each brand has five categories of flavours. Therefore, we can represent the data of Table 2 to compare three brands of juice using a multiple bar diagram. You have learnt about the manual plotting of multiple bar diagram in Unit 14 of MST-001.

We now describe the procedure of plotting the multiple bar diagram using MS Excel 2007.

Step 1: We enter the data given in Table 2 in Excel 2007 spreadsheet as shown in Fig. 3.12.

	A	B	C	D	E
1	No. of Consumers				
2	Flavour of Juice	A	B	C	
3	Orange	25	17	28	
4	Apple	15	13	8	
5	Mixed Fruits	33	23	14	
6	Litchi	18	22	14	
7	Pineapple	9	5	6	
8					

Fig. 3.12: Screenshot of the spreadsheet for the given data.

Step 2: The steps used to obtain the multiple bar diagram are shown in Fig. 3.13. We

1. select the data given in Cells A2:D7,
2. click on the **Insert** tab,
3. click on the **Column** option in the **Charts** group, and
4. select a chart subtype **3-D Clustered Column** that we wish to use.

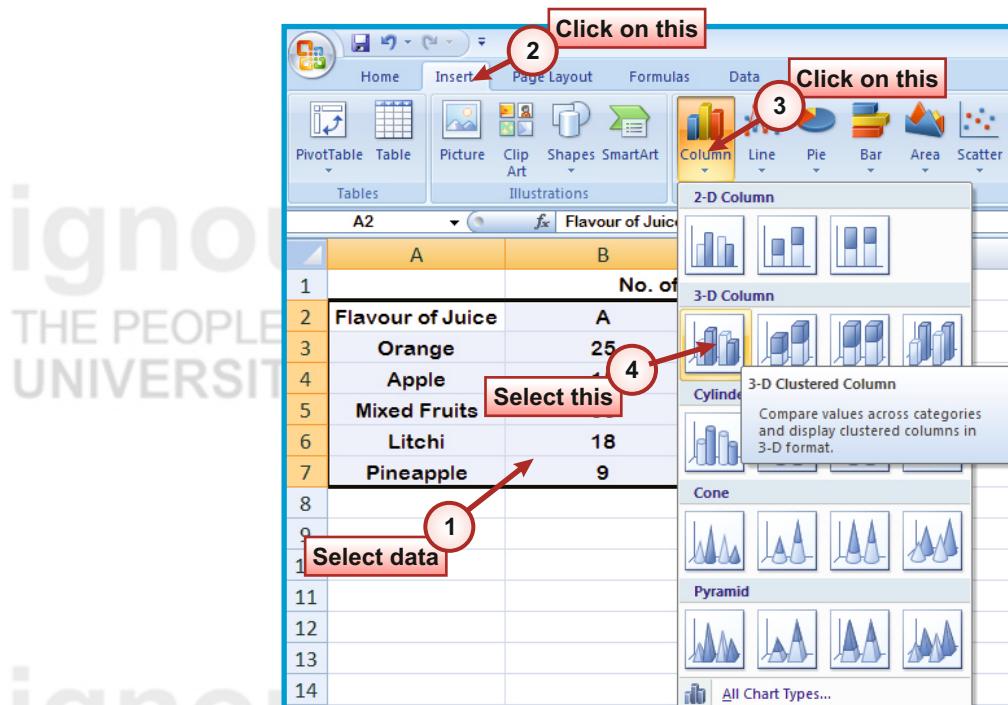


Fig. 3.13

Step 3: We format the chart as explained in Steps 4 to 9 of Sec. 3.3 and obtain the multiple bar diagram shown in Fig. 3.14.

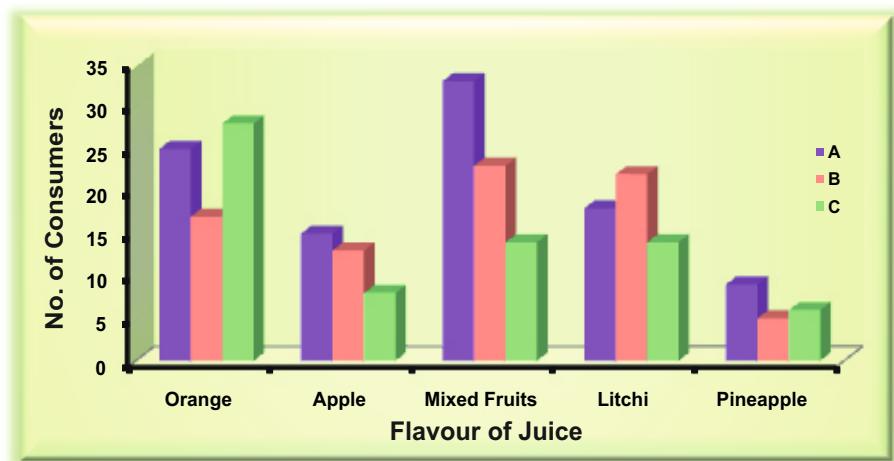


Fig. 3.14: Multiple bar diagram.

