Stat 50 - Elementary Statistics — Winter 2020

Quiz 7: Ch 7, 8 — Dr. Jorge Basilio

NAME (PRINT): _____ SCORE: _____

SIGNATURE: _____

Directions

- YOU ARE ALLOWED TO USE A CALCULATOR ON THIS EXAM. (Ti83/Ti83+/Ti84/Ti84+/Ti84+CE-T, or scientific calculator)
- Handwriting should be neat and legible. If I cannot read your writing, zero points will be given.
- Make sure to ALWAYS SHOW YOUR WORK; you will not receive any partial credits unless work is clearly shown. *If in doubt, ask for clarification.*
- Leave answers in exact form (as simplified as possible), unless told otherwise.
- Put a box around your final answer where applicable.

Quiz (30 points)

Problem 1: 10 pts

(a) (2 pts) Find the **critical value** $z_{\alpha/2}$ for a 98% confidence level.

$CL = 0.98$

$\alpha = 1 - CL = 1 - 0.98 = 0.02$

$\alpha/2 = 0.01$

$z_{\alpha/2} = \text{invNorm}(0.01, 0, 1, \text{RIGHT}) = \boxed{2.33}$

(b) (2 pts) Find the **critical value** $t_{\alpha/2}$ for a 90% confidence level.

assume sample size is 16.

$CL = 0.9$

$\alpha = 1 - CL = 1 - 0.9 = 0.1$

$\alpha/2 = 0.05$

$t_{\alpha/2} = \text{invT}(1 - 0.05, 15) = \boxed{1.75}$

(c) Suppose you work for the Department of Natural Resources and you want to estimate, with 95% confidence, the mean (average) length of all walleye fingerlings in a fish hatchery pond. You take a random sample of 31 fingerlings and determine that the average length is 7.5 inches and the population standard deviation is known to be 2.3 inches.

(i) (4 pts) Find the **point estimate**, the **critical value**, and the **margin of error**.

- $\bar{x} = 7.5$ in — point est
- $t_{\alpha/2} = \text{invT}(1 - 0.025, 30) = \boxed{2.04}$

$CL = 0.95$

$\alpha = 1 - CL = 0.05 \quad \alpha/2 = 0.025$

- Margin Error $E = t_{\alpha/2} \cdot \frac{s}{\sqrt{n}} = (2.04)\left(\frac{2.3}{\sqrt{31}}\right)$

$\boxed{E = 0.84 \text{ in}}$

(ii) (2 pts) Write the **confidence interval**

CI: $(\bar{x} - E, \bar{x} + E)$

$\boxed{CI: (6.66 \text{ in}, 8.34 \text{ in})}$

Problem 2: 20 pts

According to the Center for Disease Control website, in 2011 at least 18% of high school students have smoked a cigarette. An Introduction to Statistics class in Davies County, KY conducted a hypothesis test at the local high school to determine if the local high school?s percentage was lower. One hundred fifty students were chosen at random and surveyed. Of the 150 students surveyed, 22 have smoked. Use a significance level of 0.01, conduct a hypothesis test and state the conclusions.

(a) (3 pts) Step -1 State what the claim, the random variable, and the distribution are (E)

Claim: the proportion of HS students who have smoked has decreased from 18% since 2011.

RV $\hat{X}$ = prop of students who smoked distribution z-dist / normal dist.

(b) (2 pt) Step 0 Check requirements:

HT for proportion
1. SRS ✓
2. bi (Y or N) ✓
3. $np \geq 5$ & $nq \geq 5$
$27 \geq 5$ ✓ $123 \geq 5$ ✓

- $n = 150$
- $p_0 = 0.18$
- $q_0 = 1 - 0.18 = 0.82$

(c) (2 pts) Step 1 State the Null and Alternative Hypotheses:

$H_0: p = 0.18$
$H_A: p < 0.18$ (Left-Tailed Test)

Sample: $\hat{p} = \frac{22}{150} = 0.147$

(d) (1 pt) Step 2 State the Level of Significance: $\alpha = 0.01$

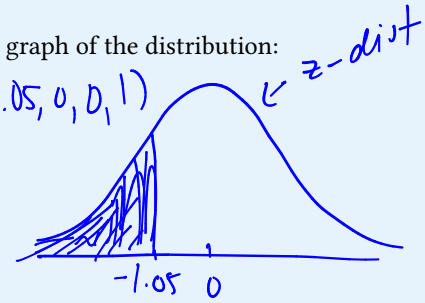
(e) (2 pts) Step 3 Find the Test Statistic:

$$z^* = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0 q_0}{n}}} = \frac{0.147 - 0.18}{\sqrt{\frac{0.18 * 0.82}{150}}} = -1.052\ldots \quad z^* = -1.05$$

(f) (4 pts) Step 4 Use the P-value Method to find the P-value and draw a graph of the distribution:

P(Critical Region) = 0.5 - normalcdf(-1.05, 0, 0, 1) using z^*

$P = 0.147$



(g) (6 pts) Step 5 Make are Decision and state your Conclusion ($M \rightarrow E$):

$\alpha = 0.01$
$P = 0.147$
$P > \alpha \rightarrow$ P high, null will fly
fail to Reject H_0

Conclusion "There is not enough statistical evidence to support the claim that the proportion of HS students who have smoked has decreased from 18% in 2011".

(h) (BONUS 4 pts) In a complete sentence, explain what the Type I and Type II errors are ($M \rightarrow E$)

Type I $P(RH_0 | H_0 T)$
"We erroneously conclude that proportion decreased when in reality it didn't"

Type II $P(FTRH_0 | H_0 F)$
"We erroneously conclude that proportion stayed same when in reality it decreased."

can't help FTR H_0
R H_0

	reality H_0 T	reality H_0 F
R H_0	I	
FTR H_0		II

Problem 3: (Practice) 20 pts

A survey in the N.Y. Times Almanac finds the mean commute time (one way) is 25.4 minutes for the 15 largest US cities. The Austin, TX chamber of commerce feels that Austin's commute time is less and wants to publicize this fact. The mean for 35 randomly selected commuters is 22.1 minutes with a standard deviation of 5.3 minutes. At the $\alpha = 0.10$ level, test the claim that the Austin, TX commute significantly less than the mean commute time for the 15 largest US cities.

(a) (3 pts) Step -1 State what the claim, the random variable, and the distribution are (E)

(b) (2 pt) Step 0 Check requirements:

(c) (2 pts) Step 1 State the Null and Alternative Hypotheses:

(d) (1 pt) Step 2 State the Level of Significance:

(e) (2 pts) Step 3 Find the Test Statistic:

(f) (4 pts) Step 4 Use the P-value Method to find the P-value and draw a graph of the distribution:

(g) (6 pts) Step 5 Make are Decision and state your Conclusion ($M \rightarrow E$):

(h) (BONUS 4 pts) In a complete sentence, explain what the Type I and Type II errors are ($M \rightarrow E$)