Quiz 4
Stat 61
Due to Gradescope by 2:00PM Dec 11

Submitting instructions:
Upload scanned, completed versions of these two pages to Gradescope by the deadline. You should also upload additional pages that show your work as scanned PDFs. Any additional pages must be clearly labeled and display how you arrived at the answers on this page. You will not receive full credit for handing in solutions without any work or justification. *Submissions that do not follow these instructions will not be graded.*

1. For each of the research settings below, state the alternative hypothesis using clearly defined symbols to represent unknown parameters (e.g. $\mu_1 - \mu_2 > 0$ where μ_1 is the average measurement for group A and μ_2 is the average measurement for group B). (Note no justification is required for Problem 1.)

   (a) An experiment on 14 cystic fibrosis patients measures the differences in the forced vital capacity of the patients' lungs before and after receiving either a placebo or a medication. Each treatment is randomly assigned to half of the patients and the patients are blind to the type of treatment they are receiving. Does the medication decrease the average rate of decline in forced vital capacity compared the placebo?

   $H_1 :$ _____ where $\begin{cases} \mu_1 = \text{\underline{\hspace{6cm}}} \\ \\ \mu_2 = \text{\underline{\hspace{6cm}}} \end{cases}$

   (b) In a large online statistics course, 14 randomly selected students recorded the scores they received on their first and last exams. Did the average student score increase over the semester?

   $H_1 :$ _____ where $\begin{cases} \mu_1 = \text{\underline{\hspace{6cm}}} \\ \\ \mu_2 = \text{\underline{\hspace{6cm}}} \end{cases}$

   (c) A laboratory is testing the impact of tobacco vaping on the lung capacity of lab mice. In one controlled section of the lab, 12 mice are treated with tobacco vape administered through an over-the face breathing device for a particular amount of time each day for one week. In another controlled section of the lab, 16 mice are treated with a similar over-the face breathing device that recirculates the air in their living environment. The mice were randomly assigned to one of these two treatments and the order in which the mice receive their treatments is also randomized every day of the week. Does daily vaping decrease the lung capacity of mice?

   $H_1 :$ _____ where $\begin{cases} \mu_1 = \text{\underline{\hspace{6cm}}} \\ \\ \mu_2 = \text{\underline{\hspace{6cm}}} \end{cases}$

   (d) For 15 randomly selected food items, the prices advertised in the local junk mail by two competing supermarkets are listed. Is there any difference in the average prices offered by the two supermarkets?

$$H_1 : \underline{\hspace{3cm}} \quad \text{where} \quad \begin{cases} \mu_1 = \underline{\hspace{6cm}} \\ \\ \mu_2 = \underline{\hspace{6cm}} \end{cases}$$

(e) A study on the impact of alcohol consumption on the muscular strength of adults considers a representative sample of 25 individuals. Some individuals are receiving treatment for alcoholism and the other individuals in the sample have no history of alcoholism. Is the average muscular strength of an adult with alcoholism less than that of an adult who does not have alcoholism?

$$H_1 : \underline{\hspace{3cm}} \quad \text{where} \quad \begin{cases} \mu_1 = \underline{\hspace{6cm}} \\ \\ \mu_2 = \underline{\hspace{6cm}} \end{cases}$$

2. Which of the statistical tests above should use the two-sample t-test for unpaired samples? (Circle all that apply below.)

    (a)   (b)   (c)   (d)   (e)

3. Which of the statistical tests above provide evidence of a cause and effect relationship between the group levels and the quantitative response? (Circle all that apply below.)

    (a)   (b)   (c)   (d)   (e)

4. Suppose the data in (d) above yields a difference in sample means of $58.70 and the sample standard error of the difference in prices is $15.20. Would a 95% confidence interval for the mean difference in prices contain zero? Justify your answer.

5. Arrange the tests for (a), (b), and (c) below in order according to their power.

    Least $\underline{\hspace{2cm}}$ $\underline{\hspace{2cm}}$ $\underline{\hspace{2cm}}$ Greatest