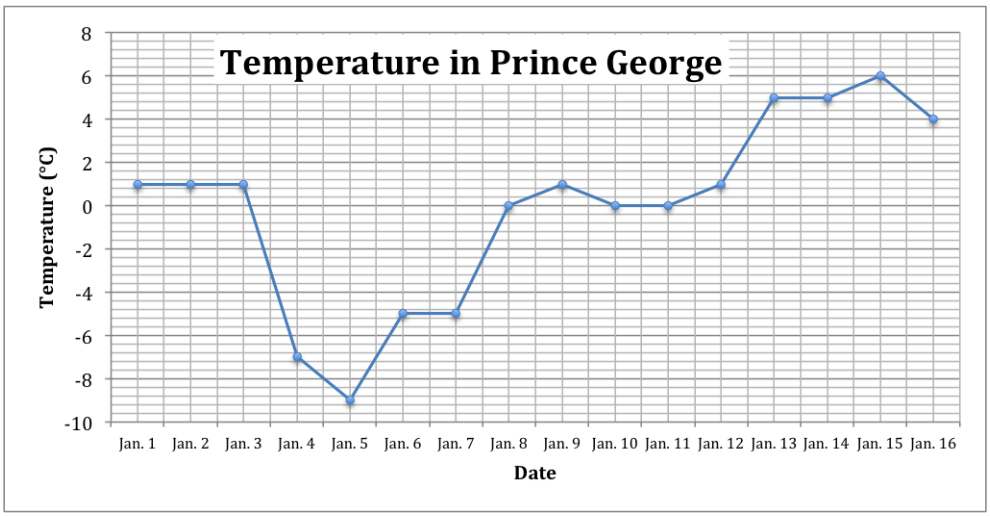
Problem Set Solutions

"*" indicates challenge question

1. The following table shows temperatures (in °C) for Prince George, BC. Use the table to make a line graph and answer the following questions

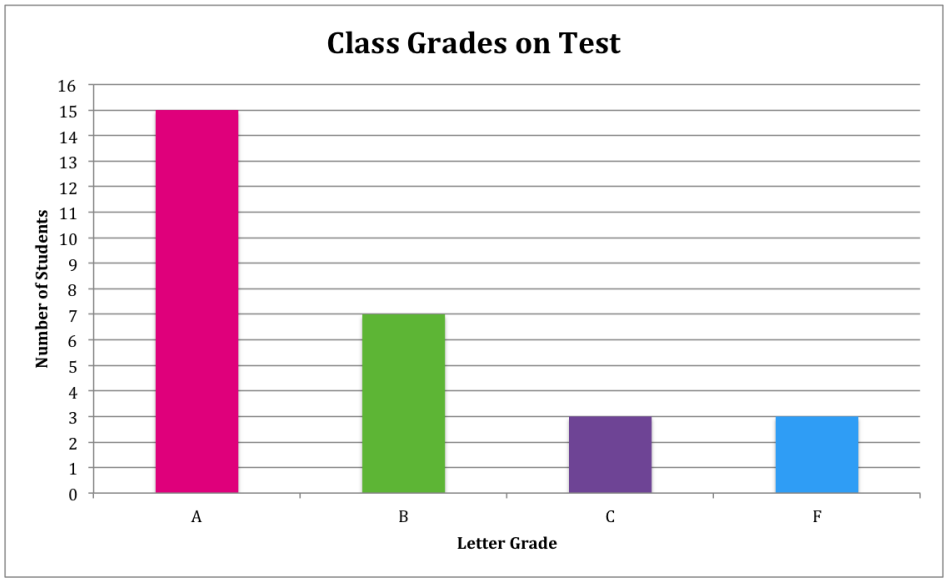


   (a) Is there a general trend in the temperature? If so, what is it?
   Answers may vary. Initially the temperature was stable, then decreased until Jan. 5. After that, there was a general increase in the temperature over time.

   (b) What does this line graph tell you about the weather?
   Answers may vary. Answers may include: It was cold. There was a cold weather system/storm. The temperature varied.