3.5 SUB-DIVIDED BAR DIAGRAM

You have learnt in Unit 14 of MST-001 that the sub-divided bar diagram is another way of representing and comparing two or more variables as well as the breakup of one variable into several components. It is also known as **component bar diagram**. We briefly mention the main steps as follows:

- Step 1:** We draw the horizontal (X) and the vertical (Y) axes.
- Step 2:** We take the categories of the variables on the X-axis and the range of the data on the Y-axis.
- Step 3:** We draw the vertical bars for each category of variables. In the sub-divided bar diagram, the height of each bar represents the total magnitude or value of the variable.
- Step 4:** We divide each bar in several parts or components according to the share of each component of the variable.
- Step 5:** We use different colours, patterns, etc., to distinguish each part of the bar representing different components of the variable.

Steps in Excel

In Problem 2, we have three brands of juice (A, B and C) and each brand has five categories of flavours. We can also represent the data of Table 2 to compare the breakup of each flavour into three brands using a sub-divided bar diagram. You have learnt about the manual plotting of sub-divided bar diagram in Unit 14 of MST-001. Here we describe the procedure of plotting the sub-divided bar diagram in MS Excel 2007:

- Step 1:** The steps used to obtain the sub-divided bar diagram are shown in Fig. 3.15. We
 1. select the data given in Cells A2:D7 (Fig. 3.15),
 2. click on the **Insert** tab,
 3. click on the **Column** option in the **Charts** group, and
 4. select a chart subtype **Stacked Column in 3-D** that we wish to use.

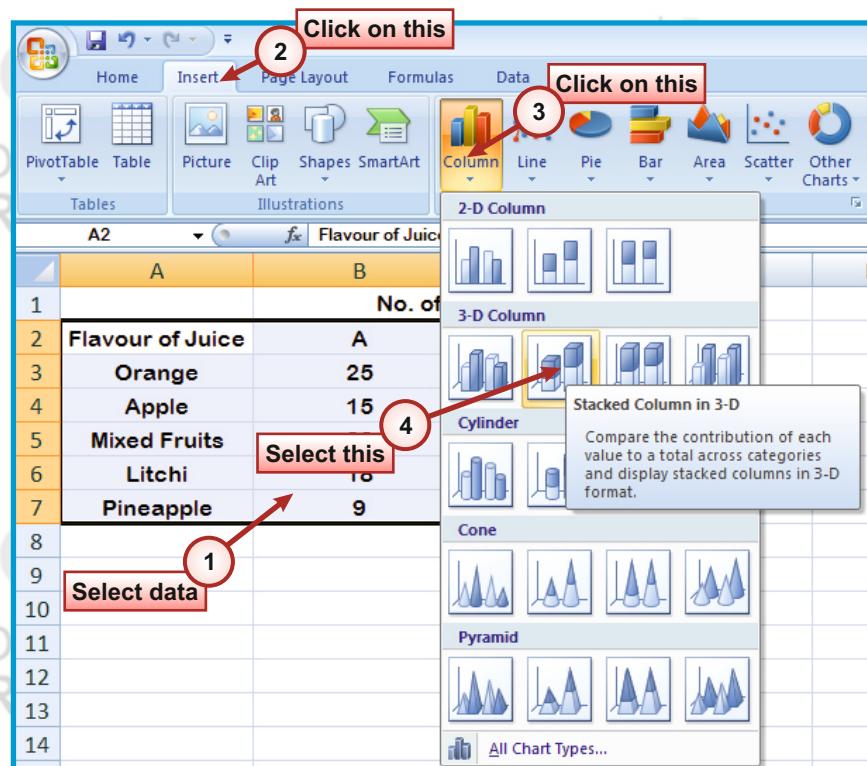


Fig. 3.15

Step 2: We format the chart as explained in Steps 4 to 9 of Sec. 3.3. The resulting sub-divided bar diagram is shown in Fig. 3.16.

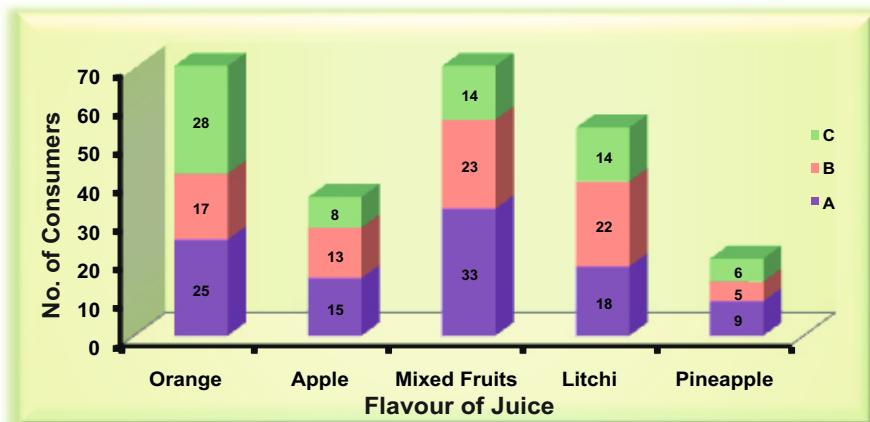


Fig. 3.16: Sub-divided bar diagram.

