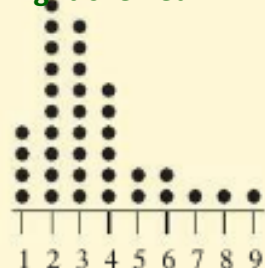**2.36 Center of plots** The figure shows dot plots for three sample data sets.

  a. For which, if any, data sets would you expect the mean and the median to be the same? Explain why.

  b. For which, if any, data sets would you expect the mean and the median to differ? Which would be larger, the mean or the median? Why?
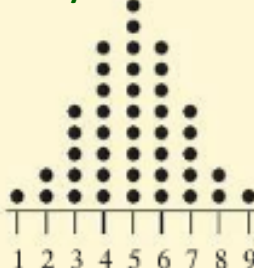
Mean > Median
Right-skewed
        Mean = Median
        Symmetric
                Mean = Median
                Symmetric

1 2 3 4 5 6 7 8 9   1 2 3 4 5 6 7 8 9   1 2 3 4 5 6 7 8 9
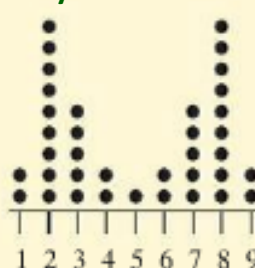
2.40 Net worth by degree The *Statistical Abstract of the United States* reported that in 2004 for those with a college education, the median net worth was $226,100 and the mean net worth was $851,300. For those with a high school diploma only, the values were $68,700 and $196,800.

  a. Explain how the mean and median could be so different for each group. **There are some extremely large values that inflated the mean, but not the median.**

  b. Which measure do you think gives a more realistic measure of a typical net worth, the mean or the median. Why? **The median. It is a resistant measure, not inflated by the outliers.**

2.48 Life expectancy The *Human Development Report 2006*, published by the United Nations, showed life expectancies by country. For Western Europe, the values reported were

Denmark 77, Portugal 77, Netherlands 78, Finland 78, Greece 78, Ireland 78, UK 78, Belgium 79, France 79,

Germany 79, Norway 79, Italy 80, Spain 80, Sweden 80, Switzerland 80.

For Africa, the values reported (many of which were substantially lower than five years earlier because of the prevalence of AIDS) were

Botswana 37, Zambia 37, Zimbabwe 37, Malawi 40, Angola 41, Nigeria 43, Rwanda 44, Uganda 47, Kenya 47, Mali 48, South Africa 49, Congo 52, Madagascar 55, Senegal 56, Sudan 56, Ghana 57.

  a. Which group (Western Europe or Africa) of life expectancies do you think has the larger standard deviation? Why? **The data points are more spread out.**

  b. Find the standard deviation for each group. Compare them to illustrate that s is larger for the group that shows more variability from the mean.

    Western Europe   **: 1.0 years**
    (s = 1.046536237 with mean = 236/3)
    Africa   **: 7.1 years**
    (s = 7.135591543 with mean = 373/8)

    Africa has a larger s.

2.50 Shape of home prices? According to the National (TRY) Association of Home Builders, the median selling price of new homes in the United States in January 2007 was $239,800. Which of the following is the most plausible value for the standard deviation: −$15,000, $1000, $60,000, or $1,000,000? Why? Explain what's unrealistic about each of the other values.

Not possible as s > 0 →

too small   **too big**

2.54 Female strength The High School Female Athletes data file on the text CD has data for 57 female high school athletes on the maximum number of pounds they were able to bench press. The data are roughly bell shaped, with $\bar{x} = 79.9$ and $s = 13.3$. Use the empirical rule to describe the distribution.

68% of the female athletes would be able to bench press between 66.6 and 93.2 pounds, 95% … between 533 and 106.5 pounds & nearly all … between 0 and 119.8 pounds.

2.56 Shape of cigarette taxes A recent summary for the di tribution of cigarette taxes (in cents) among the 50 stat and Washington, D.C. in the United States reported $\bar{x} = 73$ and $s = 48$. Based on these values, do you thin that this distribution is bell shaped? If so, why? If not, not, and what shape would you expect?

