Homework for Lecture 14: Hypothesis Testing

The following homework assignment should be completed as an RMarkdown document. Only show your working code in the code chunks, and place comments/explanations in the "white space" to help me evaluate your work. Please submit both the knitted RMarkdown document (`.docx`) and the `.Rmd` file. You may discuss the assignment with your classmates, but your write-up and work should be done independently of your classmates. The use of AI is considered a violation of academic policy for this assignment. When in doubt, ask me what is and is not allowed.

Answer the following questions. When you run code, make sure you explain what you are doing and what the output is telling us. This should be done in the written 'white" section of the RMarkdown document. The 'grey" section is where your code will go, and when you knit the document, the output will be present.

1. **Conceptual Questions**

   Answer the following theoretical questions about hypothesis testing in complete sentences.

   (a) What is a critical value, and how does it relate to a rejection region?

   (b) What is a p-value?

   (c) What are the two conclusions we can make with a hypothesis test?

   (d) What does it mean to use a significance level of $\alpha = 0.05$?

2. **Hypothesis Tests Using the `cherry` Dataset**

   Using the `cherry` dataset in the `openintro` library, use the `volume` variable to answer the following questions. Make sure you load the `openintro` library before using the dataset. For each test, use a significance level of $\alpha = 0.05$.

   For each hypothesis test, make sure you include:

   - the null hypothesis,
   - the alternative hypothesis,
   - the test statistic,
   - the p-value,
   - your decision,
   - and a conclusion written in context.

   (a) Manually carry out a hypothesis test to determine whether the mean volume is statistically different from 25.75. Then carry out the process using the `t.test()` function to compare your results.

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(b) Manually carry out a hypothesis test to determine whether the mean volume is statistically different from 36.75. Then carry out the process using the `t.test()` function to compare your results.

(c) Compare your conclusions from parts (a) and (b). Why did changing the hypothesized mean change the result of the test?

3. **Muppets Character Creation Cost**

It is known that it costs \$7,250 to create one of the characters on *The Muppets*, with a population standard deviation of \$1,200. A new designer creates a sample of 25 characters, and the average cost is \$7,800.

(a) State the null and alternative hypotheses for testing whether the true mean cost is different from \$7,250.

(b) Carry out a hypothesis test using a significance level of $\alpha = 0.05$. Since the population standard deviation is known, use the normal distribution.

(c) Write your conclusion in context. What does the result actually mean for the new designer's character creation costs?

(d) Construct a 95% confidence interval for the true mean cost.

(e) Do the confidence interval results align with your hypothesis test conclusion? Explain why or why not.