## Learning Outcome

By the end of this lecture, you will be able to:

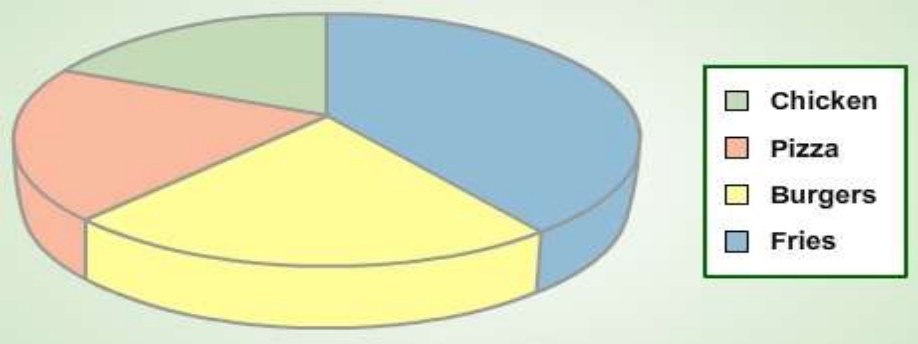
- Describe graphical tools used in descriptive statistics, such as:
  - Bar char
  - Pie chart
  - Stem and leaf plot
  - Line chart
  - Scatter plot

## Introduction

Given here is a table that shows number of orders of each item on a menu.

| Menu | Number of orders |
|---|---|
| Fries | 40 |
| Burgers | 25 |
| Pizza | 20 |
| Chicken | 15 |

The same table can be represented in a graphical method that is very easy to interpret.

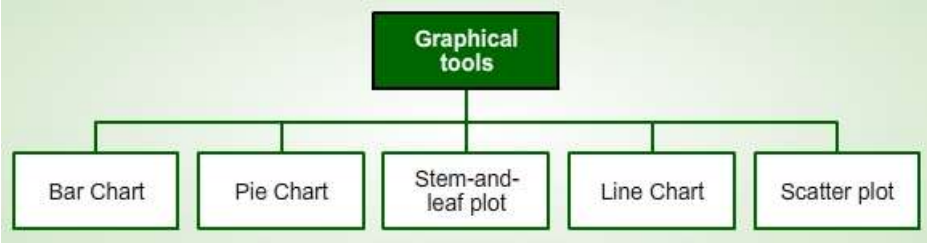



Pie chart

In this lecture, you will learn to describe graphical tools used in descriptive statistics such as bar charts, pie charts, stem and leaf plots, line charts and scatter plots.

## Descriptive Statistics

Some of the graphical tools used in descriptive statistics are:




Graphical tools used in descriptive statistics

We will now look at these graphical tools one after the other.

## Summary Table

A summary table indicates the frequency, amount, or percentage of items in a set of categories so that you can see the differences between categories. It lists the categories in one column and the frequency, amount or percentage in a different column.

**Example:**

**Summary Table**

The summary table shows number of orders of each item on a menu. It also shows percentage of orders along with cumulative frequency.

| Menu | Number of orders | Orders % | Cumulative % |
|---|---|---|---|
| Rice | 10 | 8.33% | 8.33% |
| Chicken | 20 | 16.67% | 25.00% |
| Chicken and rice | 40 | 33.33% | 58.33% |
| Fries | 50 | 41.67% | 100.00% |
| **Total** | **120** | **100.00%** | |

