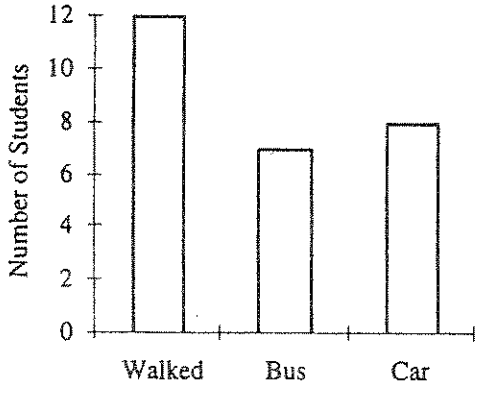
TYPES OF GRAPHS

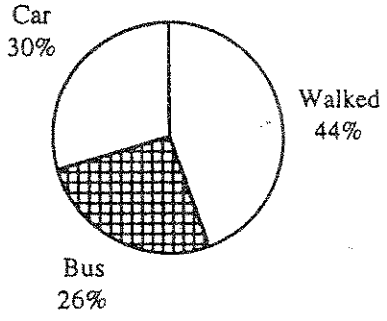
1. BAR GRAPH - Used mostly for categorical data, to show the amount in each group. To make graph, categories go along x-axis, a consistent scale appropriate for the number in each category along y-axis. Each bar should have the same width and spacing between bars.

   Example: Jasmine polled the 27 students in her sixth grade class to see how they traveled to school. She found that 12 of her classmates walked, 7 of them took the bus, and 8 of them traveled by car. A bar graph is constructed below.



2. PIE OR CIRCLE GRAPHS - Used mostly for categorical data (can be used for measurement data), shows the percentage in each category.
   To make graph, the percentage and degrees in the circle must be calculated. The percentage = $\frac{amount}{total}$ for each category. The degrees = $\frac{amount}{total}$ x 360° for each category. Using a compass, draw the circle. Using a protractor, measure the degrees for each section. Label and shade as desired.

   Example: Using Jasmine's data set from above, we can construct the following pie chart. Note that 12/27 = 44% and 12/27 x 360°= 160° for that part of the circle.



3. PICTOGRAPHS – A pictograph is similar to a bar graph. There is no vertical axis, the icons each represent a fixed amount and are counted to come up with total. To make graph, draw categories along x-axis (y-axis optional) and draw in number of icons as needed. A key as to meaning of icons is needed.

Example:

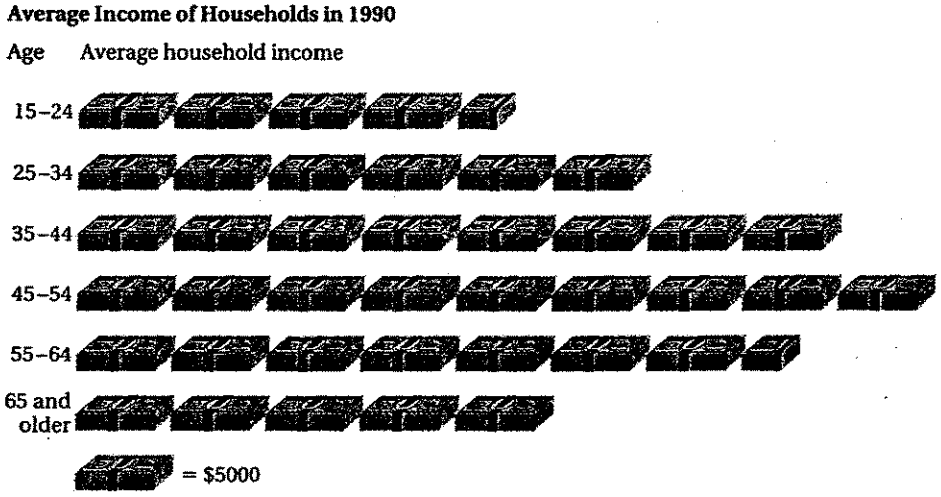
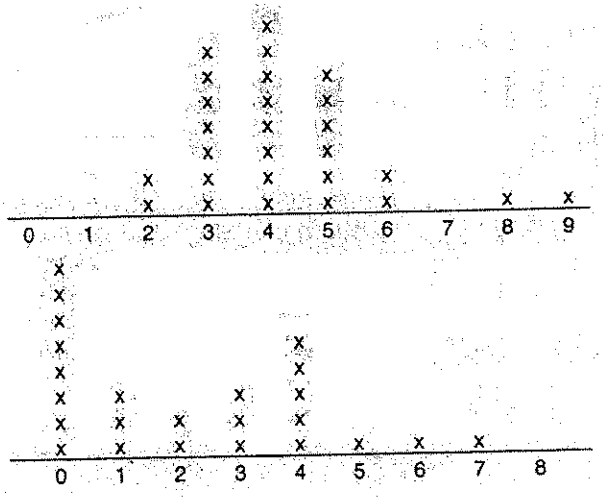