   (c) Was it useful to draw a line graph as opposed to just having the table?
   Answers may vary. Yes, it was useful to see the temperatures in the graph to see the trend. It is often hard to see trends just by looking at data in a table.

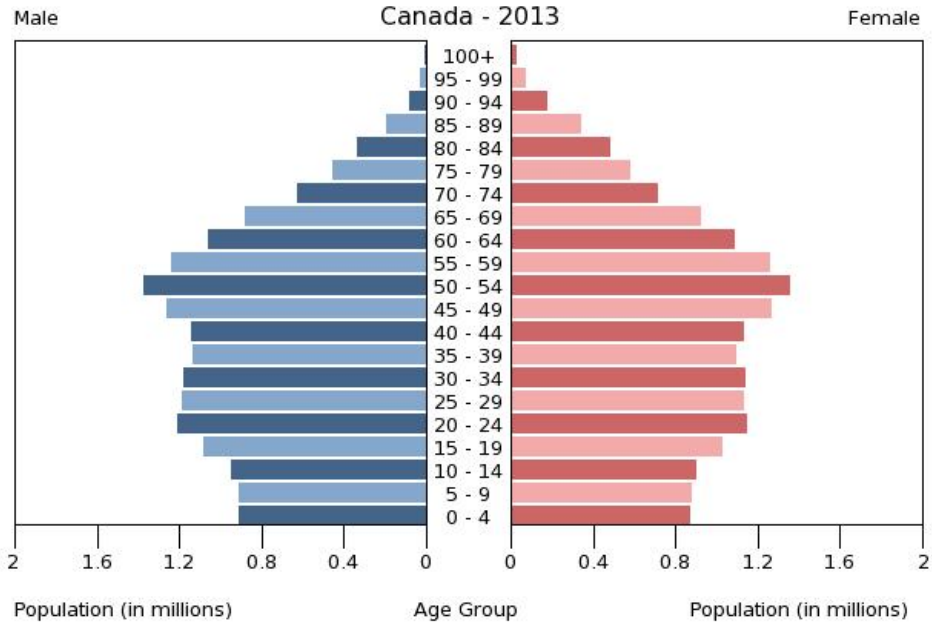
2. Lauren's class of 28 students just had a big test. Her teacher wants to analyze how the class did. He chooses to draw a bar graph. 15 people in the class got an A, 7 people got B's, and 3 people got C's. How did the class do? Was a bar graph the best choice to analyze this data? Suggest a better graph or explain why a bar graph is best. (Hint: don't forget to include the people who failed)



Answers may vary. The class did well since most people got A's or B's. A box plot might have been a better choice as it allows you to see where most of the data is more easily.

3. Pick an appropriate topic and draw a pie chart. Use your pie chart to draw three conclusions about your topic.
Answers will vary. Please see lesson for sample pie chart.

4. Use the following data to draw a population pyramid and answer the questions.



Source: `http://www.census.gov/population/international/data/idb/region.php?N=%20Results%20&T=12&A=separate&RT=0&Y=2013&R=-1&C=CA`

(a) How is the population changing? Explain.
Answers may vary slightly. Answers may include: The population is stabilizing. The population is shrinking.

(b) Why are population pyramids usually close to being symmetrical? What are some reasons they wouldn't be symmetrical?
Answers may vary. Theoretically there should be a similar number of men and women since gender is determined by chance. Some reasons for asymmetry are high rates of death of mothers when giving birth, cultural inequality of men and women, and mostly men serving in armed forces.

(c) Why aren't they perfectly symmetrical?
Because gender is determined randomly, it is unlikely that there will always be the exact same number of men and women. Think of tossing a coin 100 times. Although you would expect to see 50 heads and 50 tails, it is unlikely that there will always be exactly 50 of each every time.

5. For each of the following, list the minimum data requirements needed to effectively present the data.

   (a) Table
   Almost any data can be put in a table

   (b) Bar Graph
   Data must have categories with numerical data

   (c) Pie Chart
   Data must be split into parts that make up a whole, each with numerical data. Note that numerical data may not always be given as numbers. For example, if you are given a list of names, you can obtain numbers by counting.