3.6 PERCENTAGE BAR DIAGRAM

You have learnt in Unit 14 of MST-001 that the percentage bar diagram is similar to the sub-divided bar diagram. The main difference between these two diagrams is that in percentage bar diagram, we transform the given magnitude or value of each component of the variable into percentages of the total magnitude of that variable instead of considering only magnitude. We divide these bars in terms of percentages of the components. We briefly mention the main steps as under:

- Step 1:** We draw the horizontal (X) and the vertical (Y) axes.
- Step 2:** We take the categories of the variables on the X-axis. We consider percentage (0% to 100%) as labels on the vertical (Y) axis.
- Step 3:** In percentage bar diagram, we draw vertical bars of equal heights, which represent the total 100%.

- Step 4:** We divide each bar into several parts or components, which are transformed into percentages of the total according to the share of each component of the variable.
- Step 5:** We use different colours, patterns, etc., to distinguish each part of the bar representing different components of the variable.

Steps in Excel

In Problem 3, we have two fields (A and B) and each field has 6 categories of crops. We can represent the data of Table 3 to compare the breakup of each crop into two fields using a percentage bar diagram. You have learnt about the manual plotting of percentage bar diagram in Unit 14 of MST-001. Here we describe the procedure of plotting the percentage bar diagram using MS Excel 2007:

- Step 1:** We enter the data given in Table 3 in MS Excel 2007 spreadsheet as shown in Fig. 3.17.

	A	B	C	D
1	Area under Crop (in Sq ft)			
2	Crop	A	B	
3	Cereals	235	95	
4	Pulses	180	50	
5	Vegetables	320	360	
6	Fruits	150	250	
7	Flowers	80	165	
8	Others	35	80	

Fig. 3.17: Screenshot of the spreadsheet for the given data.

- Step 2:** The steps used to obtain the percentage bar diagram are shown in Fig. 3.18. We

1. select the data given in Cells A2:C8,
2. click on the **Insert** tab,
3. click on the **Column** option in the **Charts** group, and
4. select a chart subtype **100% Stacked Column in 3-D** that we wish to use.

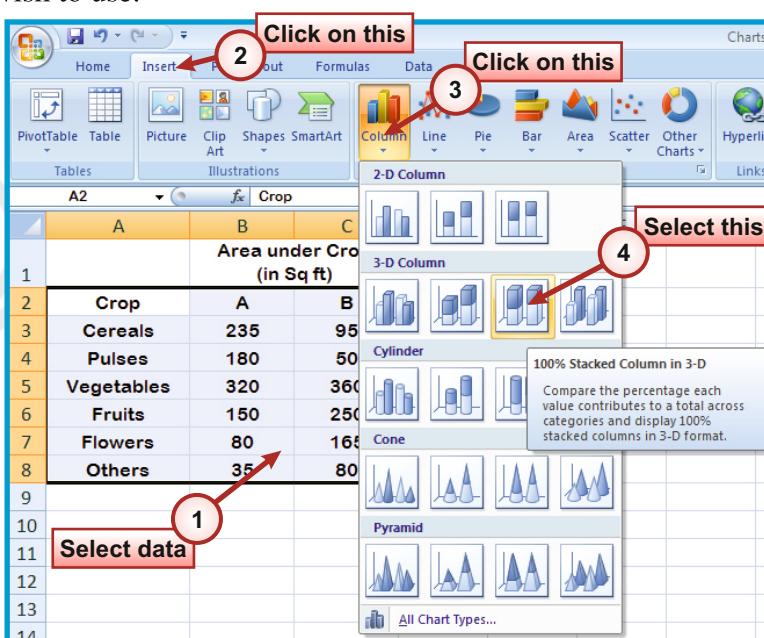


Fig. 3.18

Step 3: We get the percentage bar diagram shown in Fig. 3.19 in which each bar with colours blue and red shows the fields A and B, respectively, corresponding to different types of crops.

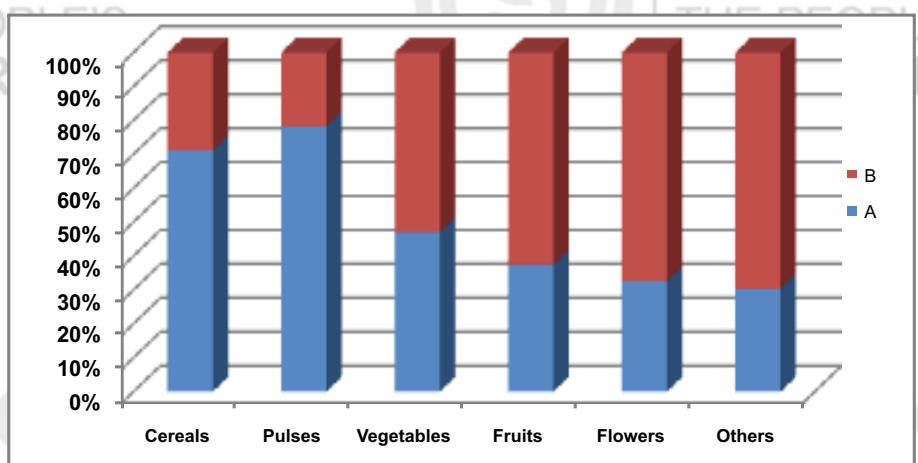


Fig. 3.19

Step 4: Since we wish to compare the area under different crops in the fields A with B, each bar should represent the percentage of area under each crop in fields A and B. If we wish to show the fields along the X-axis instead of the crops, we follow the steps shown in Fig. 3.20 and

