12 PTS each

Name Key 96/96

Date ___/___/______

Illowsky – Chapt. 9 & 10
Larson – Chapt. 7 & 8

Provide an appropriate response.

1) A fast food outlet claims that the mean waiting time in line is less than 3.5 minutes. A random sample of 60 customers has a mean of 3.6 minutes with a population standard deviation of 0.6 minute. If $\alpha = 0.05$, test the fast food outlet's claim using critical values and rejection regions.

$H_0: \mu \geq 3.5$ FTR

$H_a: \mu < 3.5$ (claim)

$n = 60$

$\bar{x} = 3.6$

$\sigma = .6$

$\alpha = .05$

$$z^* = \frac{3.6 - 3.5}{.6/\sqrt{60}} = 1.29$$

$z_c = -1.645$

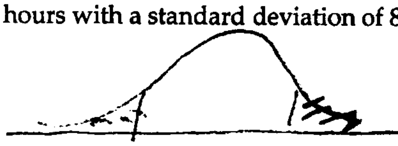
D: FTR H_0

C: At $\alpha = .05$ there is NOT enough evid. to support the claim that the mean waiting time is less than 3.5 min.

2) A manufacturer claims that the mean lifetime of its fluorescent bulbs is 1400 hours. A homeowner selects 25 bulbs and finds the mean lifetime to be 1390 hours with a standard deviation of 80 hours. Test the manufacturer's claim. Use $\alpha = 0.05$.

$H_0: \mu = 1400$ (claim)

$H_a: \mu \neq 1400$



$t_c = -2.06$ $t_c = 2.06$

$n = 25$

d.f. $= 24$

$\bar{x} = 1390$

$s = 80$

$\alpha = .05$

$$t^* = \frac{1390 - 1400}{80/\sqrt{25}} = -.625$$

D: FTR H_0

C: At $\alpha = .05$ there is not enough evid. to reject the claim that the mean lifetime is 1400 hours.

3) A recent study claimed that at least 15% of junior high students are overweight. In a sample of 160 students, 18 were found to be overweight. If $\alpha = 0.05$, test the claim using critical values and rejection regions.

$H_0: p \geq .15$ (claim)

$H_a: p < .15$

$n = 160$

$X = 18$

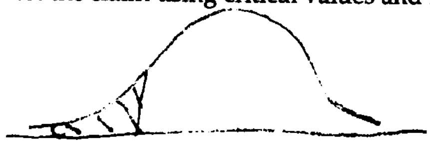
$\hat{p} = .1125$

$q = .85$

$\alpha = .05$

$np \geq 5$ ✓

$nq \geq 5$ ✓



$z_c = -1.645$

$$z^* = \frac{.1125 - .15}{\sqrt{\frac{(.15)(.85)}{160}}} = -1.33$$

D: FTR H_0

C: At $\alpha = .05$ there is not enough evidence to reject the claim that at least 15% of JH students are overweight.

4) The heights (in inches) of 20 randomly selected adult males are listed below. Test the claim that the variance is less than 6.25. Use $\alpha = 0.05$. Assume the population is normally distributed.

70	72	71	70	69	73	69	68	70	71
67	71	70	74	69	68	71	71	71	72

$\chi^2_c = 10.117$

$H_0: \sigma^2 \geq 6.25$

$H_a: \sigma^2 < 6.25$ (claim)

$n = 20 \Rightarrow d.f. = 19$

$\bar{x} = 70.35$

$S = 1.73$

$\alpha = .05$

$\chi^{2*} = \dfrac{19(1.73)^2}{6.25} = 9.1 \Rightarrow$ D: Reject H_0

C: At $\alpha = .05$, there is enough evidence ~~to~~ support ~~the~~ claim that the variance is less than 6.25.

5) At a local college, 65 female students were randomly selected and it was found that their mean monthly income was \$616 with a population standard deviation of \$121.50. Seventy-five male students were also randomly selected and their mean monthly income was found to be \$658 with a population standard deviation of \$168.70. Test the claim that male students have a higher monthly income than female students. Use $\alpha = 0.01$.

$H_0: \mu_1 \geq \mu_2$

$H_a: \mu_1 < \mu_2$ (claim)

$z_c = -2.33 \qquad 0$

$z^* = \dfrac{(616 - 658) - 0}{\sqrt{\dfrac{616^2}{65} + \dfrac{658^2}{75}}} = -1.71$

F(1)	M(2)
$n_1 = 65$	$n_2 = 75$
$\bar{x} = 616$	$\bar{x}_2 = 658$
$\sigma_1 = 121.5$	$\sigma_2 = 168.7$

$\alpha = .01$

D: FTR H_0

C: At $\alpha = .01$, there is not enough evidence to support the claim that males have a slightly higher monthly income than female students.

6) A sports analyst claims that the mean batting average for teams in the American League is not equal to the mean batting average for teams in the National League because a pitcher does not bat in the American League. The data listed below are random, independent, and come from populations that are normally distributed. At $\alpha = 0.05$, test the sports analyst's claim. Assume the population variances are equal.