   (d) Box Plot
   Numerical data for a single category.

   (e) Population Pyramid
   Population data that is broken down into gender and age categories.

   (f) Line Graph
   Numerical data split into categories that increase or decrease.

6. Which of the ways to present data from question 5 is

   (a) the least specific (has the least requirements). Why?
   A table because almost any data can be put in a table. Note: a bar graph would be the least specific **graph**

   (b) the most specific (has the most requirements). Why?
   Population pyramid because it can only be used for a very specific purpose.

7. Given the following data, which types of graphs could you use?

   (a) Total population of Canada over the past 10 years.
   Bar graph, box plot, line graph

   (b) Breakdown of a population in 2013.
   Bar graph, pie chart, population pyramid

8. What was done to the graph "Winter Olympic Gold Medals (Top 6) #1" (in the Manipulating Data section) to make it look like all the countries had a similar amount of gold medals?
   The scale was increased. This causes the difference between each graph to be worth less. For example, if each medal was worth 1 cm in a bar graph, increasing the scale would make it worth less (say 2 mm for example). Now the difference between each bar is visually less, so they look more similar.

9. What could have been done better in the graph "2010 Winter Olympic Gold Medals" (in the Bar Graphs section)? (Hint: look at the categories)
   It is a little misleading that some categories are continents and some are countries. For example, the number of medals that Canada won is compared with the number that the entire continent of Europe won. It would have been better if they were all countries or all continents.

10. In each case, choose which graph would be better. Why?

    (a) Billy wants to show how his company has grown over the past 20 years. Should he use a bar graph or a line graph?
    Although either graph would work, a line graph would be better as it shows trends better and works better with many data categories. Whereas bar graphs work better with a small number of categories.

    (b) Nadine has to graph the amount of papers in 20 different boxes. Should she use a box plot, pie chart or a line graph?
    A box plot would be best since all the data is in the same category (they are all boxes). However, it may be possible to use a line graph depending on what she wants to show. Since the box plot would only show the distribution of the number of papers, a line graph might be better if she wanted to keep each box distinct (for example, if each box was numbered). A pie chart would only be appropriate if she wanted to show how much of the total number of papers was in each box.

    (c) Emily wants to compare how many boys and girls are in her class. Should she use a pie chart or a population pyramid?
    A pie chart would be best because she is comparing two parts (genders) that make up a whole (the class). A population pyramid would be very hard to use since there would be a very limited number of age groups.

11. Which graph(s) can't be manipulated easily? Why?
    Box plots and pie charts would be hard to manipulate. With respect to box plots, most of the analysis relies on relative proportions, which can not be changed without altering the data. For pie charts, there is no scale to change, so you have to think of other ways to manipulate the data. (See question 14 for examples on how to manipulate these).

12. *How can you use grouping to manipulate data?
    You can combine and separate categories. See question 14 for details

13. Describe how you can change each of the following graphs to show the desired result.

    (a) Bar graph

        i. Make all the categories look similar
        Increase the scale (increase the maximum of the graph)

        ii. Show a big change between categories
        Decrease the scale (make the value of the largest category the maximum of the graph)

    (b) Population pyramid

        i. Make all the categories look similar
        Same as 13(a)

        ii. Show a big change between categories
        Same as 13(b)

    (c) Line graph

        i. Make it look like the graph is steady (little or no change)
        Increase the scale (increase the maximum)

        ii. Show that there is an increase
        Stretch the graph (decrease the maximum)

    (d) *Pie chart (Hint: think about manipulating the categories)

        i. Show that a category makes up less of the whole (has a smaller percentage)
        Split categories. For example, in the "Pie Charts" section of the lesson, Europe could be divided into countries. To enhance the effect, the European countries can be moved around and interchanged with other countries to make it harder for the reader to visually see how much of the circle it takes up.

        ii. Show that a category makes up less of the whole (has a smaller percentage)
        Combine categories. For example, in the "Pie Charts" section of the lesson, Germany can be combined with Europe.

