STAT 1450, Exam #3, Fall 2013 Name KEY

Instructions: Show all work. If you use your calculator to conduct the hypothesis tests or find confidence intervals rather than doing them by hand, show what your Test screen looks like, and the results after pressing calculate, along with your interpretation. Show calculator work for partial credit any time you don't use a formula.

1. In a Pew Research poll, of 3011 adults surveyed, 2198 said that they use the Internet. Construct a 95% confidence interval estimate of the proportion of all adults who use the Internet. (8 points)

1-PropZInt

$X = 2198$

$n = 3011$ $\Rightarrow$ $(.71413, .74585)$

C-Level = .95 $\hat{p} = .72999...$

Is it correct for a newspaper reporter to write "3/4 of all adults use the Internet." Why or why not? (4 points)

no. the value .75 is outside the range of our confidence interval.

2. As the newly hired manager of a company that provides cell phone service, you want to determine the percentage of adults in your state who live in a household with cell phones and no land-line phones. How many adults must you survey? Assume that you want to be 90% confident that the sample percentage is within 4 percentage points of the true population percentage.
   a. Suppose that nothing is known about the true percentage. (8 points)

$$n = \left[\frac{1.64}{.04}\right]^2 \cdot .25 = 420.025...$$

$\Rightarrow$ $n = 421$

b. Redo the calculation with the added assumption that in a previous survey, about 8% of adults live in a household with only cell phones and no landlines. (8 points)

$$n = \left[\frac{1.64}{.01}\right]^2 * .08 * .92 = 123.72\ldots \Rightarrow$$

$$n = 124$$

3. How many mean daily rainfall amounts in Boston must be randomly selected to estimate the mean daily rainfall amount? We want 99% confidence that the sample mean is within 0.010 in. of the population mean, and the population standard deviation is known to be 0.212 in. (6 points)

$$n = \left[\frac{2.575 * .212}{.010}\right]^2 = 2980.06\ldots$$

$$n \Rightarrow 2981$$

4. Randomly selected students at a university participated in an experiment to determine their ability to determine when 1 minute (or 60 seconds) has passed. Forty students yielded a sample mean of 58.3 sec. Assume that σ = 9.5 seconds. Construct a 95% confidence interval of the population mean of all statistics students. (9 points)

ZInterval (Stats)

$\sigma = 9.5$

$\bar{x} = 58.3$ $\Rightarrow (55.356, 61.244)$

$n = 40$

C-Level = .95

5. In a test of the effectiveness of garlic for lowering cholesterol, 47 subjects were treated with Garlicin, which is garlic in a processed tablet form. Cholesterol levels were measured before and after the treatment. The changes in their levels of LDL cholesterol have a mean of 3.2 mg/dL and a standard deviation of 18.6. Construct a 95% confidence interval estimate of the mean net change in LDL cholesterol after the treatment. Give your answer in the form $\bar{x} \pm E$. (7 points)

TInterval (Stats) – using sample st. dev.

$\bar{x} = 3.2$ C-Level = .95

$S_x = 18.6$

$n = 47$

$\Rightarrow (-2.261,\ 8.6612)$

$E = 5.461 \Rightarrow 3.2 \pm 5.461$

What does this information tell us about the effectiveness of the treatment? (4 points)

the treatment does not appear to be very effective since 0 is included in the interval

6. For each of the situations below, say whether you should use a normal distribution, a student T-distribution or neither to calculate a confidence interval. (5 points each)

a. N=23, σ is unknown, population appears to be normally distributed.

T-distribution $n < 30$
σ unknown

b. N=200, σ is unknown, population is very skewed.

neither pop. far from normal

c. N=38, σ=15.0, population appears normally distributed.

normal z $n \geq 30$, σ known

d. N=75, σ is unknown, population appears skewed.

T-distribution $n \geq 30$
but σ unknown
population not normal

7. Describe the Rare Event Rule. (6 points)

if an event is unlikely to happen under a given assumption, then the assumption is probably false.

8. What is the difference between a Type I and Type II error? (8 points)

a Type I error is incorrectly rejecting a Ho when Ho is correct.

a Type II error is failing to reject Ho when Ho is actually wrong.

