Chapter 8

Section 8.1

Check Your Understanding, page 485:
1. We are 95% confident that the interval from 2.84 to 7.55 g captures the population standard deviation of the fat content of Brand X hot dogs.
2. If this sampling process were repeated many times, approximately 95% of the resulting confidence intervals would capture the population standard deviation of the fat content of Brand X hot dogs.
3. False. Once the interval is calculated, it either contains σ or it does not contain σ.

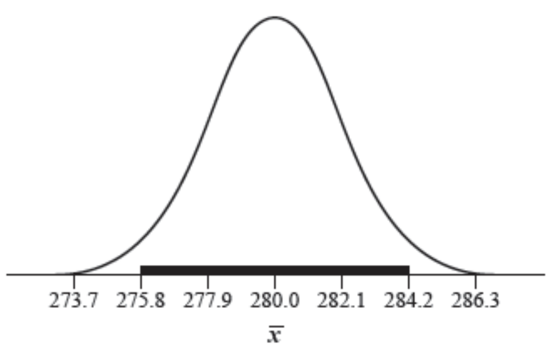
Exercises, page 489:
8.1 Use the sample mean number of pairs of shoes. In this case, $\bar{x} = 30.35$.

8.2 Use the sample variance of the pairs of shoes. In this case, $s_X^2 = 202.77$.

8.3 Use the sample proportion of those planning to attend the prom. In this case, $\hat{p} = \frac{36}{50} = 0.72$.

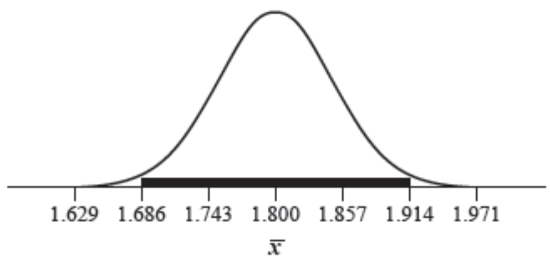
8.4 Use the sample proportion of those who would report cheating. In this case, $\hat{p} = \frac{19}{172} = 0.11$.

8.5 (a) Because the sample size is large ($n = 840 \geq 30$), the sampling distribution of $\bar{x}$ is approximately Normal with mean $\mu_{\bar{x}} = \mu = 280$. Because the sample size (840) is less than 10% of the large population, the standard deviation is $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{60}{\sqrt{840}} = 2.1$.
(b) The mean is 280. One standard deviation from the mean: 277.9 and 282.1; two standard deviations from the mean: 275.8 and 284.2; and three standard deviations from the mean: 273.7 and 286.3.



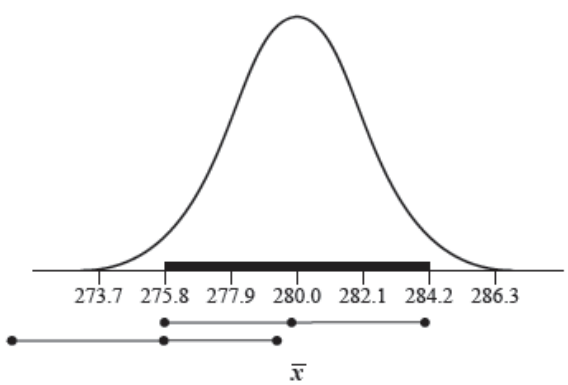
(c) About 95% of the $\bar{x}$ values will be within 2 standard deviations of the mean. Therefore, $m = 2(2.1) = 4.2$.
(d) About 95% because $\bar{x}$ will be within 2 standard deviations of the population mean in about 95% of all possible samples.

8.6 (a) Because the sample size is large ($n = 50 \geq 30$), the sampling distribution of $\bar{x}$ is approximately Normal with mean $\mu_{\bar{x}} = \mu_X = 1.8$. Because the sample size (50) is less than 10% of all trucks of this model, the standard deviation is $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{0.4}{\sqrt{50}} = 0.057$.
(b) The mean is 1.8. One standard deviation from the mean: 1.743 and 1.857; two standard deviations from the mean: 1.686 and 1.914; and three standard deviations from the mean: 1.629 and 1.971.

