A. Concepts

3.21 (a) Population = all eating and drinking establishments in the city

(b) Population = all constituents in the Congressperson's district.

(c) Population = all auto insurance claims filed during that month

3.70 (a) The number 43 is a sample statistic. Converting to a proportion, $\widehat{p} = \boxed{0.43}$

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

3.71 (a) $p = \boxed{0.68}$ is a population proportion (parameter.)

(b) $\widehat{p} = \boxed{0.73}$ is a sample proportion (statistic.)

3.85 (a) The number 2.503 is a population parameter (mean): $\mu = \boxed{2.503}$

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

B. Means

- Exercise 6.59

(a)

$$H_{\text{A}}\colon \mu > 31$$
$$H_0\colon \mu \leq 31$$

(b)

$$H_{\text{A}}\colon \mu \neq 4$$
$$H_0\colon \mu = 4$$

(c)

$$H_{\text{A}}\colon \mu < 1400$$
$$H_0\colon \mu \geq 1400$$

(continued)

- 7.3

  (a) μ = mean monthly rent, in \$
  $\bar{x} = 543$
  $s = 86.42$
  $n = 10 \implies$ degrees of freedom are $df = 9$

  A 95% confidence interval for μ is

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

  (b) The MINITAB answer is $\boxed{(\$481.20,\ \$604.80)}$

- 7.4

  (a) The margin of error would increase (in order to cover the extra 4% in confidence.)

  (b) A 99% confidence interval for μ is (by calculator)

  (\$454.19, \$631.81)

  (c) MINITAB answer: (\$454.20, \$631.80)

- 7.5

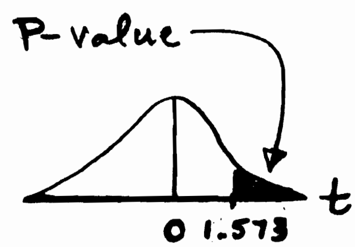
  (a) Apply Four Steps:

  1. **(Define)**

     μ = mean monthly rent, in \$

     H_A: $\mu > 500$
     H_0: $\mu \leq 500$

  2. **(Calculate)**

  $$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{543 - 500}{86.42/\sqrt{10}} = 1.573$$

  $df = 9 \qquad P\text{-value} = P(t > 1.573)$

  Notice that $1.383 < t = 1.573 < 1.823$

  $\implies .05 < P\text{-value} < .10$

  3. **(Decide)** Reject H_0 since P-value $\leq .10 = \alpha$

  4. **(Interpret)** There is sufficient evidence to show that the mean monthly rent in the area exceeds \$500.

  (b) From MINITAB, P-value = $\boxed{0.075}$

  (c) Yes, the answers are consistent since

  $$.05 < .075 < .10$$

- 7.7 Parts (a) and (b) of this exercise together cover the Four Steps:

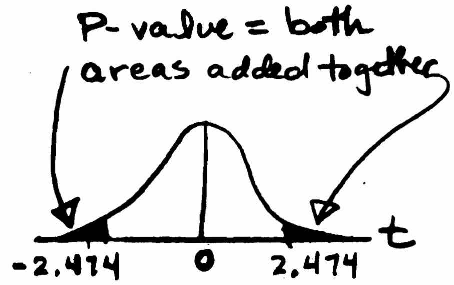
  1. (Define)
     μ = % change in sales this month compared to last month, averaged over all stores

$$H_A\colon\ \mu \neq 0$$
$$H_0\colon\ \mu = 0$$

  2. (Calculate)

     $t = \frac{4.9-0}{\frac{14}{\sqrt{50}}} = 2.474 \quad df = 49 \Longrightarrow$ Use $df = 40$ in t table

     $.01 < P\text{-value} < .02$



  3. (Decide)
     Reject H_0 since P-value $< .02 < .05 = \alpha$.

  4. (Interpret)
     There is sufficient evidence to show that average store sales differ this month compared to last month.

  (c) No, this conclusion is about the mean change in sales for all stores, not about changes in individual stores. An individual store may suffer decreased sales (a negative change.)

- 7.7, Part 2
  P-value = 0.017

- 7.40

  (a) 1. (Define)
  μ = mean increase in annual credit card charges by all customers who currently charge at least \$4000 annually.

$$H_A\colon\ \mu > 0$$
$$H_0\colon\ \mu \leq 0$$

  2. (Calculate) $t = 52.097$ P-value $< .0005$

  3. (Decide) Reject H_0 since P-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 μ is (\$370.34, \$399.66)

- 7.40 Part 2

  (a) P-value = 0.000
  (b) (\$370.46, \$399.54)

(continued)

C. Proportions

- 8.1

  p = proportion of all customers willing to pay \$100 for the upgrade

  A 95% confidence interval for p is

$$\widehat{p} \pm 1.96\sqrt{\frac{\widehat{p}(1-\widehat{p})}{n}} = .34 \pm 1.96\sqrt{\frac{(.34)(.66)}{50}}$$

$$= .34 \pm .131$$

$$= \boxed{(.209,\ .471)}$$

- 8.1 Part 2

  $\boxed{(.208697,\ .471303)}$

- 8.6

  1. (Define)

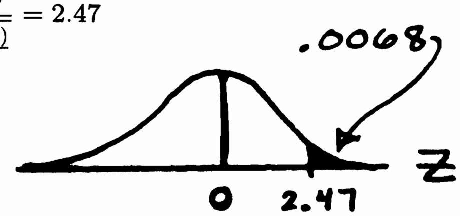
     p = proportion of all customers willing to pay \$100 for the upgrade

$$H_A\colon\ p > .20$$
$$H_0\colon\ p \leq .20$$

  2. (Calculate)

$$Z = \frac{\widehat{p} - p_0}{\sqrt{\frac{p_0\,(1-p_0)}{n}}} = \frac{.34 - .20}{\sqrt{\frac{(.20)(.80)}{50}}} = 2.47$$

     P-value= $\boxed{0.0068}$



  3. (Decide)

     Reject H_0 since P-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!

- 8.6 Part 2

  P-value = $\boxed{0.007}$

(continued)

- 8.44

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

$$H_A\colon\ p > .50$$
$$H_0\colon\ p \leq .50$$

2. P-value= .0606

3. Fail to Reject H_0 since P-value $= .0606 > .05 = \alpha$

4. There is insufficient evidence to show that a majority of coffee drinkers prefer fresh-brewed coffee.

(b) A 90% confidence interval for p is $\boxed{(.496,\ .704)}$

(c) From MINITAB, P-value = $\boxed{0.061}$ and a 90% CI is $\boxed{(.496,\ .704)}$

(continued)

D. Additional

(1) (a) Population = all college freshmen

(or perhaps)

Population = all college freshmen in the 2009/2010 school year

(if we want to impose a particular time frame.)

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

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

(2) (a)

1. (Define) μ = average daily revenue this winter (dollars)

$$H_A\colon \mu \neq 420$$
$$H_0\colon \mu = 420$$

2. (Calculate) $t = -2.030 \implies .05 < P\text{-value} < .10$

3. (Decide) Since $.05 < P$-value $< .10$ and $\alpha = .08$, no decision is possible.

4. (Interpret) No English interpretation is possible.

(b)
- Exact P-value from MINITAB = 0.082
-

Step 3. (Decide) Fail to Reject H_0 since $P\text{-value} = 0.082 > .08 = \alpha$

Step 4. (Interpret)

There is insufficient 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) μ = 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) $.15 < P\text{-value} < .20$

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