1. click on the chart shown in Fig. 3.19,
2. click on the **Design** tab under the **Chart Tools**, and
3. select the **Switch Row/Column** option.

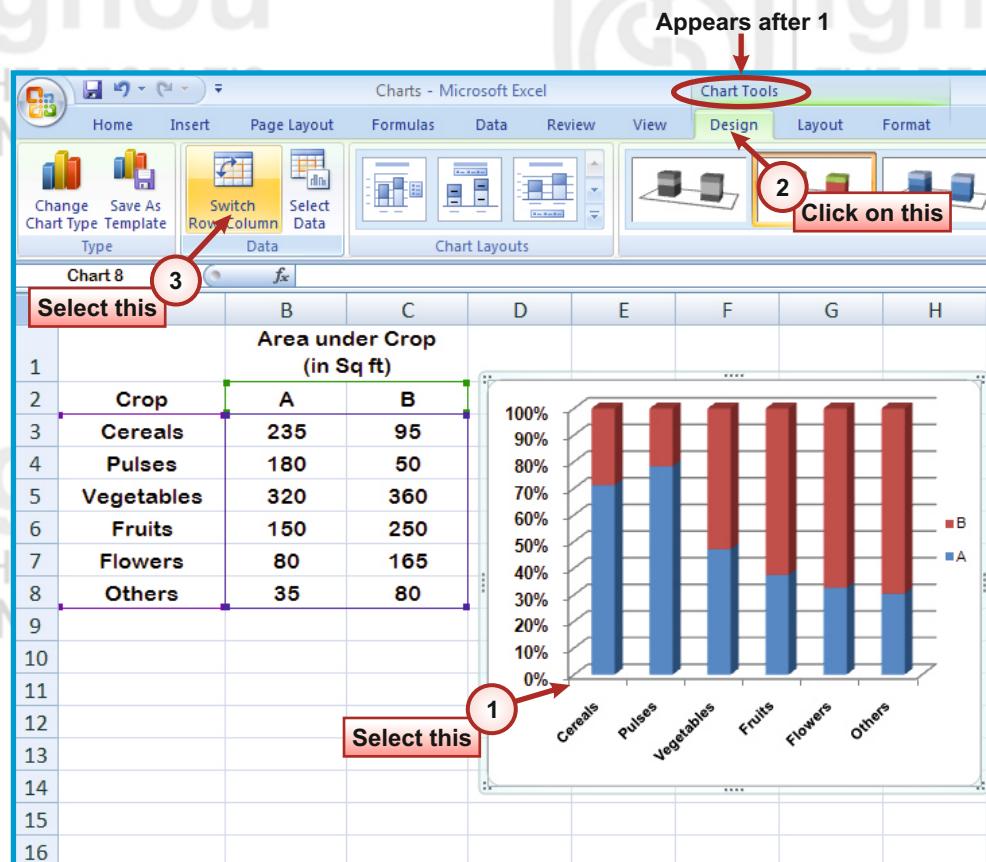


Fig. 3.20

Step 5: After switching the rows and columns, we get the percentage bar chart shown in Fig. 3.21.

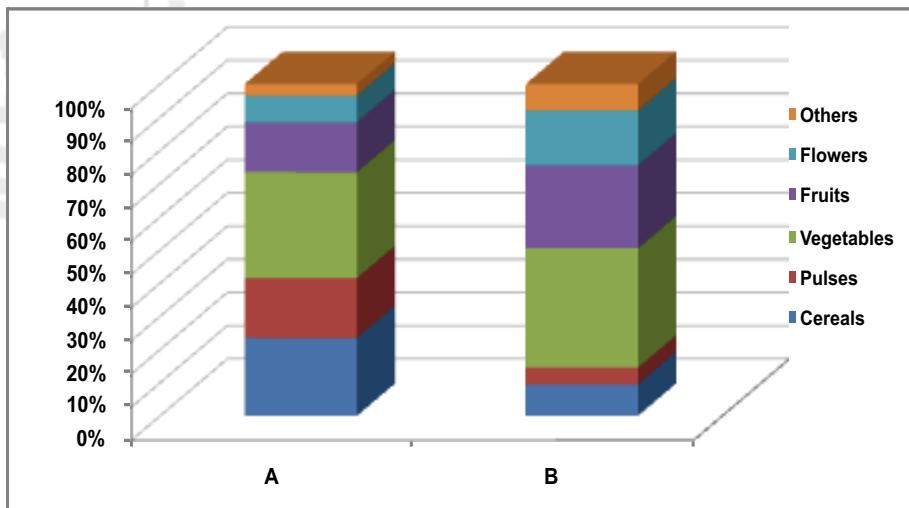


Fig. 3.21

Step 6: We format the chart as explained in Steps 4 to 9 of Sec. 3.3. The resulting percentage bar chart is shown in Fig. 3.22.

