Stats for Strategy HOMEWORK 1 Solution
(updated 01/05/2015)

B. Concepts

3.84  
• Population = All undergraduate college students ages 18–24  
• Sample = 2036 undergraduate college students who are surveyed

3.91  
(a)  
• Population = all U.S. college students  
• Sample = 17,096 surveyed students

(b)  
• Population = all restaurant workers  
• Sample = 100 selected restaurant workers

(c)  
• Population = 584 longleaf pines in the tract  
• Sample = 40 trees whose diameters were measured

SE 3.33  
(a) The number 43 is a sample statistic. Converting to a proportion, \( \hat{p} = 0.43 \)

(b) The number 52% is a population parameter: \( p = 0.52 \)

SE 3.34  
(a) \( p = 0.68 \) is a population proportion (parameter.)

(b) \( \hat{p} = 0.73 \) is a sample proportion (statistic.)

SE 3.44  
(a) The number 2.503 is a population parameter (mean): \( \mu = 2.503 \)

(b) The number 2.515 is a sample statistic (mean): \( \bar{x} = 2.515 \)

C. Means

• Exercise 6.59

(a)

\( H_A: \mu > 31 \)
\( H_0: \mu \leq 31 \)

(b)

\( H_A: \mu \neq 4 \)
\( H_0: \mu = 4 \)

(c)

\( H_A: \mu < 1400 \)
\( H_0: \mu \geq 1400 \)
7.3

(a) \( \mu = \text{mean monthly rent, in \$} \)

(b) The condition would be that the rental rates in the sample constitute all of the advertised rental rates (in which case the sample is the same as the population.)

(c) \( \bar{x} = 543 \)

\[ s = 86.42 \]

\[ n = 10 \implies \text{degrees of freedom are } df = 9 \]

A 95\% confidence interval for \( \mu \) is

\[ \bar{x} \pm t^* \frac{s}{\sqrt{n}} = 543 \pm (2.262) \frac{86.42}{\sqrt{10}} = 543 \pm 61.82 = [481.18, 604.82] \]

(d) The MINITAB answer is \([481.20, 604.80]\)

7.4

(a) The margin of error would decrease (be smaller) since creating 90\% confidence requires less effort than 95\% confidence.

(b) A 90\% confidence interval for \( \mu \) by calculator is \([492.91, 593.09]\)

(c) MINITAB answer: \([492.90, 593.10]\)

7.5

(a) Apply Four Steps:

1. (Define)
   \( \mu = \text{mean monthly rent, in \$} \)

   \[ H_k: \mu > 550 \]
   \[ H_0: \mu \leq 550 \]

2. (Calculate)

   \[ t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{543 - 550}{86.42/\sqrt{10}} = -0.256 \]

   \[ df = 9 \text{ From the shaded bell curve, } P\text{-value} = P(t > -0.256) > 0.50 \]

3. (Decide) Fail to Reject \( H_0 \) since \( P\text{-value} > 0.50 > 0.10 = \alpha \)

4. (Interpret) There is not sufficient evidence to show that the mean monthly rent in the area exceeds \$550.

(b) From MINITAB, \( P\text{-value} = [0.598] \)

(c) Yes, the answers are consistent since \( 0.598 > 0.50 \).

(d) The \( P\text{-value} \) is the risk of mistakenly rejecting \( H_0 \). To keep this risk low we need strong evidence against \( H_0 \) if we decide to reject it.

But comparing \( \bar{x} = 543 \) with \( H_0: \mu \leq 550 \) shows that the sample evidence \( \bar{x} = 543 \) actually supports \( H_0 \). So rejecting \( H_0 \) would be foolish and very risky! (59.8\% risk)
• 7.7 Parts (a) and (b) of this exercise together cover the Four Steps:

1. (Define)
   \[ \mu = \% \text{ change in sales this month compared to last month, averaged over \text{ALL} stores} \]
   \[ H_A: \mu \neq 0 \]
   \[ H_0: \mu = 0 \]

2. (Calculate)
   \[ t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{-3.2 - 0}{\frac{12}{\sqrt{40}}} = -1.687 \quad df = 39 \implies \text{Use } df = 30 \text{ in } t \text{ table} \]
   \[ 1.310 < 1.687 < 1.697 \implies 0.05 < \text{right shaded area} < 0.10 \implies 0.10 < P\text{-value} < 0.20 \]

3. (Decide)
   Fail to Reject \( H_0 \) since \( P\text{-value} > 0.10 > 0.05 = \alpha \)

4. (Interpret)
   There is not sufficient evidence to show that average store sales differ this month compared to last month.

   (c) No! The test is for the average change in sales for all stores, not \textit{individual} stores. An individual store may experience decreased sales (a negative change), increased sales (a positive change), or no change at all, regardless of the average.