Figure 8.4 A pictograph. (*Source: Statistical Abstract of the United States, 1992.* Washington, D.C.: U.S. Department of Commerce, Bureau of the Census, p. 447.)

4. LINE PLOTS – A line plot is similar to pictograph, but uses a number line as x-axis. The data is recorded by placing a mark such as an X or dot above the line for each value of the data. A line plot gives a good picture of the data set including any clusters or gaps in the data.

Example: The two line plots below represent students in a 4th grade class. One plot shows the number of students having a given number of cavities, the other shows the number of students having a given number of people in their family. Which plot contains which data?

Organize



5. STEM AND LEAF PLOTS – A stem and leaf plot is used to quickly order and organize numerical data sets. To make a stem and leaf plot, numbers must be broken into two parts, usually the tens place digit is the stem, and the ones place digit the leaf. First a list of all possible stems is formed in a column from smallest to largest. Then the leaf for each number is written in the corresponding row. We usually order the leaves in each row as a final step.

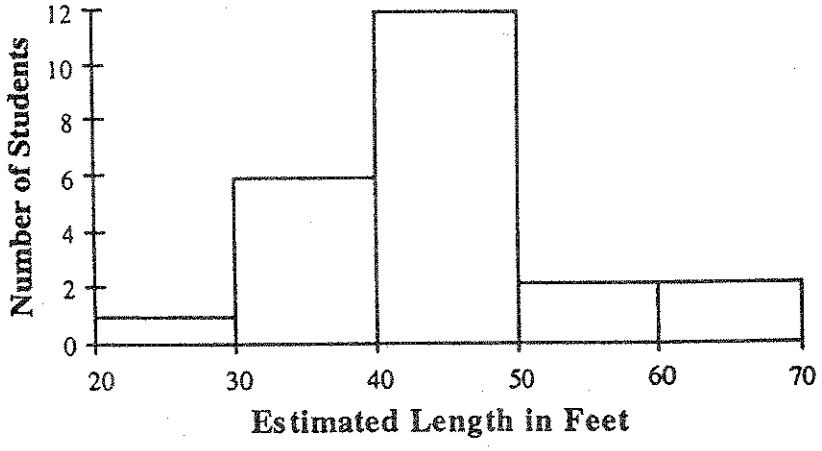
   Example: Professor Santos asked her 23 students to estimate the length of the lecture hall (which was 43 feet) in which they were seated. The results are as follows:
   35, 44, 42, 30, 24, 60, 42, 42, 40, 30, 40, 32, 46, 45, 54, 36, 45, 30, 55, 40, 40, 60, 40
   Use this to complete the stem-and-leaf plot.

Organize

2	
3	
4	
5	
6	

6. HISTOGRAMS – Similar to a bar graph, used for numerical data that is grouped in some way (like on a stem and leaf plot). Consistent scales are needed for both x-axis and y-axis. There are no gaps between bars and bars include value of the lower number to anything less than the upper number.

