Display of Data using Graphs



Introduction

Tables are used to organize data; however, graphs are used to display data in a more meaningful way. Some of the graphs we will discuss in this learning activity are listed below:

- 1. Bar Graph
- 2. Line Graph
- 3. Histogram
- 4. Pictograph
- 5. Circle Graph (Pie Chart)

- A bar graph consists of parallel bars of equal widths with lengths proportional to the frequency of the variables they represent. A bar graph is used to represent nominal data, such as days of the week. Typically, bar graphs are used for discrete data. In other words, A Bar Graph (also called Bar Chart) is a graphical display of data using bars of different heights.
- A bar graph is used to represent nominal data, such as months of the year. Typically, bar graphs are used for discrete data.

Example 1:

Imagine you just did a survey of your friends to find which kind of movie they liked best:

Comedy	Action	Romance	Drama	Sci-Fi
4	5	6	1	4

We can show that on a bar graph like this:

Example 1:

It is a really good way to show relative sizes: we can see which types of movie are most liked, and which are least liked, at a glance.

We can use bar graphs to show the relative sizes of many things, such as what type of car people have, how many customers a shop has on different days and so on.



Example 2:

A survey of 145 people revealed their favorite fruit:

Fruit:	Apple	Orange	Banana	Kiwifruit	Blueberry	Grapes
People:	35	30	10	25	40	5

We can show that on a bar graph like this:

Example 2:

For that group of people Blueberries are most popular and Grapes are the least popular.



Example 3:

In a recent test, this many students got the following grades:

Grade:	Α	В	С	D
Students:	4	12	10	2

We can show that on a bar graph like this:

Example 3:



A line chart or line graph is a type of chart which displays information as a series of data points called 'markers' connected by straight-line segments.

It is a basic type of chart common in many fields. Line Charts show how a particular data changes at equal intervals of time.

A line chart is often used to visualize a trend in data over intervals of time - a time series - thus the line is often drawn chronologically.

Example 1:

Hanah collected data on the speed of a body at certain points in time, Hanah could visualize the data by a data table such as the one on the right:

Hanah can show that on a line graph like this:

Elapsed Time (s)	Speed (m s ⁻¹)
0	0
1	3
2	7
3	12
4	20
5	30
6	45.6

Example 1:



Example 2:

Alesha bought a new car in 2001 for \$24,000. The dollar value of her car changed each year as shown in the table below.

Year	Value
2001	24000
2002	22500
2003	19400
2004	17000
2005	14900
2006	12100
2007	9800

A line chart will look like:

Example 2:



- A Histogram is a graphical display of data using bars of different heights. It is similar to a bar graph, but a histogram groups numbers into ranges and you decide what ranges to use.
- A histogram is a frequency distribution (A set of values of a variable, together with the frequency of each value) where the horizontal axis is divided into equal class intervals into which data have been divided. The heights of the rectangles represent the frequencies associated with the corresponding intervals. A histogram is used to represent data that are organized into class intervals, such as student heights. It is important that each interval have the same width.

Typically, histograms are used for continuous data. The following is an example.



Height of High School Students

How to create a Histogram without technology

- ▶ Gather the data about the variable you are interested in.
- Construct a frequency table.
- Draw a horizontal and a vertical axis.
 - □ The horizontal axis (x) shows the data categories.
 - □ The vertical axis (y) represents the frequency of the observations.

Example 1:

Ryan measures the height of every orange tree in the orchard in centimeters (cm). The heights vary from 100 cm to 340 cm.

He decides to put the results into groups of 50 cm:

- ► The **100 to just below 150 cm** range,
- ▶ The **150 to just below 200 cm** range,
- Etc.

Example 1:

The graph will look like:



You can see (for example) that there are 30 trees from 150 cm to just below 200 cm tall.

Example 2:

Each month Emma measures how much weight her puppy has gained and get the following data:

```
0.5, 0.5, 0.3, -0.2, 1.6, 0, 0.1, 0.1, 0.6, 0.4
```

They vary from -0.2 (the pup lost weight that month) to 1.6. Put in order from lowest to highest weight gain:

```
-0.2, 0, 0.1, 0.1, 0.3, 0.4, 0.5, 0.5, 0.6, 1.6
```

She decides to put the results into groups of 0.5:

- ► The -0.5 to just below 0 range,
- ▶ The **0 to just below 0.5** range,
- Etc.