• 7.7, Part 2
   \[ P\text{-value} = [0.100] \text{ from a 1-Sample } t \text{ test in MINITAB.} \]

• 7.40

(a) 1. (Define)
   \[ \mu = \text{mean increase in annual credit card charges (by all customers who currently charge at least $4000 annually) if annual credit-card fee is eliminated} \]
   \[ H_A: \mu > 0 \]
   \[ H_0: \mu \leq 0 \]

2. (Calculate) \[ t = 6.304 \quad P\text{-value} < .0005 \]

3. (Decide) \[ \text{Reject } H_0 \text{ since } P\text{-value} < .0005 < .01 = \alpha \]

4. (Interpret) There is sufficient evidence to show that mean annual credit card charges for all customers who currently charge at least $4000 annually will increase in response to the offer.

(b) A 95% confidence interval for \( \mu \) is \([\$400.33, \$769.67]\)

• 7.40 Part 2

(a) \[ P\text{-value} = [0.000] \]

(b) \([\$400.90, \$769.10]\)
D. Proportions

- SE 8.3
  
  \[ p = \text{proportion of all customers willing to pay $100 for the upgrade} \]
  
  A 95% confidence interval for \( p \) is
  
  \[ \hat{p} \pm 1.96 \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}} = .34 \pm 1.96 \sqrt{\frac{(.34)(.66)}{50}} \]
  
  \[ = .34 \pm .131 \]
  
  \[ = (0.209, .471) \]

- SE 8.3 Part 2
  
  \[ (0.208697, .471303) \]

- SE 8.7

  1. (Define)
     
     \( p = \text{proportion of all customers willing to pay $100 for the upgrade} \)
     
     \( H_A: p > .20 \)
     
     \( H_0: p \leq .20 \)

  2. (Calculate)
     
     \[ Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{.34 - .20}{\sqrt{\frac{(.20)(.80)}{50}}} = 2.47 \]
     
     \( P\text{-value} = 0.0068 \)

  3. (Decide)
     
     Reject \( H_0 \) since \( P\text{-value} = .0068 < .10 = \alpha \).

  4. (Interpret)
     
     There is sufficient evidence to show that more than 20% of customers are willing to buy the upgrade.

     (c) Yes, produce and market the upgrade!

- SE 8.7 Part 2

  \( P\text{-value} = [0.007] \)

(continued)
• 8.38

(a) (0.1459, 0.2337) (hand calculations)

(b) (0.145926, 0.233704) (MINITAB)

• 8.46

(a) 1. \( p = \) proportion of all coffee drinkers who prefer fresh-brewed coffee

\[ H_A: p > 0.50 \]
\[ H_0: p \leq 0.50 \]

2. \( P\)-value = 0.0985 (hand calculations)

3. Fail to Reject \( H_0 \) since \( P\)-value = 0.0985 > 0.05 = \( \alpha \)

4. There is not sufficient evidence to show that a majority of coffee drinkers prefer fresh-brewed coffee.

(b) A 90% confidence interval for \( p \) is \((0.4786, 0.6880)\) (hand calculations)

(c) From MINITAB, \( P\)-value = \( 0.098 \) and a 90% CI is \((0.478644, 0.688023)\)

(continued)
E. Additional

(1) (a) Population = all college freshmen

(b) \( p = \) proportion of all freshmen who gain 15 pounds or more during their first year of college

(c) \( \mu = \) average weight gain (in pounds) during the first year of college by all freshmen

(d) The answer is A

(e) B The 99% CI contains numbers which are less than 15.

(f) E What’s the minimum sample size for \textit{proportions} formulas? For \textit{means} formulas? (See Bus Stats Review on Notebook p. 26)

(g) C There’s no available CI to use for an answer.

(2) (a)

1. (Define) \( \mu = \) average daily revenue \textit{this winter} (dollars)

   \[ H_A: \mu \neq 420 \]

   \[ H_0: \mu = 420 \]

2. (Calculate) \( t = -2.030 \implies 0.05 < \text{\textit{P-value}} < 0.10 \)

3. (Decide) Since \( 0.05 < \text{\textit{P-value}} < 0.10 \) and \( \alpha = 0.08 \), no decision is possible!

4. (Interpret) No interpretation is possible.

(b) \bullet \text{Exact P-value from MINITAB} = 0.082

\bullet

Step 3. (Decide) \text{Fail to Reject} \( H_0 \) since \( \text{\textit{P-value}} = 0.082 > 0.08 = \alpha \)

Step 4. (Interpret) There is not sufficient evidence to show that this winter’s average daily revenue differs from last year’s average of $420.

(3) (a) All U.S. stocks which paid dividends of at most 5% within the past year

(b) \( \mu = \) mean percentage dividend for all U.S. stocks which paid dividends of 5% or less within the past year.

(c) \( \bar{x} = 2.60 \)

(d) The answer is C

(e) \( 0.15 < \text{\textit{P-value}} < 0.20 \)

(f) There is not enough evidence to show that the mean dividend for all stocks of interest to Firm A exceeds 2%.