Chapter 7 Worksheet

Terms and Concepts to Know

- The null hypothesis (H_0) represents the current belief or prevailing viewpoint of a population. (I.e. what doesn't change.)
- The alternative hypothesis (H_1) represents the challenging theory against the current belief. (I.e. what is changing.)
- A hypothesis is left-sided when parameter < value.
- A hypothesis is right-sided when parameter > value.
- A hypothesis is two-sided when parameter ≠ value.
- The critical region is the values that indicate we reject the null hypothesis.
- The non-critical region is the values that indicate we would not reject the null hypothesis.
- The sample standardized score used in the process of hypothesis testing is known as the test statistic (TS).
- The area based upon the test statistic is known as the p-value.
  - Using this value, we determine whether to:
    - Reject H_0 ($\alpha > p$)
    - Fail to Reject H_0 ($\alpha < p$)
  - Note: NEVER accept H_0!!

$\boxed{\begin{array}{l}\text{* If packman wants to eat } \alpha \rightarrow \text{Reject} \\ \text{* If packman wants to eat } p \rightarrow \text{Fail to Reject}\end{array}}$

- Interpretations to Remember based off of Decision:
  - Rejecting Null Hypothesis

At [α]% level of significance, we have sufficient evidence to say that the true population (proportion/mean) is [H_1 senario].

- Failing to Reject Null Hypothesis

At [α]% level of significance, we do not have sufficient evidence to say that the true population (proportion/mean) is [H_1 senario].

Population Mean

- We work with an approximately normal distribution. $\sim N(0,1)$
- The confidence level or significance level will be given to you.
  - If one is not given to you, ALWAYS assume that the confidence level is 95% and that the significance level is 5%.
- Formulas to Know:
  - Test Statistic

$$TS = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

  - p-value

-Left: p = tCDF(-E99, TS, df)

-Right: p = tCDF(TS, E99, df)

-Two: p = 2 x tCDF(lower, higher, df) → L-TS = (-E99, TS, df); R-TS = (TS, E99, df)

1. Suzie read that on average a college student will visit their hometown 4 times every semester outside of predetermined university-wide breaks. Suzie decides to test if the average for her group of friends is different from what she read. The data she collected is below.

Visits: 3, 6, 2, 1, 0, 4, 3, 8, 3, 1, 1, 0 } $\bar{x} = 2.67$; $s = 2.42$; $n = 12$

a. State the Hypotheses

$H_0: \mu = 4$ $H_1: \mu \neq 4$

b. Direction of the Test

Two-sided b/c H_1 is asking $\mu \neq 4$.

c. Find the Test Statistic

$$TS = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{2.67 - 4}{2.42/\sqrt{12}} = -1.90$$

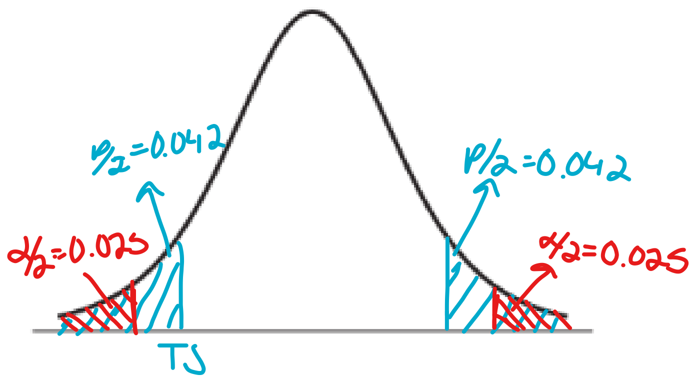
d. Find the p-value. $TS = -1.90 \rightarrow p = \underline{2\times}\, tCDF(-E99, TS, df)$

$$p = 2 \times tCDF(-E99, -1.90, 12-1) = 0.0840$$

e. What is the decision and why? $\alpha = 0.05 \rightarrow 0.05 < 0.0840$

Fail to Reject H_0 b/c $\alpha < p$

f. Sketch that decision and Interpret it.



At 5% level of significance, we do not have sufficient evidence to say that the true mean is different than 4.

2. Carter was saw on google that wildlife biologists make an average $66,350 per year. After gathering data from 25 wildlife biologists, he determines that the mean is $63,527 with a standard deviation of $7028. At a 10% significance level, determine if wildlife biologists make less than google claims.

a. State the Hypotheses

$H_0: \mu = 66{,}350 \quad H_1: \mu < 66{,}350$

b. Direction of the Test

Left-sided b/c H_1 is asking $\mu < 66{,}350$.

c. Find the Test Statistic

$$TS = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{63527 - 66350}{7028/\sqrt{25}} = -2.01$$