## Bar Chart

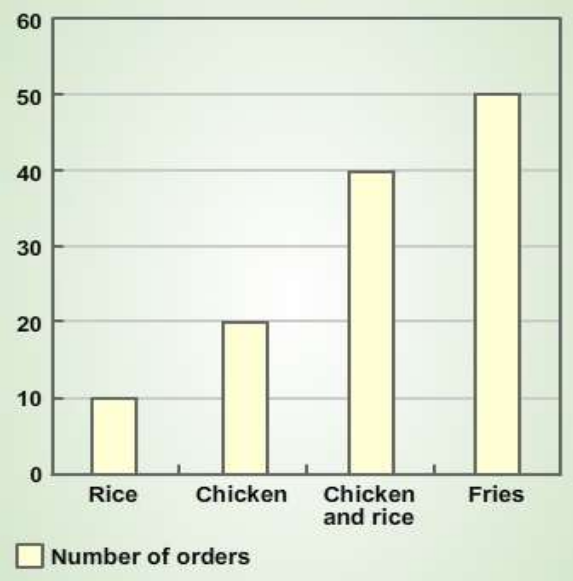
A bar chart is used mainly, for qualitative data (Nominal and Ordinal Data). The height of each bar (rectangle) is the frequency or the percentage (i.e. relative frequency in percentage) for each category.

A bar chart may be horizontal or vertical. It allows you to compare different categories.

**Example:**

## Bar Chart

Here is the bar chart created based on the summary table presented in the previous example. The bar chart shows bars for each item of menu. The height of the bar indicates number of orders.




Number of orders

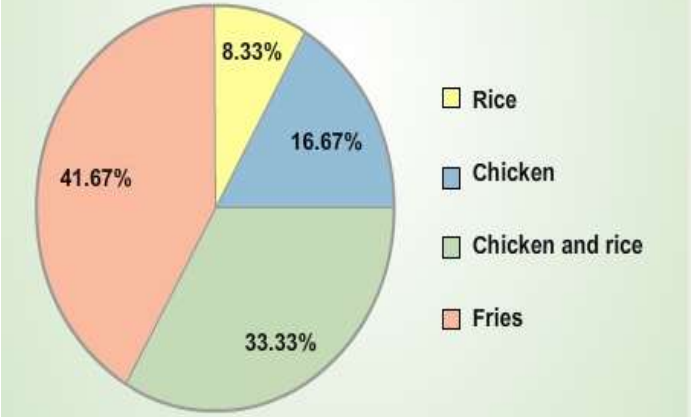
**Pie Chart**

The pie chart is a circle, subdivided into a number of slices that represent the various categories. The size of each slice is proportional to the percentage of the category it represents. A pie chart is used, mainly, for qualitative data (nominal and ordinal data).

**Example:**

The summary table shows number of orders of each item on a menu. The pie chart is created for order percentages.

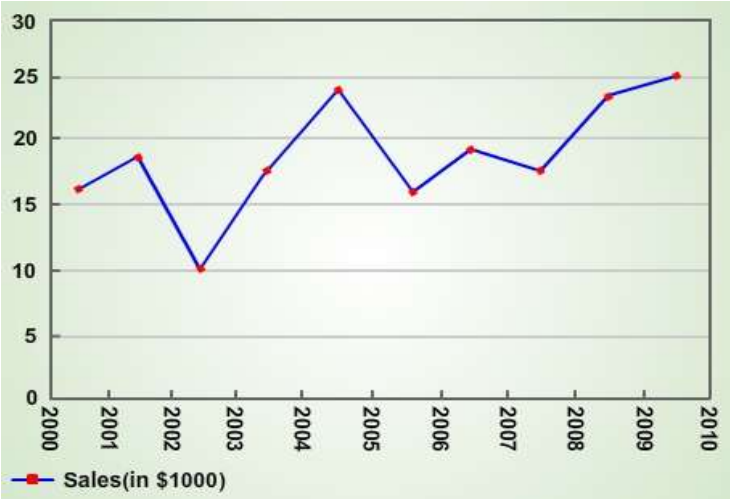
| Menu | Number of orders | Orders % | Cumulative % |
|---|---|---|---|
| Rice | 10 | 8.33% | 8.33% |
| Chicken | 20 | 16.67% | 25.00% |
| Chicken and rice | 40 | 33.33% | 58.33% |
| Fries | 50 | 41.67% | 100.00% |
| Total | 120 | 100.00% | |




