STATISTICS/GRACEY NAME Key

EXAM 3/75 POINTS POSSIBLE HW_____% Q_____% EXAM _____%

THE STAT FEATURE OF YOUR CALCULATOR MAY ONLY BE USED TO FIND SUMMARY STATISTICS. SHOW ALL WORK TO RECEIVE FULL CREDIT.

1. (16 POINTS) Assume that a SRS has been selected from a normally distributed population and test the given claim. A SRS of 70 recorded speeds (in mi/h) is observed from cars traveling on a section of Highway 805 in San Diego. The sample has a mean of 73.7 mi/h and a standard deviation of 7.3 mi/h. Use a 0.01 significance level to test the claim that the mean speed of all cars is greater that the posted speed limit of 65 mi/h. $\bar{x}=73.7,\ s=7.3,\ n=70$

a. (1 POINT) Identify the null hypothesis

$\boxed{H_0: \mu_{\bar{x}} = 65}$

b. (1 POINT) Identify the alternative hypothesis

$\boxed{H_A: \mu_{\bar{x}} > 65}$

c. (6 POINTS) Identify the test statistic

$$t = \frac{\bar{x} - \mu_{\bar{x}}}{s/\sqrt{n}}$$

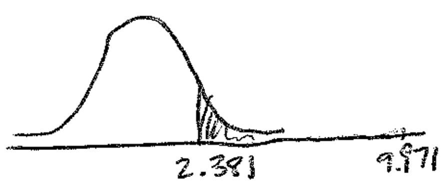
$$t = \frac{73.7 - 65}{7.3/\sqrt{70}} \approx \boxed{9.971}$$

d. (6 POINTS) Use the *P*-value method or the traditional method to test the claim. Be sure to specify which method you are using and identify the *P*-value or critical value(s).

traditional:

$t_{69,0.01} = t_{70,0.01}$

$= 2.381$



reject H_0

P-value:

P-value < 0.005 since 9.971 is to the left of 2.648

0.005 < 0.01, so reject H_0

e. (2 POINTS) What is your final conclusion?

ct H_0. There is sufficient evidence to support the claim that the speed of all cars on this section of the 805 is greater than 65 mph.

2. (16 POINTS) Assume that the two samples are independent simple random samples selected from normally distributed populations. Many studies have been conducted to test the effects of marijuana use on mental abilities. In one such study, groups of light and heavy users of marijuana in college were tested for memory recall, with the results given below.

Items sorted correctly by light marijuana users: $n = 60,\ \bar{x} = 53.3,\ s = 3.6$ ← Sample from pop. 1

Items sorted correctly by heavy marijuana users: $n = 64,\ \bar{x} = 51.3,\ s = 4.5$ ← sample from pop. 2

Use a 0.01 significance level to test the claim that the population of heavy marijuana users has a lower mean than the light marijuana users.

a. (1 POINT) Identify the null hypothesis

$H_0:\ \mu_1 = \mu_2$

b. (1 POINT) Identify the alternative hypothesis

$H_A:\ \mu_1 > \mu_2$

c. (6 POINTS) Identify the test statistic, or construct the appropriate confidence interval.

Test statistic

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$t = \frac{53.3 - 51.3 - 0}{\sqrt{\frac{3.6^2}{60} + \frac{4.5^2}{64}}} \approx \boxed{2.741}$$

OR

CI

1 tail

$$t_{59,\,0.01} \cdot \sqrt{\frac{3.6^2}{60} + \frac{4.5^2}{64}} \doteq t_{60,\,0.01}(.729$$

$$= 2.390(0.729$$

$$= 1.7439$$

$$= E$$

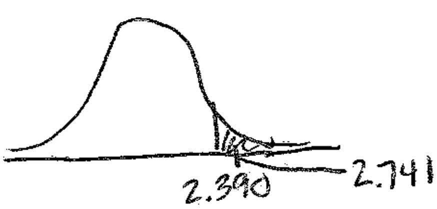
$$\bar{x}_1 - \bar{x}_2 - E < \mu_1 - \mu_2 < \bar{x}_1 - \bar{x}_2 + E$$

$$0.2561 < \mu_1 - \mu_2 < 3.7439$$

$$\boxed{0.3 < \mu_1 - \mu_2 < 3.7}$$

d. (6 POINTS) Test the claim. Be sure to specify which method you are using.