   Example: Using the stem-and-leaf plot in #5 above, we can construct a histogram as shown below.



GRAPHICAL REPRESENTATIONS (for Univariate Data)

BAR CHARTS (handmade): graph paper and straight edge are recommended.

1. Determine the number of occurrences of each type.
2. Decide on a scale (for the vertical axis).
3. Draw and label the axes.
4. Draw each bar the appropriate height.
5. Add a title or heading.

PIE CHARTS (handmade): compass and protractor are recommended.

1. Determine the percentage (or fraction) of each type of occurrence.
2. Determine the number of degrees for each sector.
3. Use a compass (or circle templet) and a protractor to construct the pie.
4. Label each sector (including its percentage).
5. Add a title or heading.

STEM-AND-LEAF PLOTS (handmade): for discrete numerical data.

1. Draw a vertical bar.
2. List the "stems" vertically. (Each stem is the left-most digits for its row of data.)
3. Add the "leaves" horizontally. (Each leaf is the last digit of its piece of data.)
4. Organize the leaves in ascending order. (This will require a second/new plot.)
5. Make sure the digits (leaves) line-up so the relative *length* of each row is obvious.
6. Add a title or heading.

HISTOGRAMS (handmade): for continuous numerical data.

1. Same as for bar charts, except:
2. there is no space between the bars, and
3. you must decide on the interval *width* for the bars.

MATH 312 - WARMUP

The table below gives the number of calories and grams of fat, carbohydrates, and protein in each serving of various items sold at Burger King.

	Serving Size (g)	Calories	Protein (g)	Carbo-hydrates (g)	Fat (g)
Whopper	270	570	27	46	31
Whopper with Cheese	294	660	32	48	38
Double Whopper	351	800	46	46	48
Double Whopper with Cheese	375	890	51	48	55
Cheeseburger	115	300	16	28	14
Whopper Jr. with Cheese	145	350	16	30	19
Hamburger	103	260	14	28	10
Whopper Jr.	133	300	14	29	15
Bacon Double Cheeseburger	149	470	30	26	28
Bacon Double Cheeseburger Deluxe	185	530	30	28	33
Double Cheeseburger	151	450	27	29	25
BK Broiler Chicken Sandwich	154	280	20	29	10
Chicken Sandwich	229	620	26	57	32
Ocean Catch Fish Filet Sandwich	165	450	16	33	28
Chicken Tenders (six piece)	90	236	16	14	13
Chef Salad without dressing	273	178	17	7	9
Chunky Chicken Salad without dressing	258	142	20	8	4
Garden Salad without dressing	223	95	6	8	5
Side Salad without dressing	135	25	1	5	0
French Fries (medium, salted)	116	372	5	43	20
Onion Rings	97	339	5	38	19

1. Using the plot below, complete the stem and leaf plot for the grams of fat for each of the food items listed.

0 |
1 |
2 |
3 |
4 |
5 |

2. Use the stem and leaf plot to construct a histogram for the data.

3. Answer some questions using the data on the graphs above.

a) What is the greatest number of fat grams for any one food item?

b) The greatest number of food items have fat grams in what range?

c) If you can only choose 1 salad item, can you have a meal (2 items) for less than 15 grams of fat?

MATH 312 - WARMUP

The table below gives the number of calories and grams of fat, carbohydrates, and protein in each serving of various items sold at Burger King.

