KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

DEPARTMENT OF MATHEMATICS & STATISTICS

DHAHRAN, SAUDI ARABIA

STAT 212: *BUSINESS STATISTICS II*

Major Exam 1

Name: ID#: **Serial:**

Please **circle** your section #:

Al-Sawi	**1** (08:00 -08:50 AM)	**3** (10:00-10:50 AM)	**4** (11:00-11:-50 AM)
Sharabati	**2** (09:00 -10:50 AM)		

Question No	Full Points	Points Obtained
1	12	
2	10	
3	9	
4	9	
Total	**40**	

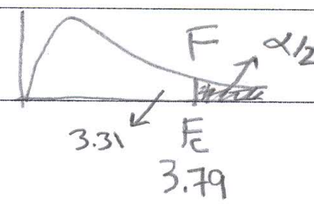
Q1. (5+7=12pts.) There are two major companies that provide SAT test tutoring for high school students. At issue is whether Company 1 that has been in business for the longer time provides better results than Company 2, the newer company. Specifically of interest is whether the mean increase in SAT scores for students who have already taken the SAT-test one time is higher for Company 1 than for Company 2. A test of this is to be conducted using a 0.10 level of significance. Two random samples of students are selected. The first group uses the tutoring services of Company 1 and the second uses Company 2's services. The following results were obtained:

	Company 1	Company 2
n	8	8
mean	53.5	34.375
S	33.84418	18.59291

i. Can we assume the two variances are equal? (assume normal populations)

The hypotheses are *(1 pt.)*: $H_0: \sigma_1^2 = \sigma_2^2$ $\quad H_0: \sigma_1^2 \neq \sigma_2^2$

Decision Rule *(1 pt.)*:



The test statistic *(1 pt.)*:

$F_{7,7} = \left(\frac{33.844}{18.59}\right)^2 = 3.31$

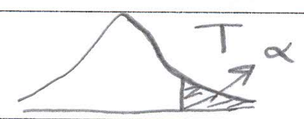
Critical value *(1 pt.)*: $F_c(0.05) = 3.79$

Conclusion *(1 pt.)*: $3.31 < 3.79$ $\quad F_c < F_s$ Fail to reject H_0. There is not enough evidence to conclude they are differente

ii. Based on these data, can you conclude that the students who use Company 1 score higher on average than students who use Company 2?

The hypotheses are *(1 pt.)*: $H_0: \mu_1 = \mu_2$ $\quad H_a: \mu_1 > \mu_2$

Decision Rule *(1 pt.)*:



The test statistic *(2 pts.)*:

$t_c = 1.345$

$t = \frac{(\bar{X}_1 - \bar{X}_2) - 0}{\sqrt{S_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{(53.5 - 34.375) - 0}{\sqrt{745.4\left(\frac{1}{8} + \frac{1}{8}\right)}} = \frac{19.125}{13.65} = 1.401$

$S_p^2 = \frac{(8-1)(33.84)^2 + (8-1)(18.59)^2}{8+8-2} = 745.4$

$df = 8+8-2 = 14$

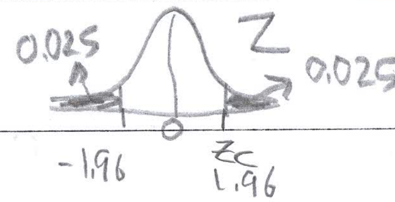
Critical value(s) *(1 pt.)*: $t_c(14, 0.1) = 1.345$

Conclusion *(2 pts.)*: $1.401 > 1.345$ $\quad t_s > t_c$ Reject H_0. There is enough evidence to conclude the pop mean score for Company 1 is higher than that of Company 2.

or $df = 10.87$ if you assume variances are not equal.
$t = 1.401$

Q2. (6+2+2=10 pts.) In clinical studies of an allergy drug, 81 of the 900 subjects experienced drowsiness. A competitor claims that 10% of the users of this drug experience drowsiness.

a. Is there enough evidence at the 5% significance level to infer that the competitor is correct?

The hypotheses are *(1 pt.)*:	$H_0: \pi = 0.1$ $\quad H_a: \pi \neq 0.1$
Decision Rule *(1 pt.)*:	
The test statistic *(1 pt.)*:	$Z_s = \dfrac{P - \pi_0}{\sqrt{\dfrac{\pi_0(1-\pi_0)}{n}}} = \dfrac{0.09 - 0.1}{\sqrt{\dfrac{0.1 * 0.9}{900}}} = \dfrac{-0.01}{0.01} = -1$ $P = \dfrac{81}{900} = 0.09$
Critical value(s) *(1 pt.)*:	$Z_c = \pm 1.96$
Conclusion *(2 pts.)*:	$-1 > -1.96$ $\quad Z_s > Z_c$ fail to reject Ho. There is not enough evidence to conclude that the pop. proportion is different from 0.1

b. Compute the *p*-value of the test? What is your conclusion based on the p-value?