Pie chart

**Line Chart**

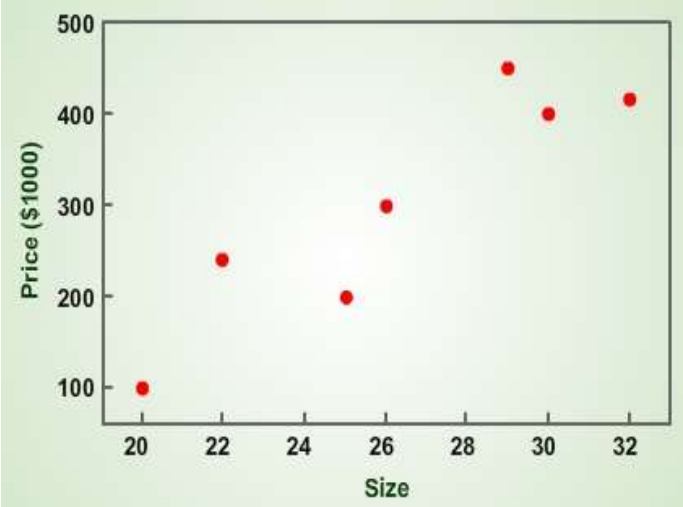
A line chart shows the values of the variable on the y-axis while the x-axis represents time. Given here is an example of a line chart. The chart shows annual sales from 2000 to 2009.




Sales chart

**Scatter Plot**

Another commonly used graphical tool is the scatter plot. A scatter plot is used to examine the relationship between two variables. One variable is measured on the Y-axis and the other on the X-axis.

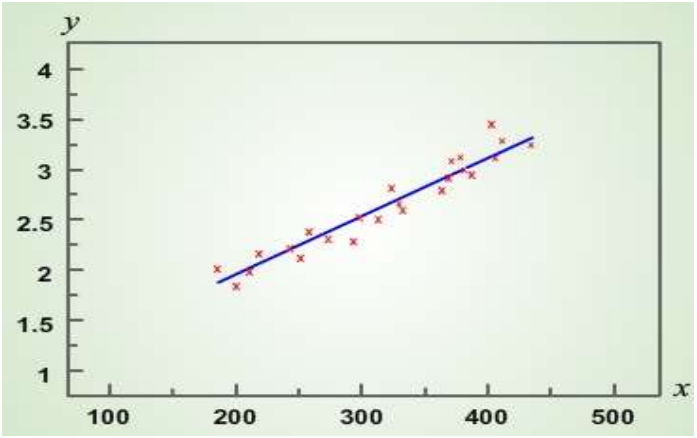



Scatterplot of price ($1000) vs size

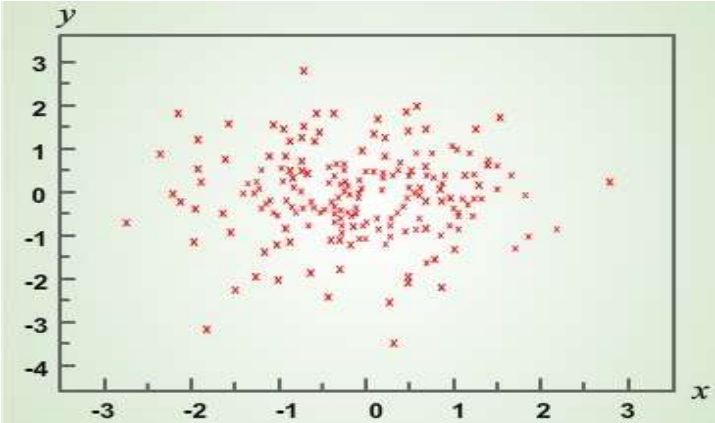
In this example, the y-axis represents the price of the house, while the x-axis represents the size of the house. The greater the house size, the greater price. There is a positive linear relationship between the two variables. From the plot, we can see that the bigger is the house the more expensive it is.

Here are Scatter Plots for different types of relations ships.