	Serving Size (g)	Calories	Protein (g)	Carbo-hydrates (g)	Fat (g)
Whopper	270	570	27	45	31
Whopper with Cheese	294	660	32	48	38
Double Whopper	331	900	48	48	48
Double Whopper with Cheese	375	990	51	48	55
Cheeseburger	115	300	15	28	14
Whopper Jr. with Cheese	145	350	16	30	15
Hamburger	103	280	14	28	10
Whopper Jr.	133	300	14	29	15
Bacon Double Cheeseburger	149	470	30	26	28
Bacon Double Cheeseburger Deluxe	186	630	30	28	33
Double Cheeseburger	181	450	27	29	25
BK Broiler Chicken Sandwich	154	290	20	29	10
Chicken Sandwich	229	626	26	57	32
Ocean Catch Fish Fillet Sandwich	165	450	16	33	28
Chicken Tenders (six piece)	90	236	16	14	13
Chef Salad without dressing	273	178	17	7	9
Chunky Chicken Salad without dressing	258	142	20	6	4
Garden Salad without dressing	223	98	6	5	5
Side Salad without dressing	136	25	1	5	0
French Fries (medium, salted)	116	372	5	43	20
Onion Rings	97	339	5	38	19

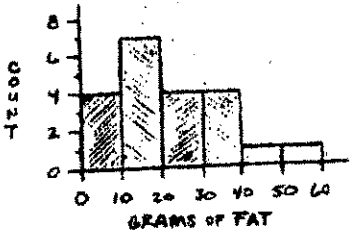
21 ITEMS

0	9 4 5 0
1	4 9 0 5 0 3 9
2	8 5 8 0
3	1 8 3 2
4	8
5	5

1. Using the plot below, complete the stem and leaf plot for the grams of fat for each of the food items listed.

0	0 4 5 9
1	0 0 3 4 5 9 9
2	0 5 8 8
3	1 2 3 8
4	8
5	5

2. Use the stem and leaf plot to construct a histogram for the data.



3. Answer some questions using the data on the graphs above.

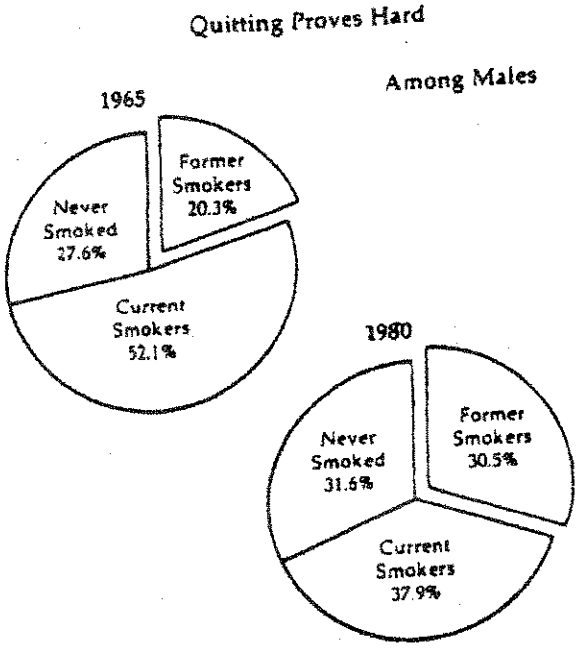
a) What is the greatest number of fat grams for any one food item? 55

b) The greatest number of food items have fat grams in what range? 10 - 19

c) If you can only choose 1 salad item, can you have a meal (2 items) for less than 15 grams of fat? YES

MATH 312 - WARMUP

The accompanying graphs give information about smoking among males and females in 1965 and 1980. Use them to answer the following questions.



1. Suppose that you met Ms. Jones in 1980. What is the probability of each of the following:

a) She does not smoke?

b) She has never smoked?

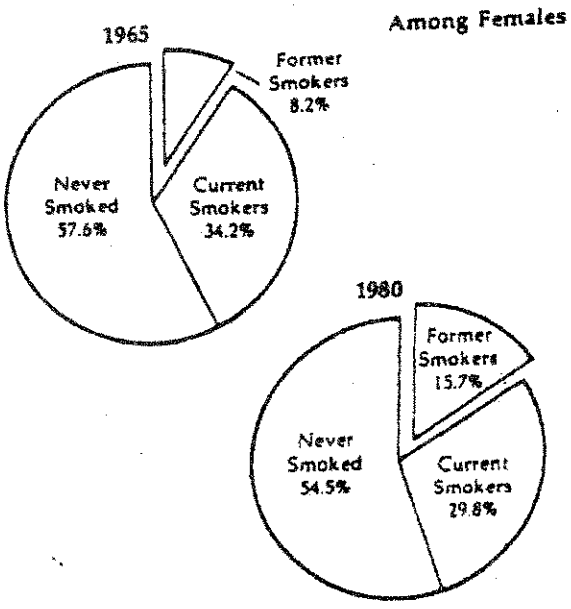
c) She has smoked some time in her life?