9. The claim is that more than 25% of adults prefer Italian food as their favourite ethnic food. A Harris Interactive survey of 1122 adults resulted in 314 who say that Italian food is their favourite. Use this information to state the null hypothesis and the alternative hypothesis for this test. State both clearly using correct notation. You do not need to calculate the test for this problem. (10 points)

$H_0: p \leq .25$

$H_1: p > .25$

10. Trials in an experiment with a polygraph include 98 results that include 24 cases of incorrect results and 74 cases of correct results. Use a 0.05 significance level to test the claim that such polygraph results are correct less than 80% of the time. (10 points)

1- Prop Z Test

$p_0 = .8$

$x = 74$

$n = 98$

prop $< p_0$

$\Rightarrow$

$z = -1.111..$

$p = .133 \Leftarrow$

$\hat{p} = .755$

$n = 98$

$H_0: p \geq .8$

$H_1: p < .80$

do not reject null

Based on the results, should polygraph test results be prohibited as evidence in trials? (5 points)

If you are one of The 1-in-5 people The polygraph gets wrong, you don't want it used.

11. A survey of 61,647 people included several questions about office relationships. Of the respondents, 26% reported that bosses scream at employees. Use a 0.05 significance level to test the claim that more than ¼ of people say that bosses scream at employees. (10 points)

$x = 16028$

1-Prop Z Test

$p_0 = .25$

$x = 16028$

$n = 61647$

prop $> p_0$

$\Rightarrow$

$z = 5.731...$

$p = 4.979...E-9 \Leftarrow$ reject Ho

$\hat{p} = .2599...$

$n = 61647$

$H_0: p \leq .25$

$H_1: p > .25$

How is the conclusion affected after learning that the survey is an Elle magazine survey in which Internet users choose whether to respond? (5 points)

the sample isn't a simple random sample and may be biased, but we don't know in which direction (though probably this is too high a figure).

12. Tests of older baseballs showed at when dropped 24 feet onto a concrete surface, they bounced an average of 235.8 cm. In a test of 40 new baseballs, the bounce heights had a mean of 235.4 cm. Assume the standard deviation of the bounce heights is 4.5 cm. Use a 0.05 significance level to test the claim that the new baseballs have bounce heights with a mean different from 235.8 cm. Are the new baseballs different? (12 points)

Z-Test (Stats)

$H_0: \mu = 235.8$
$H_1: \mu \neq 235.8$

$\mu_0 = 235.8$
$\sigma = 4.5$
$\bar{x} = 235.4$
$n = 40$
$\mu \neq \mu_0$

$\Rightarrow$

$z = -.5621\ldots$
$p = .57399\ldots \Leftarrow$
$\bar{x} = 235.4$
$n = 40$

fail to reject Ho
they are not significantly different
(if at all)

13. A teacher claims that she designs her exams to have a mean of 75%, and over time, has determined that the standard deviation of the exams are 8.3%. Based on the data below from a certain course, determine if her current class is above average. Use a 0.10 level of significance for the test. (13 points)

96, 84, 93, 100, 88, 92, 92, 77, 41, 85, 49, 63, 57, 83, 95, 82, 89, 62, 93, 72, 74, 80, 63, 62, 79, 82, 71, 53, 93, 68, 68, 60, 60, 71, 64, 94, 77, 73, 78, 90, 74, 97, 86, 53, 75, 59, 90, 59, 89

$n = 49$

Z-Test (Data)

$H_0: \mu \leq 75$
$H_1: \mu > 75$

$\mu_0 = 75$
$\sigma = 8.3$
List: L_1
$\mu > \mu_0$

$\Rightarrow$

$z = 1.0327$
$p = .1508 \Leftarrow$
$\bar{x} = 76.22$
$S_x = 14.64$
$n = 49$

fail to reject Ho

her class is about average

14. A simple random sample of 40 recorded speeds (in mph) is obtained from cars traveling on a section of Highway 405 in Los Angeles. The sample has a mean of 68.4 mph and a standard deviation of 5.7 mph. Use a 0.05 significance level to test the claim that the mean speed of all cars is greater than the posted speed limit of 65 mph. (12 points)

T-Test (Stats) use t since using Sample st. dev.

$H_0: \mu \le 65$

$H_1: \mu > 65$

$\mu_0 = 65$

$\bar{x} = 68.4$

$Sx = 5.7$

$n = 40$

$\mu > \mu_0$

$\Rightarrow$

$t = 3.77...$

$p = 2.685... E-4 \Leftarrow$ reject Ho

$\bar{x} = 68.4$

$Sx = 5.7$

$n = 40$