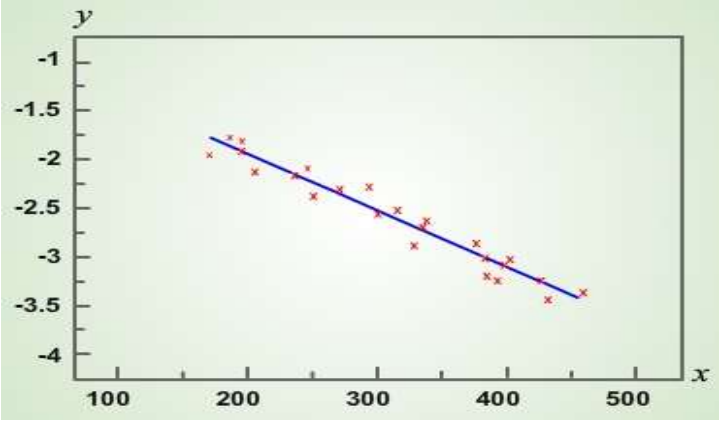
- Positive linear relationship:



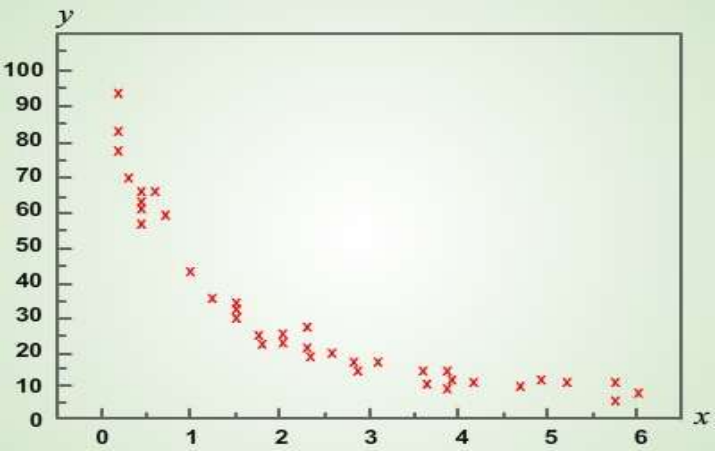
- No relationship:



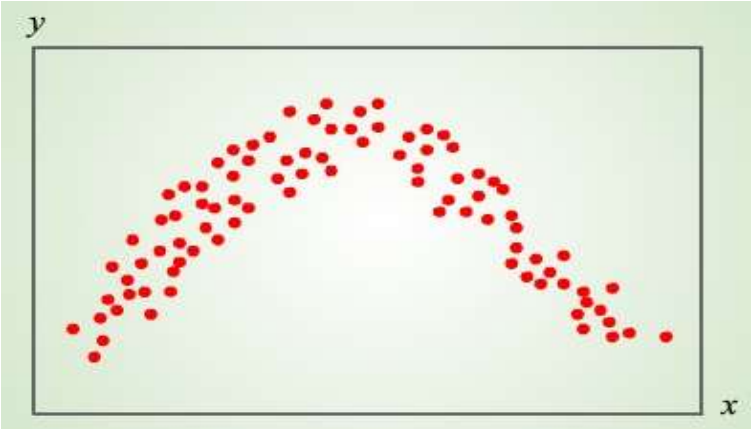

- Negative linear relationship:




- Negative nonlinear relationship:



- Nonlinear relationship




**Stem-and-Leaf Display**

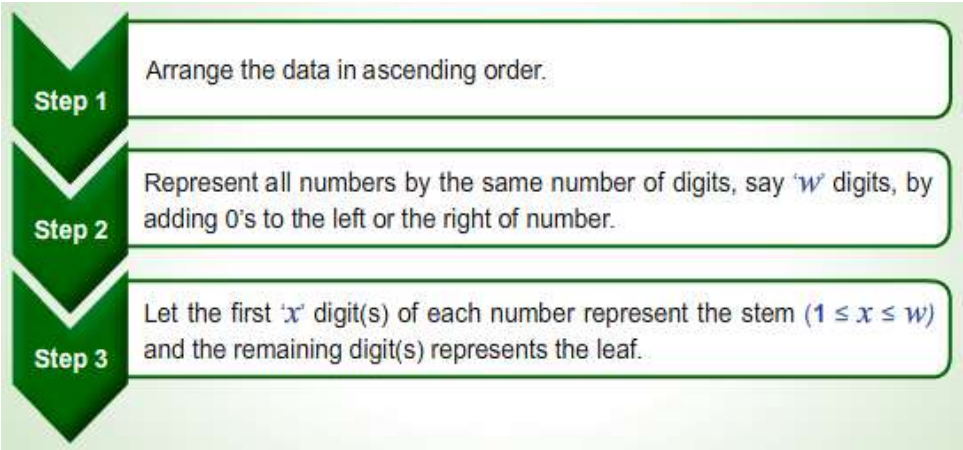
A stem-and-leaf display allows arranging the observations in each category.

This method is useful to examine:

- Overall pattern of data
- Amount of data in each category
- Variation from class to class
- Distribution of data within the class

**Steps to Draw a Stem-and-Leaf Diagram**

Let's now explore how to draw stem-and-leaf diagram. Here are steps to draw a stem-and-leaf diagram.




Steps to draw a stem-and-leaf diagram

**Example**

Draw the stem-and leaf diagram for the given data:

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 10 | 9 | 20 | 5 | 8 | 5 | 6 | 9 | 9 | 14 | 10 | 16 | 9 | 14 | 7 | 11 | 15 | 14 | 15 | 13 |

*Solution*:

Arrange the data from Minimum to Maximum and unify number of digits (maximum number of digits in data is w=2):

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 05 | 05 | 06 | 07 | 08 | 09 | 09 | 09 | 09 | 10 | 10 | 11 | 13 | 14 | 14 | 14 | 14 | 15 | 15 | 16 | 20 |

Consider the first digit as stem (we have 3 stems) and the second digit the leaf then draw:

Leaf unit=1

| Stem | Leaf |
|---|---|
| 0 | 5 5 6 7 8 9 9 9 9 |
| 1 | 0 0 1 3 4 4 4 4 5 5 6 |
| 2 | 0 |

Draw the stem-and-leaf diagram for the following data:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.78 | 1.99 | 1.56 | 0.36 | 2.8 | 2.5 | 1.63 | 0.88 | 1.61 | 2.45 |
| 2.23 | 2.12 | 2.65 | 0.55 | 2.92 | 1.48 | 0.06 | 1.94 | 1.17 | 1.32 |

*Solution*:

1. Arrange the data from Minimum to Maximum and unify number of digits (maximum number of digits in data is w=3):

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.06 | 0.36 | 0.55 | 0.78 | 0.88 | 1.17 | 1.32 | 1.48 | 1.56 | 1.61 |
| 1.63 | 1.94 | 1.99 | 2.12 | 2.23 | 2.45 | 2.50 | 2.65 | 2.80 | 2.92 |

2. Consider the first digit as stem (we have 3 stems) and the remaining digits as a leaf then draw:
   Leaf unit =0.01 (e.g., 006 =0.06)

| **Stem** | **Leaf** |
|---|---|
| 0 | 06 36 55 78 88 |
| 1 | 17 32 48 56 61 63 94 99 |
| 2 | 12 23 45 50 65 80 92 |

**Recap**

In this lecture, you have learned that:

- Some of the graphical tools used in descriptive statistics are bar charts, Pie charts, stem and Leaf plots, line charts, and scatter plots
- A summary table indicates the frequency, amount, or percentage of items in set of categories so that you can see the differences between categories
- A bar chart is used, mainly, for qualitative data
- The pie chart is a circle, subdivided into a number of slices that represent the various categories
- A line chart shows the values of the variable on the y-axis while the x-axis represents time
- A scatter plot is used to examine the relationship between two variables
- A stem-and-leaf display helps us understand the overall pattern of the data