2. Suppose that a man had been randomly selected during the year 1965. What is the probability that:

a) He is a smoker?

b) He is not a smoker?

c) Is it more or less likely that such a selection would produce a smoker in 1965 than 1980?



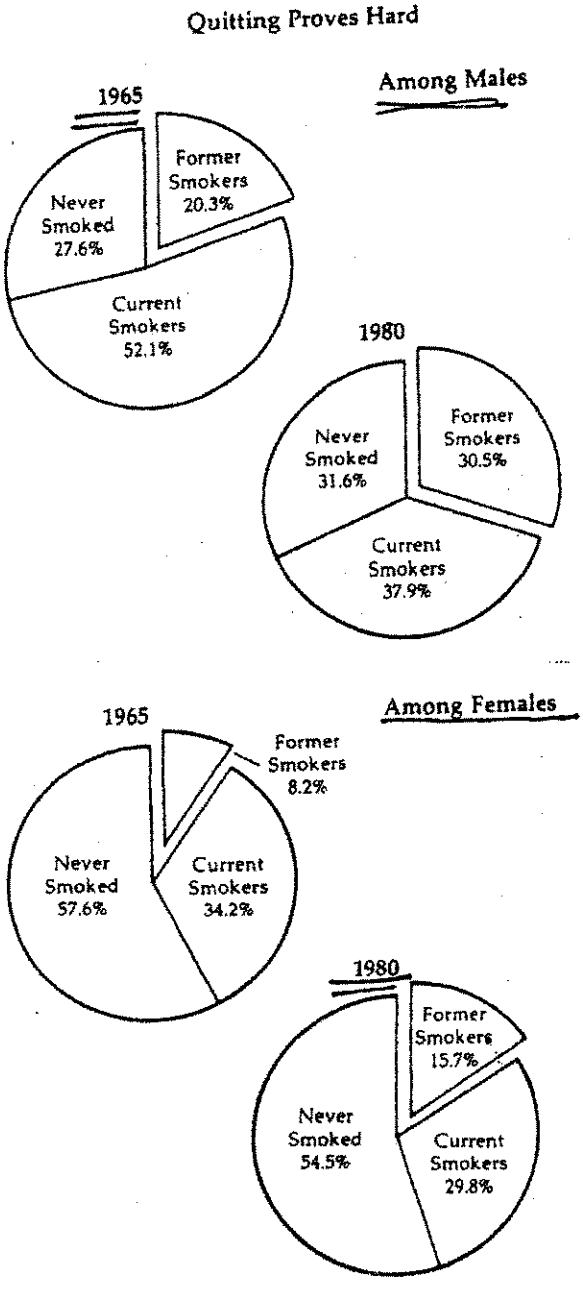
3. Suppose you met Mr. Brown for the first time in 1980. Is it more likely that he has never smoked or he has quit smoking?

4. You walk into a movie theater containing 100 adults in 1980. How many would you expect to be smokers?

Key

MATH 312 - WARMUP

The accompanying graphs give information about smoking among males and females in 1965 and 1980. Use them to answer the following questions.



1. Suppose that you met Ms. Jones in 1980. What is the probability of each of the following:

a) She does not smoke? 54.5 + 15.7 = 70.2%

b) She has never smoked? 54.5%

c) She has smoked some time in her life? 15.7 + 29.8 = 45.5%

2. Suppose that a man had been randomly selected during the year 1965. What is the probability that:

a) He ~~was~~ is a smoker? in 1965 52.1%

b) He ~~was~~ is not a smoker? in 1965 27.6 + [illegible] = 47.9%

c) Is it more or less likely that such a selection would produce a smoker in 1965 than 1980?