Traditional:



Reject H_0

P-value:

P-value < 0.005

Since 2.741 is to the left of 2.660 on the table

0.005 < 0.01, reject H_0

CI:

0 is not a likely value, so reject H_0.

e. (2 POINTS) What is your final conclusion?

Reject H_0. There is sufficient evidence to support the claim that the population of heavy marijuana users has a lower mean than light marijuana users

3. (16 POINTS) In an Accountemps survey of 200 senior executives, 47.3% said that the most common job interview mistake is to have little or no knowledge of the company. Use a 0.02 significance level to test the claim that in the population of all senior executives, 50% say that the most common job interview mistake is to have little or no knowledge of the company.

$\hat{p} = 0.473,\ n = 200,\ \alpha = 0.02$

a. (1 POINT) Identify the null hypothesis

$H_0: \boxed{p = 0.50}$

b. (1 POINT) Identify the alternative hypothesis

$H_A: \boxed{p \neq 0.50}$

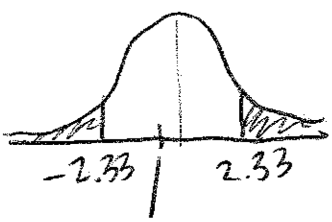
c. (6 POINTS) Identify the test statistic

$$z = \frac{\hat{p} - p}{\sqrt{pq/n}}$$

$$z = \frac{0.473 - 0.5}{\sqrt{\frac{(0.5)(0.5)}{200}}} \approx \boxed{-0.76}$$

d. (6 POINTS) Use the *P*-value method or the traditional method to test the claim. Be sure to specify which method you are using and identify the *P*-value or critical value(s).

Traditional:



Fail to reject Ho

P-value:

P-value = $2(P(z < -0.76))$

$= 2(0.2236)$

$= 0.4472$

$0.4472 > 0.02$, fail to reject H_0.

e. (2 POINTS) What is your final conclusion?

Fail to reject Ho. There is not sufficient evidence to suggest that the percentage of all senior executives who say that the most common job interview mistake is to have little or no knowledge of the company is different than 50%.

4. (12 POINTS) In an experiment, 16% of 734 subjects treated with Viagra experienced headaches. In the same experiment, 4% of 724 subjects given a placebo experienced headaches. $\hat{p}_1 = 0.16$, $n_1 = 734$, $\hat{q}_1 = 0.84$, $\hat{p}_2 = 0.04$, $n_2 = 724$, $\hat{q}_2 = 0.9$

a. (10 POINTS) Construct a 95% confidence interval estimate of the difference between the proportion of headaches for those treated with Viagra and the proportion of headaches for those given a placebo.

$$E = z_{.025}\sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}}$$

$$\hat{p}_1 - \hat{p}_2 - E < p_1 - p_2 < \hat{p}_1 - \hat{p}_2 + E$$

$$E = 1.96\sqrt{\frac{(.16)(.84)}{734} + \frac{(.04)(.96)}{724}}$$

$$\boxed{0.0899 < p_1 - p_2 < 0.150}$$

$$E \doteq 0.03012$$

b. (2 POINTS) What conclusion does the confidence interval suggest?

Since zero is not a likely value in the CI and the values in the CI are all positive, it seems that the proportion of subjects who experience headaches is greater in the Viagra population.

5. (15 POINTS) Listed below are the costs (in dollars) of repairing the front ends and rear ends of different cars when they were damaged in controlled low-speed crash tests. The cars are Toyota, Mazda, Volvo, Saturn, Subaru, Hyundai, Honda, Volkswagen, and Nissan. Construct a 95% confidence interval of the mean of the differences between front repair costs and rear repair costs. Is there a difference?

Front repair cost:	936	978	2252	1032	3911	4312	3469	2598	4535
Rear repair cost:	1480	1202	802	3191	1122	739	2769	3375	1787

$\bar{d} = 839.6$

$n = 9$

$s_d = 1935.1$

$$\bar{d} - E < \mu_d < \bar{d} + E$$

$$\boxed{-647.8 < \mu_d < 2327.0}$$

Since a mean difference of zero is a likely value, there is not a difference between front repair costs and rear repair costs.

$$E = t_{n-1, \alpha/2}\frac{s_d}{\sqrt{n}}$$

$$E = t_{8, 0.025}\frac{1935.1}{\sqrt{9}}$$

$$E \doteq 2.306\frac{1935.1}{3}$$

$$E = 1487.4$$