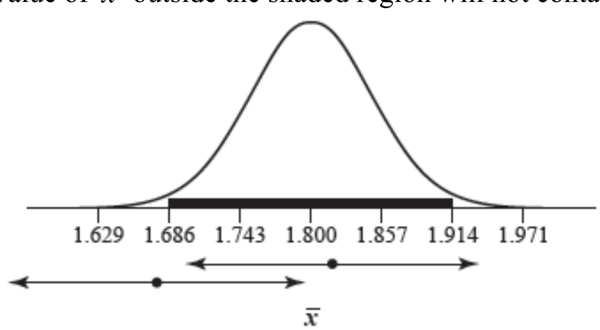


(c) About 95% of the $\bar{x}$ values will be within 2 standard deviations of the mean. Therefore, $m = 2(0.057) = 0.114$.
(d) About 95% because $\bar{x}$ will be within 2 standard deviations of the population mean in about 95% of all possible samples.

8.7 The sketch is given below. Both intervals will have the same length, but the interval with the value of $\bar{x}$ in the shaded region will contain the population mean (280), while the interval with the value of $\bar{x}$ outside the shaded region will not contain the population mean (280).



8.8 The sketch is given below. Both intervals will have the same length, but the interval with the value of $\bar{x}$ in the shaded region will contain the population mean (1.8), while the interval with the value of $\bar{x}$ outside the shaded region will not contain the population mean (1.8).



8.9 (a) We are 95% confident that the interval from 0.63 to 0.69 captures the true proportion of those who favor an amendment to the Constitution that would permit organized prayer in public schools.

(b) The point estimate $\hat{p}$ will be in the middle of the interval. Thus, $\hat{p} = \frac{0.63 + 0.69}{2} = 0.66$. The margin of error is the distance from the point estimate to the endpoints of the interval. Thus, margin of error = 0.69 – 0.66 = 0.03.

(c) Because the value 2/3 = 0.667 (and values less than 2/3) are in the interval, it is plausible that two-thirds or fewer of the population favor such an amendment. Thus, there is not convincing evidence that more than two-thirds of U.S. adults favor such an amendment.

8.10 (a) We are 95% confident that the interval from 0.56 to 0.62 captures the true proportion of U.S. adults who would like to lose weight.

(b) The point estimate $\hat{p}$ will be in the middle of the interval. Thus, $\hat{p} = \frac{0.56 + 0.62}{2} = 0.59$. The margin of error is the distance from the point estimate to the endpoints of the interval. Thus, margin of error = 0.62 – 0.59 = 0.03.

(c) Because all of the plausible values in the interval are above 0.5, there is convincing evidence that more than half of U.S. adults want to lose weight.

8.11 The figure shows that 4 of the 25 confidence intervals (16%) did not contain the true parameter. Therefore, 84% of the intervals actually did contain the true parameter, which suggests that these were 80% or 90% confidence intervals.

8.12 The figure shows that 100% of the 25 confidence intervals did contain the true mean. This suggests that the confidence level was quite high—probably 99%, but possibly 95%.

8.13 One of the practical difficulties would include non-response (those who are not available to respond or those who refuse to answer). For example, if people who were selected but do not respond have different opinions than the people who did respond, the estimated proportion may be off by much more than 3 percentage points. Another practical difficulty is response bias. For example, people might answer "yes" because they think they should, even if they don't really support the amendment.

8.14 One of the practical difficulties would include non-response (those who are not available to respond or those who refuse to answer). For example, if people who were selected but do not respond have different opinions than the people who did respond, the estimated proportion may be off by much more than 3 percentage points. Another practical difficulty is response bias. For example, people might answer "yes" because they know that they should lose weight, even if they really don't want to.