American League

0.279	0.274	0.271	0.268
0.265	0.254	0.240	

National League

0.284	0.267	0.266	0.263
0.261	0.259	0.256	

$H_0: \mu_1 = \mu_2$

$H_a: \mu_1 \neq \mu_2$ (claim)

AL(1)	NL(2)
$\bar{x}_1 = .264$	$\bar{x}_2 = .265$
$S_1 = .013$	$S_2 = .009$

(Pooled)

$n_1 = 7 \qquad n_2 = 7$

$d.f. = 12$

$t_c = -2.18 \qquad t_c = 2.18$

$t^* = \dfrac{(.264 - .265) - 0}{\sqrt{\dfrac{6(.013)^2 + (6)(.265^2)}{12}}\sqrt{\dfrac{1}{7} + \dfrac{1}{7}}} = -.167$

D: FTR H_0

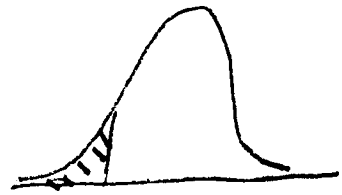
C: At $\alpha = .05$, There is not enough evidence to support the claim that the mean batting for AL is not equal to the batting ave for NL.

7) A weight-lifting coach claims that weight-lifters can increase their strength by taking a certain supplement. To test the theory, the coach randomly selects 9 athletes and gives them a strength test using a bench press. The results are listed below. Thirty days later, after regular training using the supplement, they are tested again. The new results are listed below. Test the claim that the supplement is effective in increasing the athletes' strength. Assume the samples are random and dependent, and the populations are normally distributed. Use $\alpha = 0.05$.

Athlete	1	2	3	4	5	6	7	8	9
Before	215	240	188	212	275	260	225	200	185
After	225	245	188	210	282	275	230	195	190

$H_0: \mu_d \geq 0$

$H_a: \mu_d < 0$ (claim)



$\bar{d} = -4.44$

$s_d = 6.13$

$n = 9$

$\alpha = .05$

$$t^* = \frac{-4.44 - 0}{6.13/\sqrt{9}} = -2.17$$

$t_c = -1.86$

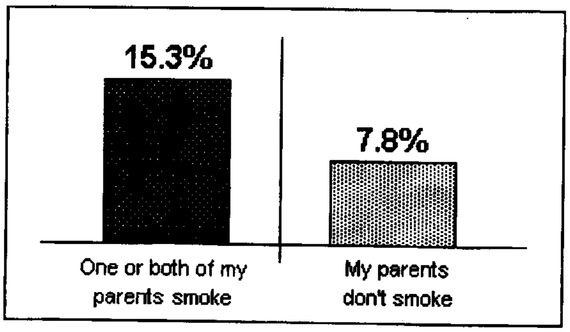
D: Reject H_0

C: At $\alpha = .05$, there is enough evidence ~~to~~ support the claim that weight lifters can increase their strength by taking a certain supplement

8) A youth prevention organization is examining the effect of parental smoking on the decision of their teenagers to smoke. A survey of 1150 teenagers, ages 11 to 17 years who smoked in the last 30 days, was conducted. The random sample consisted of 500 teenagers who had at least one parent that smoked and 650 who had parents that did not smoke. The results are shown in the figure. At $\alpha = 0.01$, can you support the organization's claim that the proportion of teens who decide to smoke is greater when one or both of their parents smoke?

Effect of Parental Smoking

Percentage of 11-17-year-olds who smoked a cigarette at least once in the past 30 days who reported that:



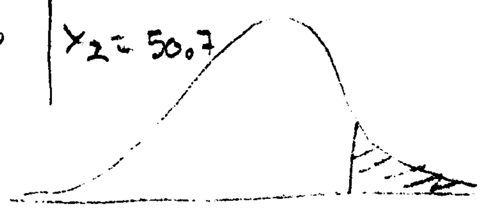
Source: Philip Morris USA Youth Smoking Prevention. Teenage Attitudes and Behavior Study. 2002.

$H_0: p_1 \leq p_2$

$H_a: p_1 > p_2$ (claim)

Smoke-1	No smoke-2
$\hat{p}_1 = .153$	$\hat{p}_2 = .078$
$n_1 = 500$	$n_2 = 650$
$x_1 = 76.5$	$x_2 = 50.7$
$\bar{p} = .1106$	
$\bar{q} = .8894$	

$\alpha = .01$



$z_c = 2.33$

$$z^* = \frac{(.153 - .078) - 0}{\sqrt{(.1106)(.8894)\left(\frac{1}{500} + \frac{1}{650}\right)}} = 4.02 \Rightarrow \text{D: Reject } H_0$$

C: At $\alpha = .01$, there is enough evidence to support the claim that the proportion of teens who decide to smoke is greater when one or both parents smoke.