Math 10 – Hypothesis Testing – Standard Deviation ANSWERS **gw18**

1. A doctor says the standard deviation of the lengths of stay for patients involved in a crash in which the vehicle struck a tree is 6.14 days. A random sample of 20 lengths of stay for patients involved in this type of crash has a standard deviation of 6.5 days. At $\alpha = 0.05$, can you reject the doctor's claim?

(a) (DESIGN) State your Hypothesis

Ho: The standard deviation of the lengths of stay for patients involved in a crash in which the vehicle struck a tree is 6.14 days

Ha: The standard deviation of the lengths of stay for patients involved in a crash in which the vehicle struck a tree is NOT 6.14 days

Ho: sigma = 6.14 Ha: sigma ≠ 6.14

(b) (DESIGN) State Significance Level of the test and explain what it means.

$\alpha = 0.05$, **which represents the maximum design probability of Type I error, which would be claiming the standard deviation is not 6.14, when it is.**

(DESIGN) Determine the statistical model (test statistic)

Chi-square Test of varaince vs. Hypothesized Value

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2} \quad df = 19$$

(d) (DESIGN) Determine decision rule (critical value method)

Use alpha /2 = .025 in each tail

Reject Ho if Chi-sqaure< 8.907 or if Chi-square > 32.852

(e) (DATA) Conduct the test and **circle** your decision

$$\chi^2 = \frac{(19)6.5^2}{6.14^2} = 21.29$$

Fail to Reject Ho

(f) (CONCLUSION) State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.

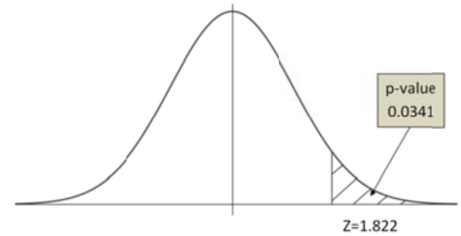
Insufficient data to conclude that the standard deviation of the lengths of stay for patients involved in a crash in which the vehicle struck a tree is NOT 6.14 days

2. This exercise shows the significance level of a test (α) and the p-value do not tell you the confidence of your claim being correct if your reject Ho.

   α = P(Reject Ho | Ho is true) power = P(Reject Ho | Ho is False)

   A researcher wanted to show that the percentage of students at community colleges who receive financial aid exceeds 40%.

   Ho: p = 0.40 (The proportion of community college students receiving financial aid is 0.40)
   Ha: p > 0.40 (The proportion of community college students receiving financial aid is over 0.40)



   The researcher sampled 874 students and found that 376 of them received financial aid. This works to a sample proportion $\hat{p} = 0.430$, which leads to a Z value of 1.822, if p = 0.40.

   p-value = P($\hat{p}$ > 0.430 | Ho is true) = P(Z > 1.822) = 0.034

   a. The researcher then incorrectly claimed that "We are 96.6% confident that more than 40% of community colleges receive financial aid." Explain why this is incorrect reasoning.
   Because p-value = P(Getting Data this extreme | Ho is true).
   The p-value is not P(Ho is true | the data) This was the researcher's error.

   b. For this researcher, suppose there is a 10% chance (without data) that Ha is true. Let's also assume the test has 85% power and that α = 0.05. We can now calculate the actual chance Ha is true given this data. We will use Bayesian Statistics, similar to the drug testing example of Chapter 4, to determine the probability that Ha will be true if you reject Ho.

   0.1 / \ 0.9

   Ho is False — 0.85 / \ 0.15 — **Reject Ho** 0.085, **FTR Ho** 0.015

   Ho is True — 0.05 / \ 0.95 — **Reject Ho** 0.045, **FTR Ho** 0.855

   A. First complete the tree diagram.

   B. Then create hypothetical table based on these probabilities.

	Ho is False Ha is true	Ho is True Ha is False	Total
Reject Ho	85	45	130
FTR Ho	15	855	870
Total	100	900	1000

   C. What is the probability that a researcher will reject Ho?
   P(Reject Ho) = 130/1000 = 13%
   13% of Ha Claims will be supported

   D. If a researcher rejects Ho, what is the chance that Ho is really true?
   P(Ho is true| Reject Ho) = 45/130 = 34.6%

   E. Why does this answer differ from α?
   α = P(Reject Ho | Ho is true) = 5%
   This is different from P(Ho is true| Reject Ho) = 45/130 = 34.6%
   The problem is the original Ha is unlikely to be significant (10% chance), which is not uncommon when researchers engage in p-hacking.