STAT 315 Chapter 8 Review Questions

Scenario A: A structural engineer tests a sample of 15 reinforced concrete beams to determine if they match the expectations from simulations. Their goal is to determine if the mean strength of the beams formed by their particular construction process. To measure stiffness, they measure the deflection of the beam under a 1000 kg load. Stiffer beams will deflect less. A maximum acceptable deflection is 12mm, and they would like to test whether the mean deflection is below this limit. The sample deflection is 11.3mm, with a standard deviation of 4.2mm

1. State the Null hypothesis

2. Would a Type I or Type II error be worse in this scenario? Why?

3. Based on your answer to question 7, do you recommend changing the value of α for this test? Why?

4. Determine the level of significance

5. Compute a test statistic

6. Calculate a p-value

7. Make a statistical decision

8. Interpret the statistical decision in the context of the problem.

9. You compute a t-test statistic of t=2.462 with 29 degrees of freedom, and p-value=0.01. Which of the following statements are valid conclusions?
    a. If the null hypothesis is true, the probability of rejecting the null is 0.01
    b. The probability that the null hypothesis is true is 0.99
    c. We should fail to reject the null hypothesis
    d. We should reject the null hypothesis
    e. The null hypothesis is true
    f. The null hypothesis is false
    g. The point estimate is 2.462 standard errors above what the null hypothesis claims
    h. The probability of getting a test statistic as or more extreme as the one we computed, assuming the null is true, is 0.01
    i. This is a two sided test
    j. The area under the sampling distribution curve above 2.462 is 0.01.
    k. If we repeat this experiment, the probability of getting a test statistic above 2.462 is 0.01.
    l. The sample size is 29
    m. A 95% confidence interval would contain the null value
    n. A 99% confidence interval would contain the null value
    o. A 90% confidence interval would contain the null value

10. Which of the following are valid conclusions if we reject the null hypothesis with $\alpha = 0.05$?
    a. The null hypothesis is false
    b. If we repeat the experiment with a new sample, we will reject the null hypothesis again
    c. There is a 5% chance we were wrong
    d. The data are unlikely to have occurred if the null were true
    e. The data are likely to have occurred if the null were false

11. Since we reject the null hypothesis when $p < \alpha$, then we could always compute p first, then pick an α that allows us to reject (or fail to reject). Intuitively this seems wrong, because it seems like the sample doesn't matter anymore. Why would this not make sense from a *statistical perspective*? In other words, what does keeping α fixed (at 0.05 for example) guarantee for us, that we lose if we change alpha every time?