Example 2:

The graph will look like:



There are no values from 1 to just below 1.5, but we still show the space.

Example 3:

Create a histogram displaying the top ten women's figure skating scores for the 2010 Winter Olympics

Names	Scores
Yu-Na Kim	228.56
Mao Asada	205.5
Joanie Rochette	202.64
Mirai Nagasu	190.15
Miki Ando	188.86
Laura Lepisto	187.97
Rahail Flatt	182.49
Akiko Suzuki	181.44
Alena Leonova	172.46
Ksenia Makarova	171.91

Example 3:

The x-axis needs to span from at least 171 to 229 in order to accommodate all of the data.

Since we are not given a specific bin width we can create a histogram with whatever width we choose. It is easiest to pick a nice round number like 5 or 10, but it really depends on how the data is spread. We choose a bin width of 10 points as follows:

Example 3:

Now we look at the data and find how many skaters scored in each interval. The highest will be 180-190, with a frequency of 4. So we need to make sure that our y-axis spans to at least 4.

Finally we plot the frequency of each interval:

- ▶ 2 between 170-180,
- ▶ 4 between 180-190,
- 1 between 190-200,
- ▶ 2 between 200-210, and
- 1 between 220-230

Example 3:

The graph will look like:



Example 4:

Suppose the following data is gathered from the waiting time (in minutes) for the patients in an Emergency Room (ER) at a local hospital :

75, 18, 68, 10, 81, 15, 80, 38, 45, 48, 98, 50, 64, 72, 84, 110, 23, 130, 85, 135, 88, 140, 12, 125

Step 1 - Arrange the data in ascending order:

10, 12, 15, 18, 23, 38, 45, 48, 50, 64, 68, 72, 75, 80, 81, 84, 85, 88, 98, 110, 125, 130, 135, 140

Example 4:

Step 2 - Determine the range:

140 - 10 = 130

Step 3 - Decide about the number of intervals: In this case the number of intervals = 5

Step 4 - Calculate bin width: Bin width = (max - min) / number of intervals Bin width = range / number of intervals 130 / 5 = 26 (rounded to 30 min)

Example 4:

The frequency table will look like:

Waiting time	Number of Patients	Percentage
0 - 30	5	21%
31 - 60	4	17%
61 - 90	9	37%
91 - 120	2	8%
121 - 150	4	17%
Total	24	100%

Example 4:

The graph will look like:



We can notice that the majority of patients wait from 61 to 90 minutes.

4. Pictograph

A pictograph is a symbolic representation of data.

Pictographs are charts in which icons represent numbers to make it more interesting and easier to understand. A key is often included to indicate what each icon represents. All icons must be of the same size, but a fraction of an icon can be used to show the respective fraction of that amount.

4. Pictograph

Example 1:

The following pictograph displays the number of participants (aged 15 and older) in the five most popular sport activities in Canada.

Sport Activity	Number of Participants
Golf	*****
Ice Hockey	ŶŶŶŶŶŶŶŶŶŶŶŶŶŶŶŶ
Baseball	<u>^</u>
Swimming	ŶŶŶŶŶŶŶŶŶŶŶ
Basketball	****

Legend: 🛉 represents 100 000 people

Source: Statistics Canada, General Social Survey, 1998.

4. Pictograph

Example 2:

The following pictograph displays the number of favourite pizza toppings in a junior kindergarten class.

Favorite Pizza Toppings		
cheese		
m ushroom		
sausage		
pepperoni		
Key 🍻 = 5 pizzas		

A circle graph (or pie chart) is a circle divided into sectors whose areas are proportional to the quantities represented. The size of each piece of a pie chart is determined by the central angle. It is calculated by multiplying the percent of data for each category by 360°.

Pie charts are very widely used in the business world and the mass media.

Example 1:

The table on the right displays the television viewing habits of Canadians based on Statistics Canada.

For example: Sports represents 4.7% of the data

or

0.047 x 360° = 17°

Programming Type	Percent of Viewing Time
News and Public Affairs	31.8
Documentary	2.7
Instruction	3.7
Religion	0.3
Sports	4.7
Variety and Games	13.2
Music and Dance	0.8
Comedy	8.8
Drama	28.7
Other	5.3

Source: Statistics Canada

Example 1:

The Pie chart will look like:



Example 2:

The following chart represents Amy's monthly budget. That is she spends 48% of her monthly salary on apartment rental.