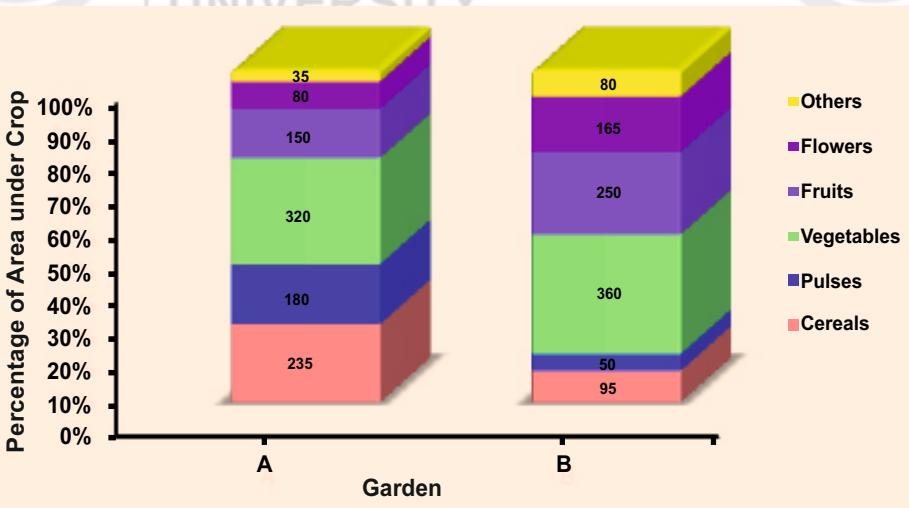


Fig. 3.22: Percentage bar diagram.

3.7 PIE DIAGRAM

You have learnt in Unit 14 of MST-001 that the pie diagram is the most popular diagram used to represent the breakdown of an aggregate into its components or sub-divisions. A pie diagram shows the components in terms of percentages and the area of each sector is proportional to the angles subtended at the centre of the circle. We briefly mention the main steps as follows:

- Step 1:** In the pie diagram, we convert each component in terms of degrees in a circle considering aggregate angle as 360° .
- Step 2:** We draw a circle and divide it into various sectors with areas equal to the corresponding components.
- Step 3:** We use different colours, patterns, etc., to distinguish each sector of the circle representing different components of the variable.

Steps in Excel

In Problem 3, we have two fields (A and B) and each field has 6 categories of the crops. We can also represent the data of Table 3 to compare the breakup of

each crop in the two fields using a pie diagram. You have learnt about the manual plotting of pie chart in Unit 14 of MST-001. Here we describe the procedure of plotting the pie diagram using MS Excel 2007 for Problem 3.

Step 1: We need to plot separate pie diagram for the fields A and B in Excel 2007. To obtain the pie diagram for A, we follow the steps shown in Fig. 3.23 and

1. select the data given in Cells A2:B8,
2. click on the **Insert** tab,
3. click on the **Pie** option in the **Charts** group, and
4. select a chart subtype **Pie in 3-D** that we wish to use.

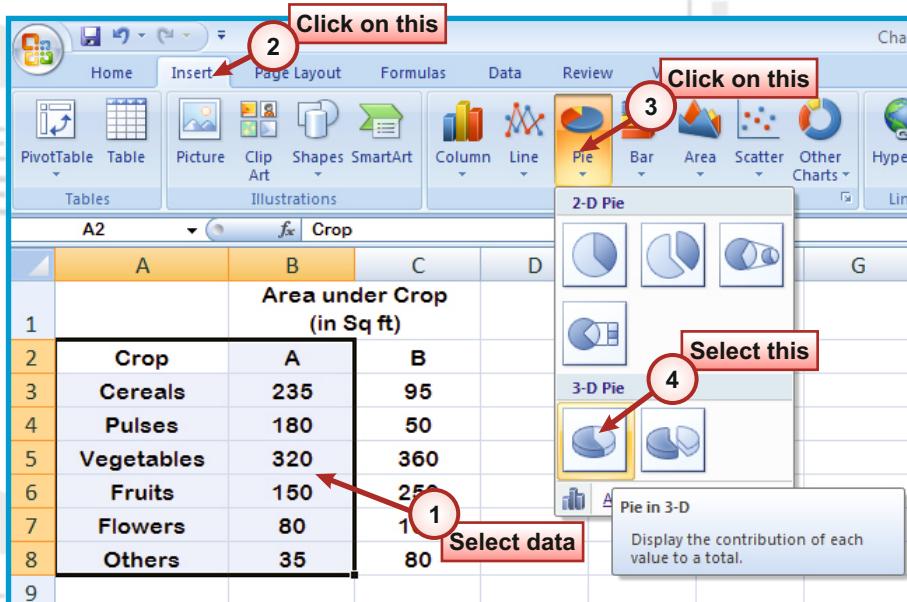


Fig. 3.23

Step 2: We format the chart as explained in Steps 4 to 7 of Sec. 3.3. The resulting pie diagram is shown in Fig. 3.24.