P-value $= 2 * P(Z < -1) = 2 * 0.1587 = 0.3174 > 0.05$

Fail to reject Ho

c. Construct a 95% confidence interval estimate of the population proportion of the users of this allergy drug who experience drowsiness <u>and</u> explain how to use this confidence interval to test the hypothesis.

1 $\quad p \pm Z_{\alpha/2}\sqrt{\dfrac{p(1-p)}{n}}$

$0.09 \pm 1.96\sqrt{\dfrac{0.09 * 0.91}{900}}$

0.09 ± 0.0187

$(0.0713,\ 0.1087)$

1

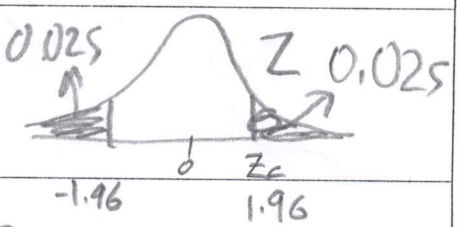
Because 0.1 falls in the 95% C.I. we fail to reject Ho at the 5% sig. level.

Q3. (9 pts.) The dean of a college is interested in the proportion of graduates from his college who have a job offer on graduation day. He is particularly interested in seeing if there is a difference in this proportion for accounting and economics majors. In a random sample of 100 of each type of major at graduation, he found that 65 accounting majors and 52 economics majors had job offers. **If the accounting majors are designated as "Group 1" and the economics majors are designated as "Group 2," perform the appropriate hypothesis test using a level of significance of 0.05.**

The hypotheses are *(1 pt.)*:

$H_0: \pi_1 = \pi_2 \qquad H_a: \pi_1 \neq \pi_2$

Decision Rule *(1 pt.)*:



The test statistic *(4 pts.)*:

$\bar{p}_1 = 0.65$ (1) $\bar{p}_2 = 0.52$ (1) $\bar{p} = \frac{65+52}{200} = 0.585$ (1)

$$Z_s = \frac{(0.65-0.52)-0}{\sqrt{0.585 * 0.415\left(\frac{1}{100}+\frac{1}{100}\right)}} = \frac{0.13}{0.0697} = 1.865$$ (1)

Critical value(s) *(1 pt.)*:

$Z_c = \pm 1.96$

Conclusion *(2 pts.)*:

$1.865 < 1.96 \quad Z_s < Z_c$ fail to reject Ho (1)

(1) There is not enough evidence to conclude that the proportions from the two groups are different

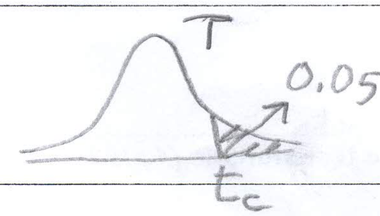
Q4. (7+2=9 pts.) A drug company has developed a new drug that reduces total cholesterol levels (HDL + LDL), measured in mg/dl, in male patients with a high risk of heart attacks. The drug company wants to determine the effectiveness of its new drug; as a start, company researchers measured the cholesterol level of a random sample of 16 high risk male patients, the mean is 241.63 mg/dl with a standard deviation of 14.975. The company compared the high risk group's average cholesterol level to the target for all men, 200mg/dl. They wanted to be sure at the 0.05 significance level that their high risk group did have higher cholesterol levels on average.

a. What should the drug company conclude?

The hypotheses are *(2 pts.)*:

$H_0: \mu = 200$ $\quad H_a: \mu > 200$

Decision Rule *(1 pt.)*:



The test statistic *(1 pt.)*:

$$t_s = \frac{\bar{X}-\mu_0}{s/\sqrt{n}} = \frac{241.63-200}{14.975/\sqrt{16}} = \frac{41.63}{3.74} = 11.13$$

df = 15

Critical value(s) *(1 pt.)*:

$t_c(15, 0.05) = 1.753$

Conclusion *(2 pts.)*:

$11.13 > 1.753$ $\quad t_s > t_c$ Reject H_0. There is enough evidence to conclude that the population mean cholesterol level is more than 200 mg/dL

b. Which of the two statistical errors might have made in this case? Explain.

Type I error, which is false rejection of the null hypothesis. Type I error is rejecting the null when the null is true. i.e. saying the pop. mean is not 200 mg/dL when in fact it is.