1965 - 52.1% smoked in 1980 - 37.9% smoked

3. Suppose you met Mr. Brown for the first time in 1980. Is it more likely that he has never smoked or he has quit smoking?

more likely - never smoked

4. You walk into a movie theater containing 100 adults in 1980. How many would you expect to be smokers?

current smokers male = 37.9% } ≈ 34% smokers
female = 29.8% }

Section 30.1

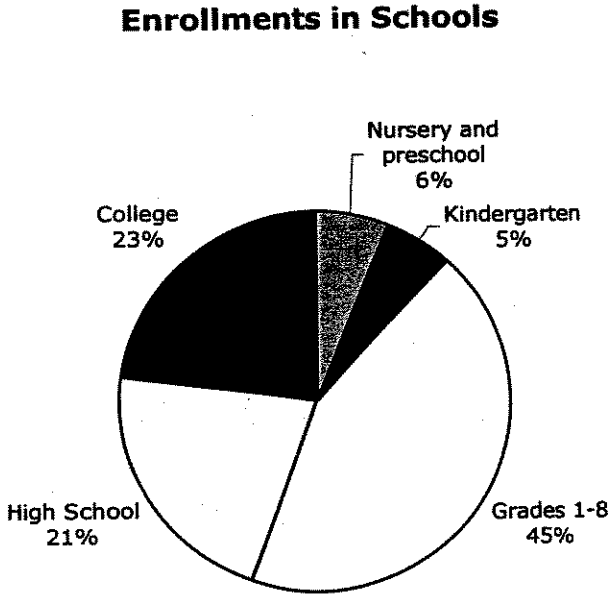
1. a. Bar chart? Yes. We no longer know who actually walked, rode the bus, and took a car to school. Circle graph? We lose some more information when we use a circle graph. We no longer know the actual number of students who took a car, rode a bus or walked to school. We now know only the percentage of students in the class who took each form of transportation.

   b. A pie chart shows at a glance what part of the whole sample each group is (and most often the percent as well). A disadvantage is that the actual number in each group may not be shown on a pie chart. Which of the two is more effective depends on the story to be told.

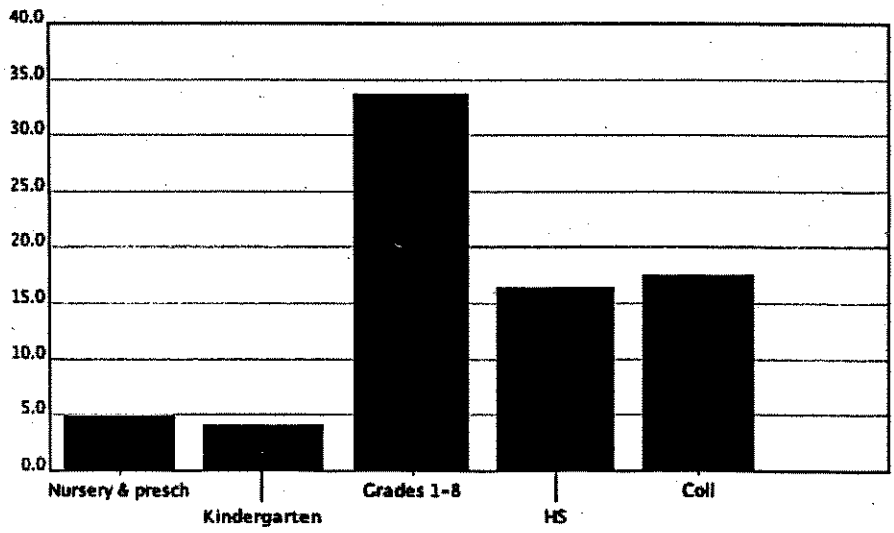
2. (Instructor only)

   a. If you required your students to make the graph without software, here are the numbers of degrees for the sectors:

