

Organizing data into appropriate graphical representations

There are several ways to collect and organize data. You can use surveys, samplings, experiments, and research to gather information. When formulating questions for a survey, keep in mind the purpose of your survey, and ask questions that are clearly stated.

Once you have collected the data, you can display it several ways, including bar graphs, line graphs, and circle graphs. A circle graph is used to display data that is part of a whole. A line graph is used to display data that changes over time. A bar graph is used to display data that can be counted.

Example:

Miguel surveyed his ninth-grade class to see what elective each student was taking this semester. His results showed that 32% took physical education, 19% took home economics, 29% took study hall, and 20% took art. What type of graph would best display the results of his survey?

One strategy that you could use is to eliminate choices that do not make sense.

Should Miguel use a line graph?

Line graphs shows data that change over time. Since Miguel's data is not changing over time, this graph is not appropriate.

Should Miguel use a bar graph?

Bar graphs display data that can be counted. Although the percentage can be counted, this may not be the best choice.

Should Miguel use a circle graph?

Circle graphs are used to display data that is part of a whole. In this case, Miguel surveyed the whole ninth-grade. The percentages for each elective add up to 100%, or a whole. A circle graph would best display Miguel's data.

Ways to display data

There are many ways to construct equivalent displays of data using lists, tables, and graphs. You will use graphs to analyze data and to make predictions based on patterns. Since we studied bar graphs, line graphs and circle graphs in the last math prompt, in this prompt we will focus on Frequency charts, stem-and-leaf

plots and box-and-whisker plots. We will focus on how you make one and then try to make one ourselves

Frequency Charts

A frequency chart show data values and the number of times each value occurs (the frequency).

Example:

The following list shows the class size of Mrs. Kamp's 10th-grade poetry class for each of the last 30 years.

34, 32, 30, 31, 30, 33, 32, 35, 36, 32, 35, 30, 31, 34, 33
39, 35, 32, 31, 32, 34, 35, 38, 32, 33, 34, 39, 30, 32, 32

These data are displayed in the following frequency chart. The numbers of tally marks, called the frequencies, are listed in the third column. We will write the class sizes in order from 30 to 39. The class size of 37 students was not recorded but is still shown in the chart with a frequency of zero.

Mrs. Kamp's Class Size

Class Size	Tally Marks	Frequency
30		4
31		3
32	 	8
33		3
34		4
35		4
36		1
37		0
38		1
39		2

Stem-and-leaf Plots

A stem-and-leaf plot shows the maximum and minimum of a data set, as well as the median and the mode. For a single-digit value, the stem is zero, and the leaf is the number itself. For a two-digit value, the tens digit is the stem, and the ones digit is the leaf. For a three-digit value, the hundreds and tens digits are the stem, and the ones digit is the leaf. Holes in a data set occur when there are stems without any leaves (an empty interval).

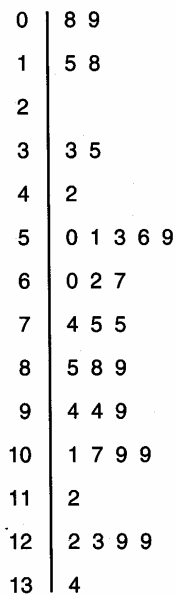
Example:

The following list show the number of songs purchased online last year by each of the 34 students in Mrs. Hopes' literature class.

9, 15, 50, 94, 85, 75, 134, 42, 18, 129, 94, 51, 53, 109, 123, 101, 62
 33, 88, 67, 35, 74, 59, 60, 8, 129, 122, 75, 109, 56, 89, 99, 107, 112

The following stem-and-leaf plot shows the information from the list. After you record the information in a stem-and-leaf plot, you can find the minimum, the maximum, the median, the mode, and any holes that may exist. For this set of data, the minimum number of songs purchased is 8, the maximum is 134, the median is 75, and the modes are 75, 94, 109, and 129. A hole occurs at the empty interval 20-29.

Number of Songs Purchased



Box-and-whisker plot

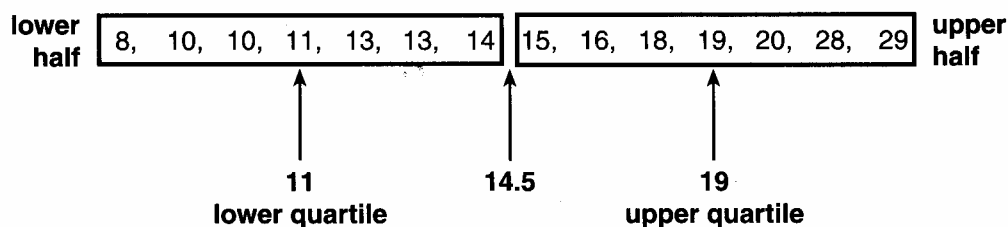
A box-and-whisker plot shows how a large set of data clusters together. It shows the median, the quartiles, and the minimum and maximum values.

Example

The following list shows the number of Arizona souvenir license plates sold each day at a store during the last two weeks.

14, 20, 15, 11, 13, 19, 29, 28, 16, 10, 10, 13, 8, 18

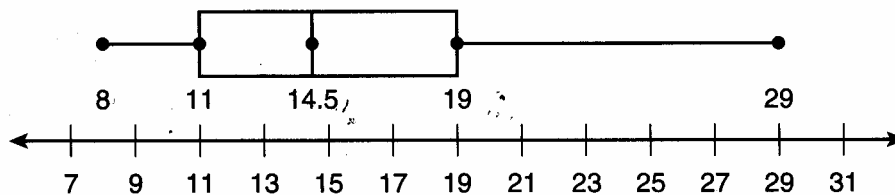
The following diagram show how to separate the data.



