STATISTICS/GRACEY   NAME Key

EXAM 3/75 POINTS POSSIBLE

YOU MAY USE THE STAT FEATURE OF YOUR CALCULATOR.

ASSUME ALL SAMPLE DATA ARE SIMPLE RANDOM SAMPLES WITH DISTRIBUTIONS THAT ARE APPORXIMATELY NORMAL.

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 69.1 mi/h and a standard deviation of 6.3 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.

a. (1 POINT) Identify the null hypothesis

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

b. (1 POINT) Identify the alternative hypothesis

$H_1: \mu_{\bar{x}} > 65$

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

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

$\bar{x} = 69.1$ $t = 5.4449$

$s = 6.3$ p-value = 3.73×10^{-7}

$n = 70$ 98% CI: (67.3, 70.9)

$$\boxed{t = \frac{69.1 - 65}{\frac{6.3}{\sqrt{70}}} \approx 5.4449}$$ OR $\boxed{67.3 < \mu < 70.9}$

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

P-value:

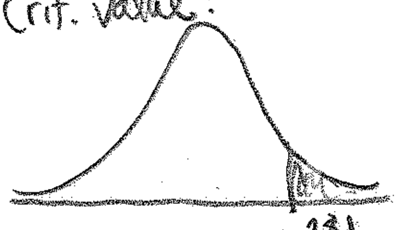
$.000000373 < 0.01 = \alpha$

so reject H_0

CI:

65 is not in the CI

Crit. value:



$t = 2.381$

$t_{69,.01} \rightarrow$

$t_{70,.01} = 2.648$

1-tail area

$t = 5.4449$ is in crit. region so reject H_0

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

Reject H_0. There is significant evidence at the 1% level to support the claim that the mean speed of all cars is greater than the posted speed limit of 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.

1 Items sorted correctly by light marijuana users: $n_1 = 62,\ \bar{x}_1 = 55.3,\ s_1 = 3.8$

2 Items sorted correctly by heavy marijuana users: $n_2 = 66,\ \bar{x}_2 = 50.3,\ s_1 = 4.5$

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

$H_1: \mu_1 > \mu_2$

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

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

$$t = \frac{55.3 - 50.3 - 0}{\sqrt{\frac{3.8^2}{62} + \frac{4.5^2}{66}}} \approx 6.8059$$

$t \approx 6.8059$

or

$3.3 < \mu_1 - \mu_2 < 6.7$

$\bar{x}_1 = 55.3,\ s_1 = 3.8,\ n_1 = 62$

$\bar{x}_2 = 50.3,\ s_2 = 4.5,\ n_2 = 66$

$t = 6.8059$

p-value $= 1.88 \times 10^{-10}$

98% CI: (3.2687, 6.7313)

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

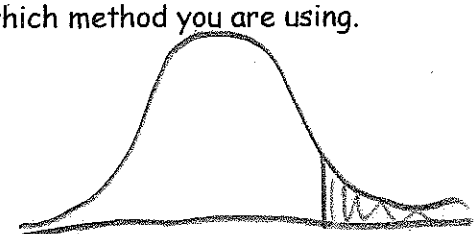
P-value:

$.000000000188 < 0.01 = \alpha$

So reject H_0

CI:

0 is not in the CI so reject H_0



2.390

$t = 6.8059$ is in the crit. region so reject H_0

$t_{61,.01} =$

$t_{60,0.01} = 2.39$

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

There is sufficient evidence at the 1% level to support the claim that the population of heavy marijuana users has a lower mean than the 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.

a. (1 POINT) Identify the null hypothesis

$H_0: p = 0.5$

b. (1 POINT) Identify the alternative hypothesis

$H_1: p \neq 0.5$

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

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

$$z = \frac{0.473 - 0.5}{\sqrt{\frac{.25}{200}}} \approx -0.76$$

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

$x = \hat{p} \cdot n \doteq 95$

$z \doteq -0.71$

p-value $\doteq 0.479$

98% CI: (0.39285, 0.55715

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

p-value:

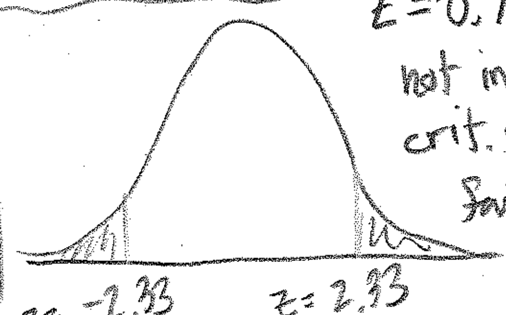
$0.479 > 0.02 = \alpha$

so fail to reject H_0

CI:

0.5 is in the CI, so fail to reject H_0

Critical value:



$z \doteq -0.76$ is not in the crit. region, so fail to reject H_0.

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

Fail to reject H_0. There is not sufficient evidence at the 2% level to reject the claim that 50% of all senior executives say that the most common job interview mistake is to have little or no knowledge of the company.

4. (12 POINTS) In an experiment, 18% of 550 subjects treated with Viagra experienced headaches. In the same experiment, 5% of 560 subjects given a placebo experienced headaches.

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.

$\hat{p}_1 = 0.18,\ n_1 = 550,\ x_1 = .18 \cdot 550 = 99$

$\hat{p}_2 = 0.05,\ n_2 = 560,\ x_2 = 28$

$(0.0937, 0.16683)$

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

$.18 - .05 - .0368 < p_1 - p_2 < .18 - .05 + .0368$

$\boxed{0.0932 < p_1 - p_2 < 0.167}$

$E = 1.96\sqrt{\frac{(0.18)(0.82)}{550} + \frac{(0.05)(0.95)}{560}}$

$E \doteq 0.0368$

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

Since zero is not one of the likely values, it seems that patients who ~~take~~ viagra are more likely to experience headaches.

5. (15 POINTS) Listed below are body mass indices (BMI) of students. The BMI of each student was measured in September and then again in April of the freshman year. Construct a 95% confidence interval estimate of the change in BMI during freshman year. Is there a difference? Explain.

~~dependent~~

April BMI:	20.15	19.24	20.77	23.85	21.32
September BMI:	20.68	19.48	19.59	24.57	20.96
differences:	-0.53	-0.24	1.18	-0.72	0.36

$\bar{d} = 0.01$

$s_d \doteq 0.771$

$n = 5$

$\alpha = 0.05$

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

$0.01 - 0.957 < \mu_d < 0.01 + 0.957$

$\boxed{-0.947 < \mu_d < 0.967}$

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

$E = t_{4, .025} \frac{s_d}{\sqrt{n}}$

$E \doteq 2.776 \frac{.771}{\sqrt{5}} \approx 0.957$

Since zero is a likely difference, there is no significant difference in BMI during freshman year.