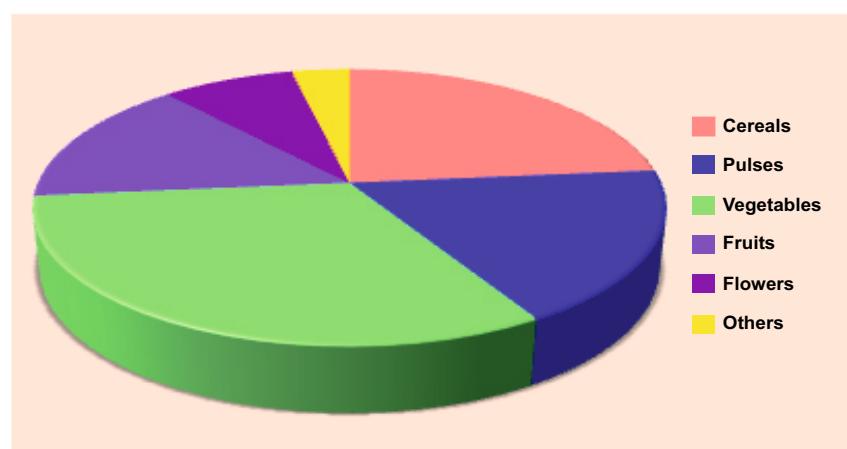


Fig. 3.24

Step 3: We can also add the corresponding values and percentages on each sectors of the pie diagram. For this, we

1. click on the chart shown in Fig. 3.24,
2. click on the **Layout** tab under the **Chart Tools**, and
3. choose the **More Data Label Options** under the **Data Labels** as shown in Fig. 3.25.

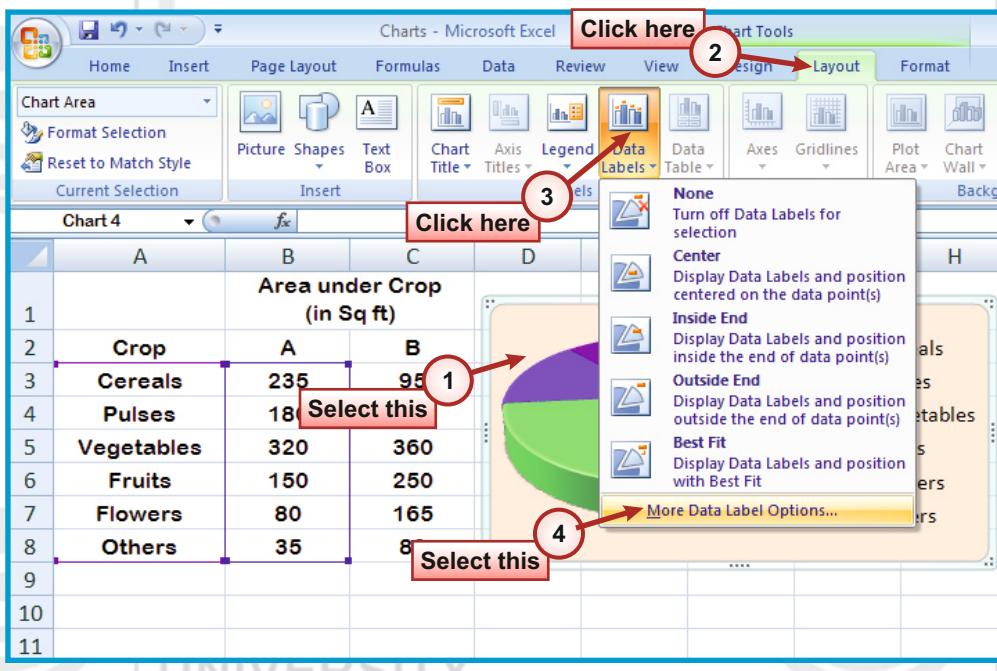


Fig. 3.25

Step 4: The dialog box shown in Fig. 3.26a will appear after Step 3.

In the dialog box, we

1. tick on the **Value**, **Percentage** and **Show Leader Lines** options under **Label Contains**,
2. tick on **Outside End** under **Label Position**, and
3. click on **Close**. These steps are shown in Fig 3.26b.

