Lesson 7 Review Problem Solutions- Workbook + Book

PROBLEM # 7.6 In this case, we need to assume that the population is normally distributed and the population standard deviation is known.

PROBLEM # 7.8 When n < 30, we must assume that the population is approximately normally distributed.

PROBLEM # 7.9 Referring to the 0.025 column and the d.f. = 19 row of the t table, the value of t corresponding to an upper tail area of 0.025 is t = 2.093.

PROBLEM # 7.11

a) P(t >=A)= 0.025

$P(t \geq A) = 0.025$. From the 0.025 column and the d.f. = 25 row of the t table, A = 2.060.

b) P(t=<A) = 0.10

$P(t \leq A) = 0.10$. Referring to the 0.10 column and the d.f. = 25 row of the t table, the value of t corresponding to a right-tail area of 0.10 is t = 1.316. Since the curve is symmetrical, the value of t for a left-tail area of 0.10 is A = -1.316.

c) P(-A =< t <= A) = 0.98

$P(-A \leq t \leq A) = 0.98$. In this case, each tail will have an area of (1 - 0.98)/2 = 0.01. Referring to the 0.01 column and the d.f. = 25 row of the t table, A = 2.485.

PROBLEM # 7.17

For the 99% level of confidence, z = 2.58. The maximum likely error is e = 0.02 (2 percentage points). If we make no estimate regarding the actual population proportion, we can be conservative and use p = 0.5. The recommended sample size would be:

$$n = \frac{z^2 p(1-p)}{e^2} = \frac{2.58^2(0.5)(1-0.5)}{0.02^2} = 4160.25$$, rounded up to 4161

Persons who are aware that Count Chocula is a kid's cereal, and that senior citizens don't tend to consume the product, might want to use a lower estimate, such as p = 0.10. In this case, we would end up with a recommended sample size of just 1498.

PROBLEM # 7.18

Using the Estimators workbook that accompanies Data Analysis Plus:

	A	B	C	D	E
1	**z-Estimate of a Proportion**				
2					
3	**Sample proportion**	0.20	**Confidence Interval Estimate**		
4	**Sample size**	400	**0.200**	±	**0.039**
5	**Confidence level**	0.95	**Lower confidence limit**		**0.161**
6			**Upper confidence limit**		**0.239**

PROBLEM # 7.19

point estimate of the population proportion.

point estimate of π: $p = \frac{450}{1000} = 0.45$

a. Confidence interval estimate for the population proportion.

confidence interval for π:0.419 to 0.481

b. Confidence level and the confidence coefficient.

confidence level: 95%; confidence coefficient: 0.95

Understanding the Basics: Suggested Problems from the Book.

Population mean σ known-Suggested: page 314, # 2, 3, 8

2. a. $32 \pm 1.645\ (6/\sqrt{50})$

   32 ± 1.4 or 30.6 to 33.4

   b. $32 \pm 1.96\ (6/\sqrt{50})$

   32 ± 1.66 or 30.34 to 33.66

   c. $32 \pm 2.576\ (6/\sqrt{50})$

   32 ± 2.19 or 29.81 to 34.19

3. a. $80 \pm 1.96\ (15/\sqrt{60})$

   80 ± 3.8 or 76.2 to 83.8

   b. $80 \pm 1.96\ (15/\sqrt{120})$

   80 ± 2.68 or 77.32 to 82.68

   c. Larger sample provides a smaller margin of error.

8. a. Since *n* is small, an assumption that the population is at least approximately normal is required.

   b. $z_{.025}(\sigma/\sqrt{n}) = 1.96(5/\sqrt{10}) = 3.1$

   c. $z_{.005}(\sigma/\sqrt{n}) = 2.576(5/\sqrt{10}) = 4.1$

Population mean σ unknown-Suggested: page 322 # 11,19,21 (webfile: alcohol)

11. a. .025

   b. 1 - .10 = .90

c. .05

d. .01

e. 1 – 2(.025) = .95

f. 1 – 2(.05) = .90

19. a. $t_{.025}(s/\sqrt{n})$ $df = 44$

$t_{.025} = 2.015$ $s = 65$

$2.015(65/\sqrt{45}) = 19.52$ or approximately \$20

b. $\bar{x} \pm t_{.025}(s/\sqrt{n})$

273 ± 20 or 253 to 293

c. At 95% confidence, the population mean is between \$253 and \$293. This is definitely above the \$229 level of 2 years ago. Hotel room rates are increasing.

