1. A class survey in a large class for first-year college students asked, "About how many minutes do you study on a typical weeknight?" The mean response of the 463 students was $\bar{x} = 118$ minutes. Suppose that we know that the study time follows a Normal distribution with standard deviation $\sigma = 65$ minutes in the population of all first-year students at this university.

(a) Use the survey result to give a 99% confidence interval for the mean study time of all first-year students.

(b) What condition not yet mentioned must be met for your confidence interval to be valid?

2. Young men in North America and Europe (but not in Asia) tend to think they need more muscle to be attractive. One study presented 200 young American men with 100 images of men with various levels of muscle. Researchers measure level of muscle in kilograms per square meter (kg/m^2) of fat-free body mass. Typical young men have about 20 kg/m^2. Each subject chose two images, one that represented his own level of body muscle and one that he thought represented "what women prefer." The mean gap between self-image and "what women prefer" was 2.35 kg/m^2. Suppose that the "muscle gap" in the population of all young men has a Normal distribution with standard deviation 2.5 kg/m^2. Give a 90% confidence interval for the mean amount of muscle young men think they should add to be attractive to women. (They are wrong: women actually prefer a level close to that of typical men.)

3. A class survey in a large class for first-year college students asked, "About how many minutes do you study on a typical weeknight?" The mean response of the 463 students was $\bar{x} = 118$ minutes. Suppose that we know that the study time follows a Normal distribution with standard deviation $\sigma = 65$ minutes in the population of all first-year students at this university.

The above survey excluded one response. There were actually 464 responses to the class survey. One student claimed to study 60,000 minutes per night. We know he's joking, so we left out this value. If we did a calculation without looking at the data, we would get $\bar{x} = 247$ minutes for all 464 students. Now what is the 99% confidence interval for the population mean? (Continue to use $\sigma = 65$.) Compare the new interval with the one which leaves out the outlier. The message is clear: always look at your data, because outliers can greatly change your result.

4. A student reads that a 95% confidence interval for the mean ideal weight given by adult American women is 140 ± 1.4 pounds. Asked to explain the meaning of this interval, the student says, "95% of all adult American women would say that their ideal weight is between 138.6 and 141.4 pounds." Is the student right? Explain your answer.

5. How heavy a load (pounds) is needed to pull apart pieces of Douglas fir 4 inches long and 1.5 inches square? Here are data from students doing a laboratory exercise:

33190	32320	23040	24050	31860
33020	30930	30170	32590	32030
32720	31300	26520	30460	33650
28730	33280	32700	32340	31920

(a) We are willing to regard the wood pieces prepared for the lab session as an SRS of all similar pieces of Douglas fir. Engineers also commonly assume that characteristics of materials vary Normally. Make a graph to show the shape of the distribution for these data. Does it appear safe to assume that the Normality condition is satisfied? Suppose that the strength of pieces of wood like these follows a Normal distribution with standard deviation 3000 pounds.

(b) Give a 95% confidence interval for the mean load required to pull the wood apart.

6. Breast-feeding mothers secrete calcium into their milk. Some of the calcium may come from their bones, so mothers may lose bone mineral. Researchers measured the percent change in mineral content of the spines of 47 mothers during three months of breast-feeding. Here are the data:

-4.7	2.2	-6.5	-4.0	0.3	-2.5	-4.9	-7.8	-3.1	-1.0
-3.0	-4.9	-4.7	-2.3	0.4	-2.7	-1.0	-3.6	-3.8	-5.3
-0.8	-6.5	-5.2	-5.9	0.2	-5.3	-1.8	-2.0	-2.5	-2.2
-8.3	-5.2	-2.1	-0.3	-5.1	-2.1	-6.8	-4.3	-5.7	-7.0
-2.2	-5.6	-4.4	-3.3	-6.2	-6.8	1.7			

(a) The researchers are willing to consider these 47 women as an SRS from the population of all nursing mothers. Suppose that the percent change in this population has standard deviation $\sigma = 2.5\%$. Make a stemplot of the data to verify that the data follow a Normal distribution quite closely. (Don't forget that you need both a 0 and a -0 stem because there are both positive and negative values.)

(b) Use a 99% confidence interval to estimate the mean percent change in the population.

7. Sulfur compounds cause "off-odors" in wine, so winemakers want to know the odor threshold, the lowest concentration of a compound that the human nose can detect. The odor thresh- old for dimethyl sulfide (DMS) in trained wine tasters is about 25 micrograms per liter of wine (μg/L). The untrained noses of consumers may be less sensitive, however. Here are the DMS odor thresholds for 10 untrained students:

30	30	42	35	22	33	31	29	19	23

(a) Assume that the standard deviation of the odor threshold for untrained noses is known to be \sigma = 7 μg/L. Briefly discuss the other two "simple conditions," using a stemplot to verify that the distribution is roughly symmetric with no outliers.

(b) Give a 95% confidence interval for the mean DMS odor threshold among all students.

8. Here are the IQ test scores of 31 seventh-grade girls in a Midwest school district:

114	100	108	130	111	103	104	89	102	91
120	132	111	128	74	112	107	103	114	118
98	114	119	96	103	86	112	105	72	112
93									

(a) These 31 girls are an SRS of all seventh-grade girls in the school district. Suppose that the standard deviation of IQ scores in this population is known to be \sigma = 15. We expect the distribution of IQ scores to be close to Normal. Make a stemplot of the distribution of these 31 scores (split the stems) to verify that there are no major departures from Normality. You have now checked the "simple conditions" to the extent possible.

(b) Estimate the mean IQ score for all seventh-grade girls in the school district, using a 99% confidence interval.