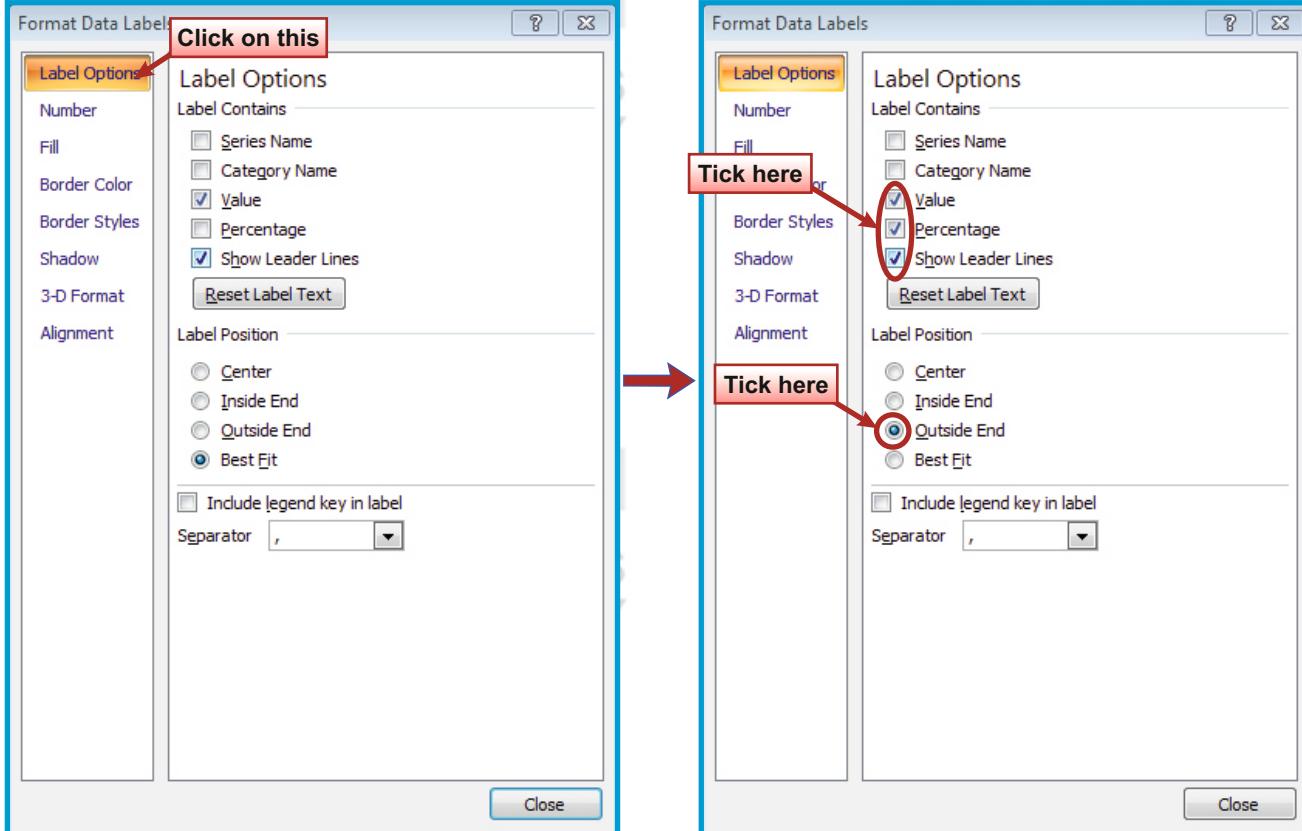


Fig. 3.26

Step 5: When we click on **Close** in Step 4, we get the pie diagram with data labels as shown in Fig. 3.27.

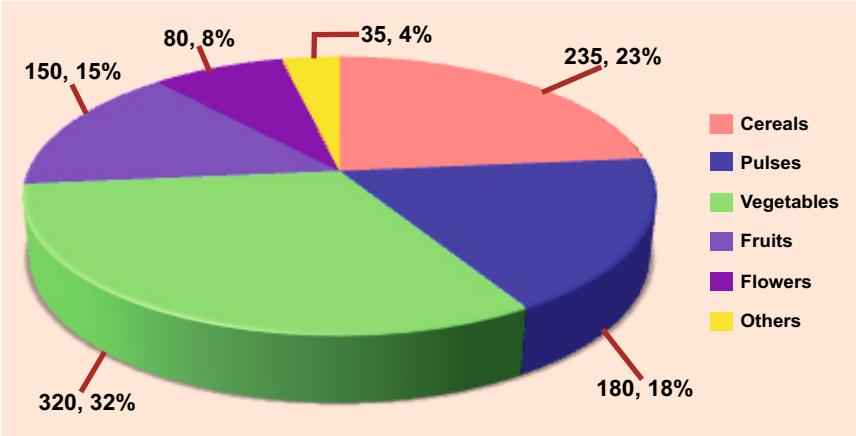


Fig. 3.27

Step 6: To obtain the pie diagram for field B, we follow the steps shown in Fig. 3.28 and

1. select the data given in Cells A2:A8 and C2:C8 by holding ***Ctrl*** key,
2. click on the **Insert** tab,
3. click on the option **Pie** in the **Charts** group, and
4. select a chart subtype **Pie in 3-D** that we wish to use.

