Jan. 17 Statistic for the day: Number of Wisconsin’s 33 Senators who voted in favor of a 1988 bill that allows the blind to hunt: 27
Source: Legislative Hotline, Madison, Wisc.
Assignment: Read Chapter 8 and do exercises 1, 2, 3, 8, 10

Age at Death of 20 British Rulers Revisited
60, 50, 47, 53, 48, 33, 71, 43, 65, 34, 56, 59, 49, 81, 67, 68, 49, 16, 86, 67

How should we turn this data into information?

Shape: Histogram

Histogram but different shape (The number of intervals has been changed from 8 to 10.)

Alternatives to median and IQR:
- Mean or average of the data.
- Standard deviation of the data.

The mean is easy. Just add up the numbers and divide by the sample size.
The standard deviation is a pain. Generally you will use a calculator or computer.

Rough way to approximate the standard deviation (for roughly bell-shaped distributions, such as the ages of British Rulers at death):

Look at the histogram and estimate the range of the middle 95% of the data. The standard deviation is about $\frac{1}{4}$ of this range.

Range = maximum minus minimum.
In Summary:

The standard deviation is roughly .25 times the range of the middle 95% of the data. The mean is the arithmetic average.

Conversely, if you want to visualize a histogram and you only know the mean and the standard deviation:
1. Put the center at the mean or the median.
2. Go out 2 standard deviations on either side of the center.
3. Draw a bell-shaped histogram centered at the mean and dropping off on either side so that 95% of the area is between the two S. D. marks from part 2.

Smoothing the histogram: The Normal Curve (Chapter 8)

A histogram tends to be rough. To replace it with a bell shaped curve:

Center the bell at the mean.

The middle 95% of the bell should be 4 standard deviations.

This makes systematic, accurate predictions possible, provided the bell shape is appropriate for the underlying population.
Research Question 1: If I built my doors 75 inches (6 feet 3 inches) high, what percent of the people would have to duck?

Research Question 2: How high should I build my doorways so that 99% of the people will not have to duck?

Z-Scores: Measurement in Standard Deviations

Given the mean (68), the standard deviation (4), and a value (height say 75) compute

\[
Z = \frac{75 - \text{mean}}{SD} = \frac{75 - 68}{4} = 1.75
\]

This says that 75 is 1.75 standard deviations above the mean.

Answer to Question 1: What percent of people would have to duck if I built my doors 75 inches high?

Recall: 75 has a Z-score of 1.75

From the standard normal table in the book: .96 or 96% of the distribution is below 1.75. Hence, .04 or 4% is above 1.75.

So 4% of the distribution is above 75 inches.

Compute your Z-score.

1. How many standard deviations are you above or below the mean.

Use:
Mean = 68 inches
Standard deviation = 4 inches

2. Now use the table from the book (p. 157) to determine what percentile you are.
Question 1: The value at $x$ is 75; find the amount of distribution above it. Convert 75 to $Z = 1.75$ and use Table 8.1 on p. 157.

Question 2: What is the value so that 99% of the distribution is below it? (called the 99th percentile.)

1. Look up the $Z$-score that corresponds to the 99th percentile. From the table: $Z = 2.33$.

2. Now convert it over to inches:

$$h_{99} = 68 + 2.33(4) = 77.3$$

Therefore, 99% of the distribution is shorter than 77.3 inches (6 foot 5.3 inches) and that's how high the door should be built.