To construct a box-and-whisker plot, draw five points to represent the following:

- Minimum: 8
- Low quartile: 11
- Median: 14.5
- Upper quartile: 19
- Maximum: 29

Draw vertical lines through the median and the upper and lower quartiles; make a box around those three points. Draw lines on the outside of the box that connect the minimum to the lower quartile and the upper quartile to the maximum. The following box-and-whisker plot shows the information from the list.



Making predictions from linear graph and scatter plots

Line graphs and scatter plots show trends in data. They are very important in the area of business. Many businesses track profit on line graphs and scatter plots to help predict whether their businesses are growing.

Line graphs

Line graphs show trends over a period of time. A trend is a clear direction in a graph that suggests how the data values will behave in the future. A line graph can have an increasing trend, a decreasing trend or no trend at all.

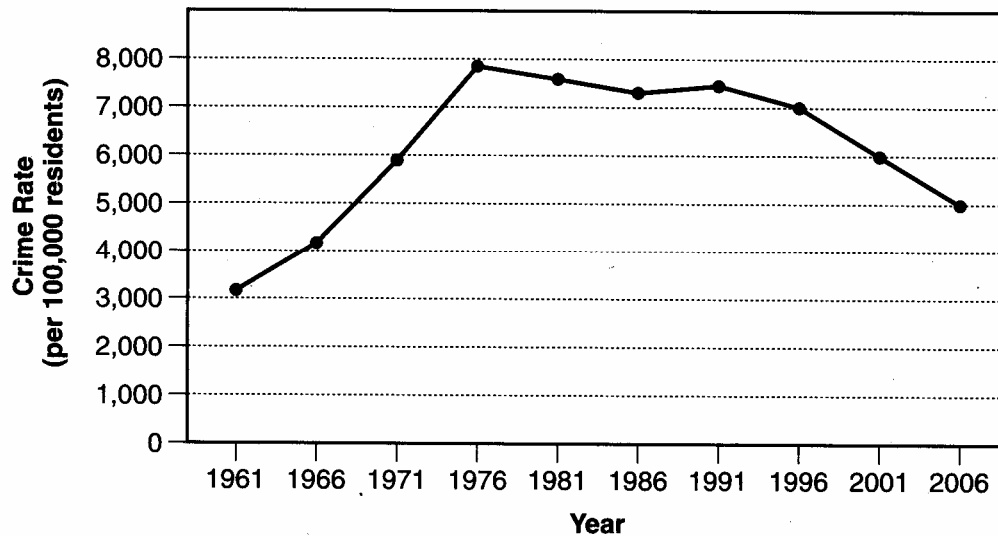
The following table shows the crime rate, per 100,000 residents, in Arizona since 1961, using 5-year increments.

Arizona Crime Rates (per 100,000 residents)

Year	1961	1966	1971	1976	1981	1986	1991	1996	2001	2006
Crime Rate	3,130	4,140	5,940	7,890	7,600	7,320	7,400	7,000	6,000	5,000

While it is possible to see that there currently is a decreasing trend by looking at the numbers alone, a line graph shows the information more clearly.

Arizona Crime Rates (per 100,000 residents)



What inferences can be drawn from the graph? For example, what do you predict the crime rate will be in 2011? A reasonable prediction is that the crime rate will be less than or equal to the last data value, which is 5,000. But can a more specific rate be found? If so, how can you find that rate? To make a prediction for the year 2011, first extend the horizontal axis, then follow the trend to extend the line. The extended line shows that the Arizona crime rate will be about 4,000 in 2011, if the trend continues.

Scatter plots

A scatter plot shows how two data sets are related. The data values are plotted as ordered pairs and then observed to see how closely they come to forming a straight line.

Example

The following table shows the number of hours Stuart trained for each of his last 7 weekly timed miles and the associated mile time for each week.

Mile Time Versus Training Time

Training Time (in hours)	4.5	9	3	7.5	4.5	10.5	12
Mile Time (in minutes)	8.4	7.3	8.9	7.6	7.9	7.0	6.8

The following scatterplot show the information from the table. The scatterplot shows that the data points come close to forming a straight line. The more hours

Stuart trained, the more his mile time lowered. This relationship is inverse: as one quantity increases, the other quantity decreases. Relationships can also be direct: as one quantity increases, the other quantity increases.

Make reasonable predictions from a set of data based on patterns :

Sometimes charts and data do not have enough information in them to give us accurate information. It then becomes necessary to make a prediction based on the information given in the chart. Financial analyst and insurance actuaries make this a common practice in their professions.

Example:

Sam's pizza Palace price list for plain pizzas is shown below:

Diameter	Cost
10"	\$5.00
12"	\$7.20
14"	\$9.80
16"	\$12.80

Based on this information, what would a 20" pizza likely cost?

The first step is to analyze the first column of information. The first column of information tells you the diameter of the pizza. More importantly the difference between each row is 2 inches. The 20" pizza is 4 inches larger than the last pizza listed on the chart. This means that when we find the difference between prices we will have to add two rows to the chart to predict the price accurately.

The second step is to look at the 2nd column and determine the difference between each of the rows. The first two rows have a difference of \$7.20-\$5.00, which is \$2.20. The next two rows have a difference of \$9.80-\$7.20, which is \$2.60. The last two rows have a difference of 12.80-9.80 which is \$3.00. It looks like the price increases by \$.40 for each increment of 2 inches. So,

18" would be \$12.80 plus \$3.40 which would be \$16.20

20" would be \$16.20 plus \$3.80 which would be \$20.00