    (e) Box plot

        i. A small range of data
        Shrink the scale so the data becomes closer together.

        ii. A large range of data
        Stretch the scale so the box plot becomes larger.

14. When drawing a bar graph or pie chart it is important to pick good categories. For example, instead of drawing a bar graph with 20 bars, you might group the data into 5 different categories. Find a different way of grouping the following.
Answers may vary

    (a) Letters of the alphabet
    Examples include:
    - Vowels and consonants
    - Curly and straight letters
    - Position in alphabet (ex. first five letters, second five letters, etc.)

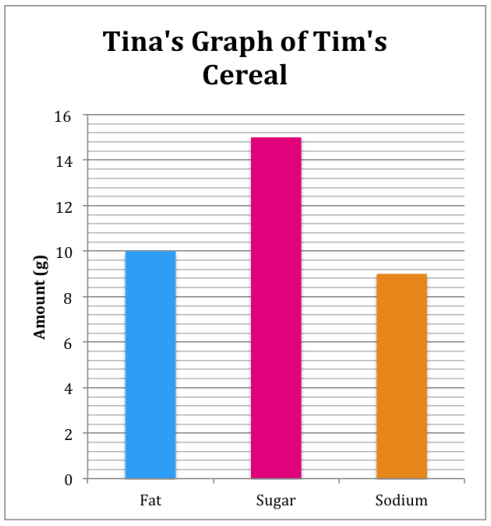
    (b) Soccer, football, hockey, golf, and dance teams.
    Examples include:
    - Sports that use balls (Soccer, football and golf) and other sports
    - Sports that can be played indoors, sports that can be played outdoors, sports that can be played outdoors and indoors
    - Full contact sports, minor contact, no contact

    (c) Schools
    Examples include:
    - Elementary, middle, and high schools
    - Size of school
    - Number of grades

    (d) TV shows
    Examples include:
    - Live, reality, fictional
    - Length of show
    - Genre

    (e) *Can you find another way to group each of the above categories?
    See above

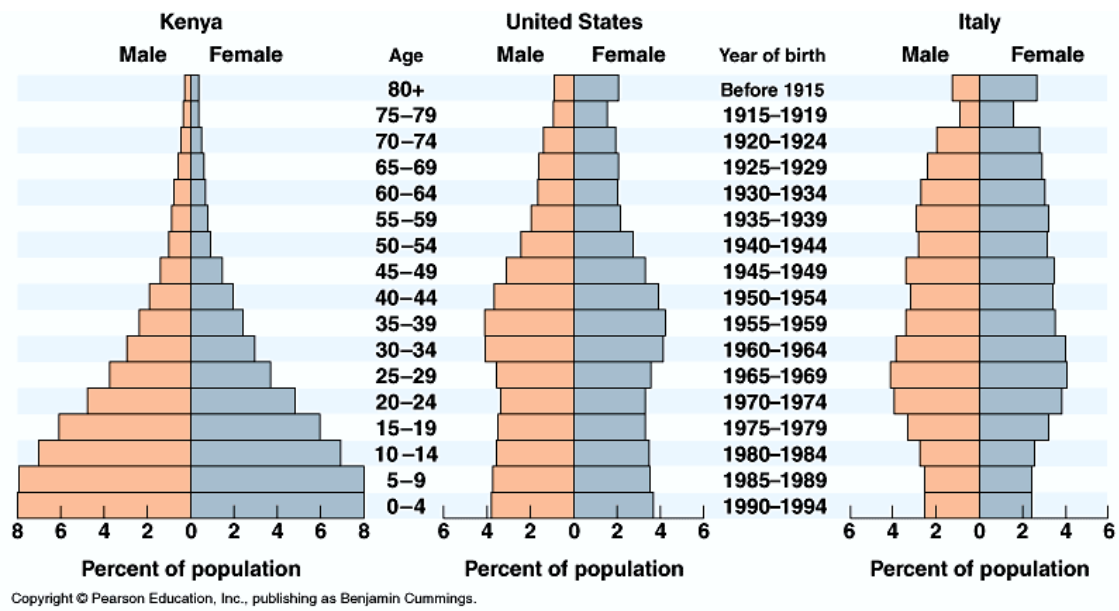
15. Tim works for a cereal company. He created this graph to show how healthy his cereal is. Tina is a doctor and wants to show that Tim's cereal isn't really that healthy. Help Tina by redrawing the graph.
See graph on right