Nursery and preschool:	23°
Kindergarten:	20°
Grades 1-8:	158°
High School:	77°
College:	82°

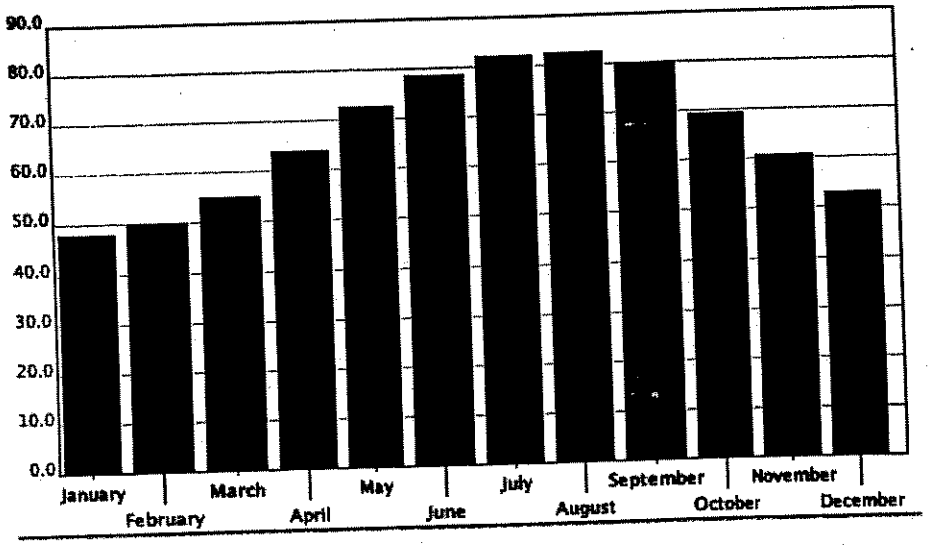


Z b. Bar Grapher, from http://illuminations.nctm.org/ActivityDetail.aspx?ID=63 could be used. (You may have required your students to make theirs without software.)



c. Answers will vary. Many are surprised that there were more students in post-high-school than in high school (in 2000).

3. Typically, a graph has a title. What would be a reasonable title for this graph?



6. B Is it surprising that 21% of the eighth graders were *not* correct? But to respond correctly, one must recognize that the time spent on Mathematics is represented by about 1/4 of the circular region, so if that represents 2 hours, then the whole circular region, 4/4, must represent 8 hours. A correct response required reading the graph and dealing with the resulting fraction, extrapolating the time for the fraction to the time for the whole.

Section 30.2

1. a. Stem-and-leaf plot? No. It's just organized differently. Histogram? Yes. The data are now gathered into selected ranges of values, so we no longer know what the individual estimates were.

   b. Advantage: Counts indicated on the vertical scale. Disadvantage: Cannot tell the original scores because they are lumped together in the cells. If by "telling a story" is meant giving an overall impression of the data, the histogram is so much more common than the stem-and-leaf plot that it might be preferred. (1 Instructor only)

2. a. The cells are not of equal size.

   b. A pie chart might be usable, although there are 10 categories. Alternatively, the data could be put into cells of size $50,000 (but doing that loses lots of information, especially for the low incomes). (2 Instructor only)

3. a. pie chart, or bar chart

   b. histogram, or stem-and-leaf plot

   c. pie chart, or bar chart

   d. pie chart, or bar chart

   e. histogram, or line graph, or stem-and-leaf plot

   f. histogram, or stem-and-leaf plot

   g. histogram, or stem-and-leaf plot if the number of types of candy bars is of concern; bar graph if focus is on grams vs type of candy bar

   h. histogram, or line graph, or stem-and-leaf plot. The first two would be easiest to make as the weights are made.