Name:_____   Math 130
Date: 5/5/2025   Exam 4

   Please show ALL your work on the problems below. No more than 1 point will be given to problems if you only provide the correct answer and insufficient work.

1. (22 points) To illustrate the effects of driving under the influence (DUI) of alcohol, a police officer brought a DUI simulator to a local high school. Student reaction time in an emergency was measured with unimpaired vision and also while wearing a pair of special goggles to simulate the effects of alcohol on vision. For a random sample of six teenagers, the time (in seconds) required to bring the vehicle to a stop from a speed of 60 miles per hour was recorded.

Subject	1	2	3	4	5	6
Braking Time With Normal Vision (seconds)	4.4	4	5.3	5.7	4.8	4.1
Braking Time With Impaired Vision (seconds)	5.7	5.8	5.1	6.5	5.7	5.8

Test the claim that braking time is longer with impaired vision than with normal vision at the 0.02 significance level. Use the rejection region method.

2. (22 points) Some people have said that a college education is not as important as it once was. One way to test this is to look at how having a college degree effects a person's salary. As of today, the average salary of all people in California is $73,220 per year. Do California employees with a college degree make the same? To test this, 100 California employees with a college degree were polled and their salaries had a mean of $91,380 and a standard deviation of $3920. Test this claim at the 0.10 significance level. Use the rejection region method.

3. (22 points) Researchers wondered if there was a difference between males and females in regard to some common annoyances. They asked a random sample of males and females, the following question: "Are you annoyed by people who repeatedly check their mobile phones while having an in-person conversation?" Among the 526 males surveyed, 198 responded "Yes". Among the 543 females surveyed, 216 responded "Yes." Does the evidence suggest a higher proportion of females are annoyed by this behavior at the 0.08 significance level? Use the p-value method.

4. (22 points) A doctor says that 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 30 lengths of stay for patients involved in this type of crash has a standard deviation of 5.8 days. At the $\alpha = 0.05$ level of significance, can you reject the doctor's claim? Use the p-value method.

5. (22 points) In 2015, the proportion of California residents who lived in an apartment was 19.3%. To see if this proportion has dropped since then, 380 California residents were randomly selected and 64 said that they currently live in an apartment. Test the claim at the 0.04 level of significance. Use the p-value method.

6. (7 points) What does a the 0.03 mean in a hypothesis test that is performed at the 0.03 significance level.

7. (3 points) What is a type II error?

Some formulas you may need:

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} \qquad df = n - 1$$

$$z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$$

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

$$z = \frac{\hat{p}_1 - \hat{p}_2 - (p_1 - p_2)}{\sqrt{\hat{p}\hat{q}}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \qquad \hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

$$t = \frac{\bar{d} - \mu_d}{\frac{s_d}{\sqrt{n}}} \qquad t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \qquad df = \text{smaller of } n_1 - 1 \ \& \ n_2 - 1$$

$$F = \frac{s_1^2}{s_2^2} \qquad df_1 = n_1 - 1 \qquad df_2 = n_2 - 1$$

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}} = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n - 1}}$$