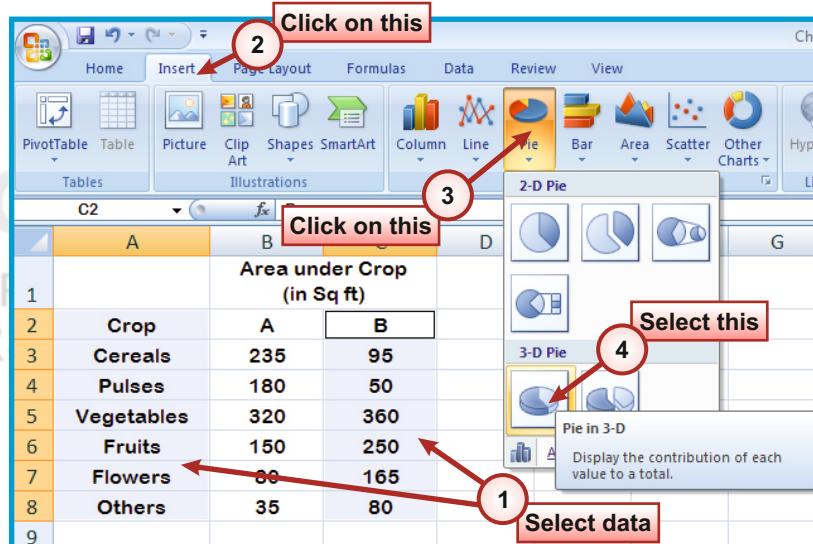


Fig. 3.28

Step 7: We format the chart as explained in Steps 4 to 7 of Sec. 3.3 and add the labels as explained in Steps 3 and 4 in this section. The resulting pie diagram is shown in Fig. 3.29.

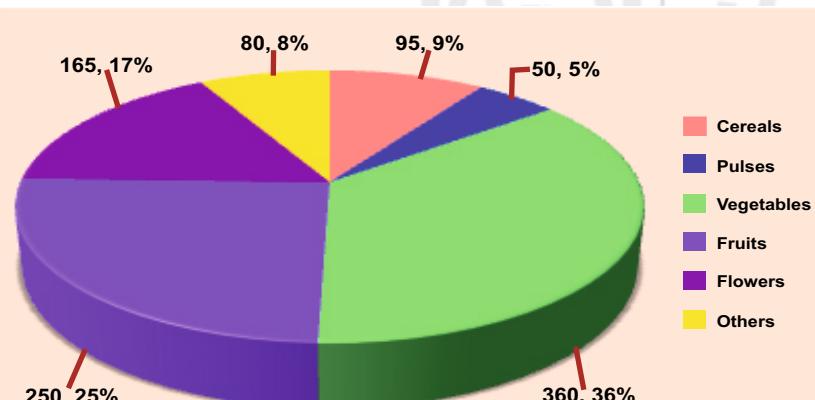


Fig. 3.29

You should now apply these methods to other problems for practice.



Activity

Construct suitable diagrams with the help of MS Excel 2007 and interpret the results for

- A1)** Examples 1, 2, 3, 4 and 10 given in Unit 14 of MST-001.
- A2)** Exercises E1 to E5, E9 and E10 given in Unit 14 of MST-001.

Match the results with the manual plotting of the charts done in Unit 14 of MST-001.



Continuous Assessment 3

1. A survey was conducted on 100 families for their preference of cooking oil. The data collected in the survey are recorded in Table 4.

Table 4: Preferences of families for cooking oils

Cooking Oil	Number of Families
Sunflower	19
Soybean	15
Cottonseed	18
Olive	11
Mustard	18
Ghee	12
Others	7

Draw a bar diagram for the given data.

2. The cooking oil preferences of 100 families in three regions I, II and III are recorded in Table 5.

Table 5: Preferences of families for cooking oils in three regions

Cooking Oil	Number of Families		
	I	II	III
Sunflower	19	17	28
Soybean	15	13	10
Cottonseed	18	15	16
Olive	11	14	14
Mustard	18	5	8
Ghee	12	13	10
Others	7	23	14

Draw the multiple and sub-divided bar diagrams to compare the cooking oil preferences of families in the three regions.

3. The average amount of time that Mr. A and Mr. B spend each day on various activities is recorded in Table 6. What is the percentage of the pie chart representing the time Mr. A spends playing sport and Mr. B spends on social media?

Table 6: Amount of time spent each day

Work	Mr. A	Mr. B
Office	8	10
Eating	2	1
Sports	1	0
Social Media	3	5
Sleeping	8	7
Others	2	1

Draw the percentage bar diagram and pie diagram to compare their work patterns.



Home Work: Do It Yourself

- 1) Follow the steps explained in Secs. 3.3 to, 3.7 to present the data of Tables 1, 2 and 3 diagrammatically. Use a different format for the charts. Take the final screenshots and keep them in your record book.
- 2) Develop the spreadsheets for the exercises of “Continuous Assessment 3” as explained in this lab session. Take screenshots of the final spreadsheets.
- 3) **Do not forget** to keep all screenshots in your record book as these will contribute to your continuous assessment in the Laboratory.