Homework Solutions – Chapters 6-7

Homework 6.1

1.
(a) $\sigma_{\bar{x}} = \frac{0.44}{\sqrt{81}} = 0.0489$
(b) [7.1042, 7.2958]

2.
(a) [2.896, 3.004] = [2.90, 3.00]
(b) 0.054
(c) [2.8856, 3.0144] = [2.89, 3.01]

3.
(a) [1.8367, 2.1633]
(b) [3.3628, 3.6372]
(c) ME(L)=0.1633, ME(M)=0.1372. Thus, the inference on the Magnolia leaves is more precise because it has a smaller margin of error.

4.
(a) decreases
(b) increases
(c) increases
(d) decreases
(e) decreases
(f) increases
(g) decreases

1. Fill in the blanks in the table below with the word *Increases* or *Decreases.*

		Margin of Error	Width	Precision
as *n*	Increases	Decreases	Decreases	Increases
	Decreases	Increases	Increases	Decreases
As *s*	Increases	Increases	Increases	Decreases
	Decreases	Decreases	Decreases	Increases
As Confidence Level	Increases	Increases	Increases	Decreases
	Decreases	Decreases	Decreases	Increases

Homework 6.2

1.
(a) [$12.76, $17.24]
(b) We interpret the confidence interval to mean that we are 99% sure that the true *mean* is somewhere between $12.76 and $17.24, thus, the union's claim that the true mean is $16 can not be denied. There is not evidence that the claim is false.

2.
(a) [11.183, 13.217].
(b) The margin of error is 1.017 grams.
(c) The width of the confidence interval is 2.034 grams.

Homework 6.3

1.
(a) n = (7.2 * 1.96 / 2)^2 = 49.8 or 50
(b) n = (7.2 * 1.96 / 1)^2 = 199.1 or 200
(c) (200-50)/50 * 100 = 300%
(d) n = (7.2 * 2.576 / 2)^2 = 86.0 or 86
(e) (86-50)/50 * 100 = 72%

Homework 6.4

1.
(a) 0.62
(b) $[0.56355, 0.67645] \approx [56.3\%, 67.6\%]$
(c) $0.05645 \approx 5.6\%$
(d) $[0.55273, 0.68727] \approx [55.2\%, 68.7\%]$
(e) $0.06727 \approx 6.7\%$
(f) Going from a 90% confidence interval to a 95% resulted in 1.1% more margin of error.

2.
(a) $\bar{p} = 18.9\%$, $ME = 2.3\%$, $[0.16557, 0.21203] \approx [16.6\%, 21.2\%]$
(b) $\bar{p} = 11.8\%$, $ME = 1.95\%$, $[0.09931, 0.13767] \approx [9.9\%, 13.8\%]$
(c) We see that a *smaller* point estimate (11.8%) resulted in a *smaller* margin of error (1.95%). In general, this is true until you get to a p-bar equal to 0.5. Larger than that, and the margin of error starts to decrease. The curve showing the margin of error as a function of p-bar, is an upside down U shape centered at 0.5. Thus, estimates are more precise when you have *extreme* values of p-bar, either very small or very large. Estimates are less precise the closer the true proportion is to 0.5. In other words, there is more uncertainty when things are 50-50.

(d) $\bar{p} = 69.3\%$, $ME = 2.8\%$, $[0.665, 0.720] \approx [66.5\%, 72.0\%]$

3. $\bar{p} = 53.3\%$, $ME = 10.6\%$, $[0.42739, 0.63927] \approx [42.7\%, 63.9\%]$. We have a very large margin of error because we have a relatively small sample (60). When we are dealing with proportions, we have a different notion of what large and small sample sizes are.

4.   answer: d

Homework 6.5

1. $n = \left(\dfrac{1.645}{0.05}\right)^2 0.5\,(1 - 0.5) = 270.6 \implies 271$

2.   Answer: c

Homework 7.1

1.   b
2.   a
3.   d
4.   e
5.   g
6.   b

Homework 7.2

1.

Problem Type	Large sample Z test
Hypothesis	$H_o : \mu = 2.2$ vs. $H_a : \mu \neq 2.2$
P-value	$0.00156 \approx 0.002$
Decision	Since $0.002 < 0.05$, reject the null hypothesis
Conclusion	The evidence revealed by the data is strong enough at the 5% significance level to claim that the true mean completion time is not 2.2 minutes.

2.   (a)

Problem Type	Large sample Z test
Hypothesis	$H_o : \mu \leq 50$ vs. $H_a : \mu > 50$

P-value	$0.1151 \approx 0.12$
Decision	Since $0.12 > 0.1$, fail to reject the null hypothesis
Conclusion	There is not enough evidence to say that the true mean amount of garbage per household per week exceeds 50 lbs.