8.15 *Confidence interval*: We are 95% confident that the interval from 10.9 to 26.5 captures the true difference (girls – boys) in the mean number of pairs of shoes owned by girls and boys. *Confidence level*: If this sampling process were repeated many times, approximately 95% of the resulting confidence intervals would capture the true difference (girls – boys) in the mean number of pairs of shoes owned by girls and boys.

8.16 *Confidence interval*: We are 95% confident that the interval from 0.120 to 0.297 captures the true difference (younger – older) in the proportions of younger teens and older teens who include false information on their profiles. *Confidence level*: If this sampling process were repeated many times, approximately 95% of the resulting confidence intervals would capture the true difference (younger – older) in the proportions of younger teens and older teens who include false information on their profiles.

8.17 Yes. Because the 95% confidence interval does not include 0 as a plausible value for the difference in means, there is convincing evidence of a difference in the mean number of shoes for boys and girls.

8.18 Yes. Because the 95% confidence interval does not include 0 as a plausible value for the difference in proportions, there is convincing evidence of a difference in the proportion of younger teens and older teens who include false information on their profiles.

8.19 (a) Incorrect. The interval provides plausible values for the *mean* BMI of all women, not plausible values for individual BMI measurements, which will be much more variable.
(b) Incorrect. We shouldn't use the results of one sample to predict the results for future samples.
(c) Correct. A confidence interval provides an interval of plausible values for a parameter.
(d) Incorrect. The population mean always stays the same, regardless of the number of samples taken. The population mean will either be a value between 26.2 and 27.4 100% of the time or 0% of the time, not 95% of the time.
(e) Incorrect. We are 95% confident that the population mean is between 26.2 and 27.4, but that does not absolutely rule out any other possibility.

8.20 (a) Incorrect. The population mean is always the same, so the probability that μ is in the interval is either 0 or 1 (but we don't know which).
(b) Incorrect. The point estimate $\bar{x}$ will always be in the center of the confidence interval, so there is a 100% chance that $\bar{x}$ will be in the interval.
(c) Correct. This is the meaning of 95% confidence.
(d) Incorrect. It doesn't make sense to say that a sample contains an interval. Also, different samples will produce different intervals—there is nothing special about the interval (107.8, 116.2).
(e) Correct. The value of μ is always the same, so it is either always in the interval or always not in the interval.

8.21 b.

8.22 e.

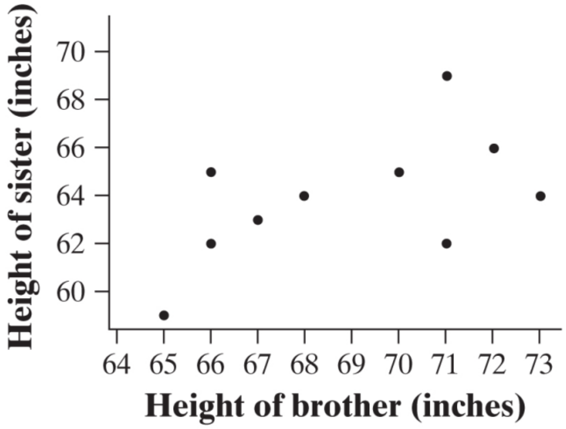
8.23 e.

8.24 c.

8.25 (a) This was an observational study. There was no treatment imposed on the pregnant women or the children, but rather they measured, after the fact, the amount of exposure to magnetic fields.

(b) No. We cannot make any conclusions about cause and effect because this was not an experiment. We can only conclude that there isn't convincing evidence that living near power lines is related to whether children develop cancer.

8.26 (a) The scatterplot (below) shows a weak, positive linear association between the two heights.



(b) Let y = sister's height and x = brother's height. The least squares regression line is $\hat{y} = 27.64 + 0.5270x$. For each increase of one inch in the brother's height, the predicted height of the sister will increase by 0.5270 inches.

(c) Tonya's predicted height is $\hat{y} = 27.64 + 0.5270(70) = 64.53$inches.

(d) Because the association is fairly weak, I don't think that the predicted height will be very close to the actual height. However, because the association is linear, it should be about equally likely to get a prediction that is too high or a prediction that is too low.