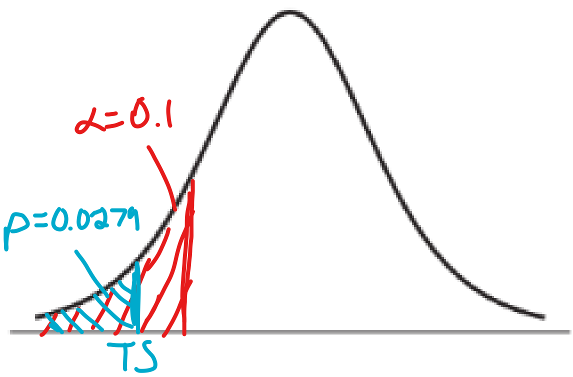
d. Find the p-value.

$$p = tCDF(-E99, -2.01, 25-1) = 0.0279$$

e. What is the decision and why? $\alpha = 0.1 \rightarrow 0.1 > 0.0279$

Reject H_0 b/c $\alpha > p$.

f. Sketch that decision and Interpret it.



At 10% level of significance, we have sufficient evidence to say that the true population mean is less than \$66,350.

Population Proportions

- Formulas to Know:
  - Test Statistic

$$TS = \frac{\hat{p} - p_0}{\sqrt{p_0 - q_0/n}}$$

  - P-value

-Left: p=normCDF(-E99,TS,0,1)

-Right: p=normCDF(TS,-E99,0,1)

-Two: p= 2x (lower,higher,0,1)

→L-TS =(-E99,TS,0,1)

→R-TS =(TS,E99,0,1)

1. A professor claims that for every class, 10% of the students will skip. Johnny believes that the proportion of students skipping is more than 10%. Test his theory when there are 52 students in every class, 5 students skip every class.

$\hat{p} = \frac{5}{52} = 0.096$

a. State the Hypotheses

$H_0: p = 0.1 \quad H_1: p > 0.1$

b. Direction of the Test

Right-sided b/c H_1 is asking $p > 0.1$

c. Find the Test Statistic

$$TS = \frac{\hat{p} - p_0}{\sqrt{p_0 - q_0/n}} = \frac{0.096 - 0.1}{\sqrt{0.1 - 0.9/52}} = -0.01$$

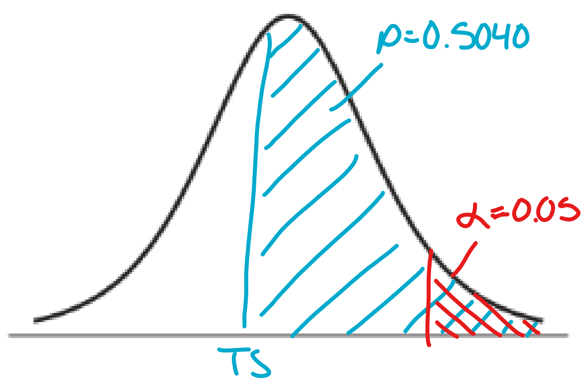
d. Find the p-value.

$p = \text{normCDF}(-0.01, E99, 0, 1) = 0.5040$

e. What is the decision and why? $\alpha = 0.05 \Rightarrow 0.05 < 0.5040$

Fail to Reject H_0 b/c $\alpha < p$.

f. Sketch that decision and Interpret it.



At 5% level of significance, we do not have sufficient evidence to say that the true population proportion is more than 10%.

2. A survey asking 2000 random people reveals that 640 prefer ice cream cake over regular sheet cakes. At a 1% significant level, determine whether less than 45% prefer ice cream cake.

$\hat{p} = \frac{640}{2000} = 0.32$

a. State the Hypotheses

$H_0: \mu = 0.45 \quad H_1: \mu < 0.45$

b. Direction of the Test

Left-sided b/c H_1 is asking $\mu < 0.45$.

c. Find the Test Statistic

$TS = \frac{\hat{p} - p_0}{\sqrt{p_0 - q_0/n}} = \frac{0.32 - 0.45}{\sqrt{0.45 - 0.55/2000}} = -0.19$

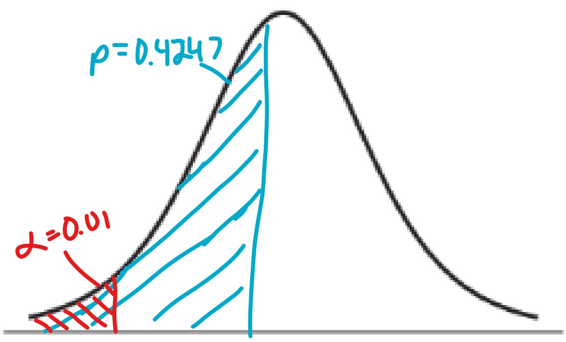
d. Find the p-value.

$p = \text{normCDF}(-E99, -0.19, 0, 1) = 0.4247$

e. What is the decision and why? $\alpha = 0.01 \rightarrow 0.01 < 0.4247$

Fail to Reject H_0 b/c $\alpha < p$

f. Sketch that decision and Interpret it.



At 1% level of significance, we do not have sufficient evidence to say that the true population proportion is less than 45%.