(b)

Problem Type	Large sample Z test
Hypothesis	$H_o : \mu \leq 50$ vs. $H_a : \mu > 50$
P-value	$0.00256 \approx 0.003$
Decision	Since $0.003 < 0.1$, reject the null hypothesis
Conclusion	There is evidence that the true mean amount of garbage per household per week exceeds 50 lbs.

3.

Problem Type	Large sample Z test
Hypothesis	$H_o : \mu_{new} \geq 9$ vs. $H_a : \mu_{new} < 9$
P-value	$5.49 * 10^{-9} = 0.00000000549 \approx 0$
Decision	Since the p-value is practically 0, this says that there is virtually no risk in rejecting the null hypothesis. Thus, we will reject the null hypothesis
Conclusion	There is strong evidence that the average time for the new process is less than for the old process.

4. Answer: *a*
5. Answer: *c*

Homework 7.3

1.
(a) The statistics indicate that the advertising campaign will increase sales when in fact they will not.
(b) The manager will adopt the advertising campaign, expecting sales to increase, but sales will not increase. This causes the company to spend more money and get nothing in return.
(c) Concluding that the advertising campaign is not effective when it really is.
(d) The manager will not adopt the new advertising campaign, when it does really work. Thus, the company will miss an opportunity to make more money.

2.
(a) Concluding that the company's claim is invalid, when in fact it is.
(b) The FDA will take unwarranted action against the company, perhaps costing the company loss in sales due to bad publicity and extra costs to fight the action by the FDA.
(c) Reach the conclusion that there is not enough evidence to say that the company's claim is invalid when it really is invalid.
(d) No action will be taken by the FDA and as a result, the erroneous label may cause people to not get all the protein that they need!

Homework 7.4

1.

Problem Type	Large sample Z test
Hypothesis	$H_o : \mu = 250{,}000$ $vs.$ $H_a : \mu \neq 250{,}000$
P-value	$0.104 \approx 10.4\%$
Decision	This is a close call. If we reject the null hypothesis, there is a 10.4% chance that we are wrong. We will conclude to fail to reject the null hypothesis.
Conclusion	There is not strong evidence that the true mean salary differs from \$250,000

Homework 7.5

1.

Problem Type	Large sample Z test
Hypothesis	$H_o : \mu = 250{,}000$ $vs.$ $H_a : \mu \neq 250{,}000$
95% Confidence Interval	[\$224,538, \$252,380]
Decision	Since \$250,000 is in the confidence interval, we fail to reject the null hypothesis.
Conclusion	There is not strong evidence that the true mean salary differs from \$250,000. The true mean could be \$250,000.

2. False, we would fail to reject the null hypothesis because 0.005 is in the confidence interval.
3. $H_o : \mu \geq 72$ $vs.$ $H_a : \mu < 72$. Since 72 greater than upper bound, 71 (outside the CI), we reject the null hypothesis.
4. $H_o : \mu \leq 40$ $vs.$ $H_a : \mu > 40$. Since 40 is greater than the lower bound (in the CI), we fail to reject the null hypothesis

Homework 7.6

1.

Problem Type	Small sample t-test
Hypothesis	$H_o : \mu \leq 14$ $vs.$ $H_a : \mu > 14$
P-value	$0.1485 \approx 15\%$
Decision	Since $0.1485 > 0.1$, fail to reject the null hypothesis
Conclusion	There is not strong evidence that the new plan increases average sales volume.

2.

Problem Type	Small sample t-test
Hypothesis	$H_o : \mu \geq 110$ vs. $H_a : \mu < 110$
P-value	$0.0319 \approx 3\%$
Decision	Since $0.03 < 0.05$, reject the null hypothesis
Conclusion	The evidence supplied by the data is sufficient to state the average weight of a serving of nuts is less than 110 grams.

Homework 7.7

1. Answer: *b*
2.

Problem Type	Proportion z-test
Hypothesis	$H_o : p \leq 0.3$ vs. $H_a : p > 0.3$
$\bar{p}$	$0.35 \approx 35\%$
P-value	$0.0145 \approx 1\%$
Decision	Since $0.0145 < 0.05$, reject the null hypothesis
Conclusion	There is strong evidence that the statement is true.

3.

Problem Type	Proportion z-test
Hypothesis	$H_o : p \geq 0.5$ vs. $H_a : p < 0.5$
$\bar{p}$	$0.47 \approx 47\%$
P-value	$0.0619 \approx 6\%$
Decision	Since $0.0619 > 0.05$, fail to reject the null hypothesis
Conclusion	There is not evidence that the true proportion of college students who are lower classmen is less than 50%

Problem Type	Proportion z-test
Hypothesis	$H_o : p \leq 0.45$ vs. $H_a : p > 0.45$
$\bar{p}$	$0.47 \approx 47\%$
P-value	0.2302
Decision	Since $0.2302 > 0.05$, fail to reject the null hypothesis
Conclusion	There is not strong evidence that the true proportion of college students who are lower classmen is in excess of 45%.