16. *Can you think of a place where statistics is not used? This could be an industry, or a sport, or a company, or anything else.
Answers will vary. Remember: Statistics is **everywhere**.

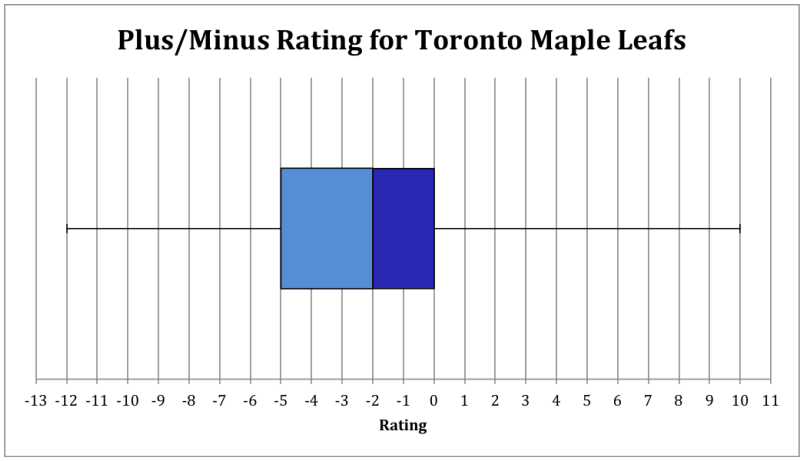
17. **Demography** is a branch of statistics that deals with human populations. Demographers analyze population pyramids to determine how a population is changing. Using the population pyramids below, match each country with a description of how their population is changing.

(a) Kenya (iii)	(i) Slow growth
(b) United States (i)	(ii) Decreasing
(c) Italy (ii)	(iii) Rapid growth



http://blue.utb.edu/paullgj/geog3320/lectures/AgeStructures.gif

18. In ice hockey players are given a plus/minus rating after each game. Players get a point added to their rating if they do something good, such as scoring a goal. A point is subtracted if they do something bad, such as letting the other team score a goal. Plus/minus ratings from each game are added together to get a season total. Below is the plus/minus rating for the Toronto Maple Leafs this season. Use this data to draw a box plot.



Source: http://mapleleafs.nhl.com/club/stats.htm

(a) *Using your box plot, determine where most of the data is (ie. is it grouped toward the front, back, evenly spaced, etc.)
The data is fairly evenly spaced. There is a slight grouping of data toward the middle (between -5 and 0).

(b) *How would the median change if the following were applied? How would the box plot change?

i. 2 points were added to each player's plus/minus rating.
The entire box plot would be shifted right 2 spaces. It would look identical, but with the scale shifted.

ii. Each player's rating was doubled.
The box plot would expand. The relative proportions would remain the same however. It would look the same as the one above but with the scale doubled. Notice that all the "landmark values" double: the minimum value, maximum value, Q1, median, and Q2 all double.

iii. All negative ratings became positive (-2 becomes 2, -5 becomes 5, 1 stays the same, etc.)
This would be a completely different box plot

iv. All numbers switched signs (-2 becomes 2, 1 becomes -1, etc.)
The box plot would be flipped. Imagine that the paper was see-through and you were looking at it from the other side

(c) What conclusions can you draw about the Maple Leafs' season so far?
Since the Q3 value is 0, 75%of the players are below 0 (meaning they have a negative value). Since negative points are accumulated for bad reasons, it seems that the Maple Leafs are not doing very well this season. It is important to note, however, that you can not say anything definite using just this statistic.