The point estimate of the increase is \$273 - \$229 = \$44 or 19%.

21. $\bar{x} = \frac{\Sigma x_i}{n} = \frac{2600}{20} = 130$ liters of alcoholic beverages

$$s = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{81244}{20-1}} = 65.39$$

$t_{.025} = 2.093$ $df = 19$

95% confidence interval: $\bar{x} \pm t_{.025}(s/\sqrt{n})$

$130 \pm 2.093(65.39/\sqrt{20})$

130 ± 30.60 or 99.40 to 160.60 liters per year

Determining the sample size-Suggested: page 327, # 27,30

27. Planning value $\sigma = \frac{45{,}000 - 30{,}000}{4} = 3750$

a. $n = \frac{z_{.025}^2 \sigma^2}{E^2} = \frac{(1.96)^2(3750)^2}{(500)^2} = 216.09$ Use $n = 217$

b. $n = \frac{(1.96)^2(3750)^2}{(200)^2} = 1350.56$ Use $n = 1351$

c. $n = \frac{(1.96)^2(3750)^2}{(100)^2} = 5402.25$ Use $n = 5403$

d. Sampling 5403 college graduates to obtain the $100 margin of error would be viewed as too expensive and too much effort by most researchers.

30. Planning value $\sigma = \frac{60-5}{4} = 13.75$

$$n = \frac{z_{.025}^2\sigma^2}{E^2} = \frac{(1.96)^2(13.75)^2}{(3)^2} = 80.70 \quad \text{Use } n = 81$$

Population Proportion

Determining the sample size-Suggested: page 331, # 31,37 (webfile: job satisfaction), 43

31. a. $\bar{p}$ = 100/400 = .25

b. $\sqrt{\frac{\bar{p}(1-\bar{p})}{n}} = \sqrt{\frac{.25(.75)}{400}} = .0217$

c. $\bar{p} \pm z_{.025}\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$

.25 ± 1.96 (.0217)

.25 ± .0424 or .2076 to .2924

37. a. $\bar{p}$ = 473/1100 = .43

b. $z_{.025}\sqrt{\frac{\bar{p}(1-\bar{p})}{n}} = 1.96\sqrt{\frac{.43(1-.43)}{1100}} = .0293$

c. $\bar{p}$ ± .0293

.43 ± .0293 or .4007 to .4593

d. With roughly 40% to 46% of employees surveyed indicating strong dissatisfaction and with the high cost of finding successors, employers should take steps to improve employee satisfaction. The survey suggested employers may anticipate high employee turnover costs if employee dissatisfaction remains at the current level.

43. a. Margin of Error $= z_{\alpha/2}\sqrt{\frac{\bar{p}(1-\bar{p})}{n}} = 1.96\sqrt{\frac{(.53)(.47)}{1500}} = .0253$

95% Confidence Interval: .53 ± .0253 or .5047 to .5553

b. Margin of Error = $1.96\sqrt{\frac{(.31)(.69)}{1500}} = .0234$

95% Confidence Interval: .31 ± .0234 or .2866 to .3334

c. Margin of Error = $1.96\sqrt{\frac{(.05)(.95)}{1500}} = .0110$

95% Confidence Interval: .05 ± .0110 or .039 to .061

d. The margin of error decreases as $\bar{p}$ gets smaller. If the margin of error for all of the interval estimates must be less than a given value (say .03), an estimate of the largest proportion should be used as a planning value. Using $p^* = .50$ as a planning value guarantees that the margin of error for all the interval estimates will be small enough.

End of chapter problems: page 335, # 45

45. a. $\bar{x} \pm t_{.025}(s/\sqrt{n})$ $df = 63$ $t_{.025} = 1.998$

$252.45 \pm 1.998\,(74.50/\sqrt{64})$

252.45 ± 18.61 or \$233.84 to \$271.06

b. Yes. the lower limit for the population mean at Niagara Falls is \$233.84 which is greater than \$215.60.