(0-73)/48 = - 1.52

The lowest possible value of 0 is 1.52 standard deviations below the mean. Thus the distribution is not bell-shaped. It is right-skewed.

2.60 Judging skew using $\bar{x}$ and s If the largest observation is less than 1 standard deviation above the mean, then the distribution tends to be skewed to the left. If the smallest observation is less than 1 standard deviation below the mean, then the distribution tends to be skewed to the right. A professor examined the results of the first exam given in her statistics class. The scores were

35 59 70 73 75 81 84 86

The mean and standard deviation are 70.4 and 16.7. Using these, determine if the distribution is either left or right skewed. Construct a dot plot to check.

Min = 35 ; (35-70.4)/16.7 = - 2.12
Max = 86; (86-70.4)/16.7 = 0.93
The min is 2.12 standard deviations below the mean.
The max is 0.93 standard deviations above the mean.
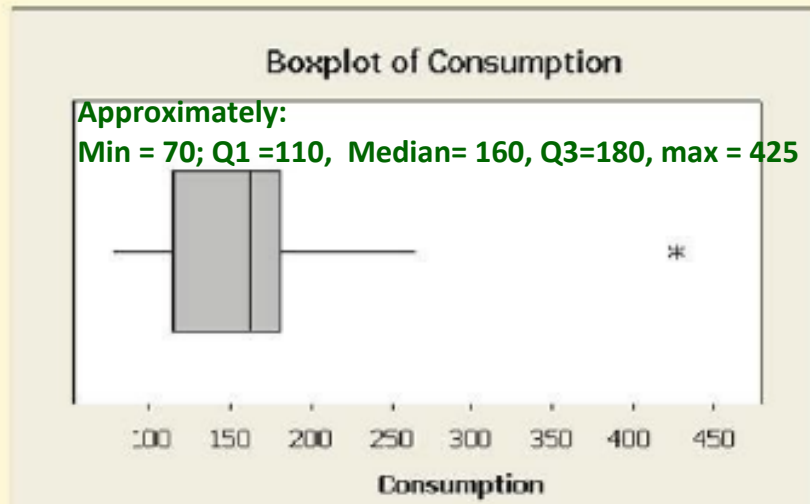**It is left-skewed.**

2.76 Energy statistics The Energy Information Admin-(TRY) istration records per capita consumption of energy by country. The 2006 data for the 27 nations that now make up the European Union are used to create the boxplot below. The energy values (in millions of BTUs) have a mean of 167.8 and a standard deviation of 72.8, and are roughly bell shaped, except for the value of 424.1 for Luxembourg.

2

a. Using the MINITAB box plot shown, give approximate values for the five-number summary and indicate whether any countries were judged to be potential outliers according to that plot.

b. Italy had a value of 138.7. How many standard deviations from the mean was it? **Italy: (138.7-167.8)/72.8= -0.40. It is 0.40 standard deviation below the mean.**

c. The United States is not in the data used below, but its value was 334. Relative to the distribution for the EU nations, how many standard deviations from the mean was it? **US: (334-167.8)/72.8= 2.28. it is 2.28 standard deviation above the mean.**

Approximately: Min = 70; Q1 =110, Median= 160, Q3=180, max = 425

Boxplot of Consumption

Consumption

2.78 **Air pollution**   Example 18 discussed EU carbon dioxide emissions, which had a mean of 8.3 and standard deviation of 3.6.

a. Canada's observation was 16.5. Find its z-score relative to the distribution of values for the EU nations, and interpret.

b. Sweden's observation was 5.0. Find its z-score, and interpret.

Canada: (16.5-8.3)/3.6= 2.28.
Canada is 2.28 standard deviation above the mean in terms of air pollution. Their air pollution is comparatively high.

Sweden: (5.0-8.3)/3.6= -0.92.
Sweden is 0.92 standard deviation below the mean in terms of air pollution. Their air pollution is comparatively high.