

Math 11 Group Project

Latoya and Skye

Group Members: _____

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In this assignment, students will use hypothesis testing to do some or all of the following.

- Represent and explain mathematical information beyond the level of intermediate algebra symbolically, graphically, and numerically.
- Apply mathematical models of real-world situations and explain the assumptions and limitations of those models.
- Use mathematical models to find optimal results, make predictions, draw conclusions, and check whether the results are reasonable.

Problem	Points Possible	Points Earned
1	25	
2	25	
Total	50	

Background

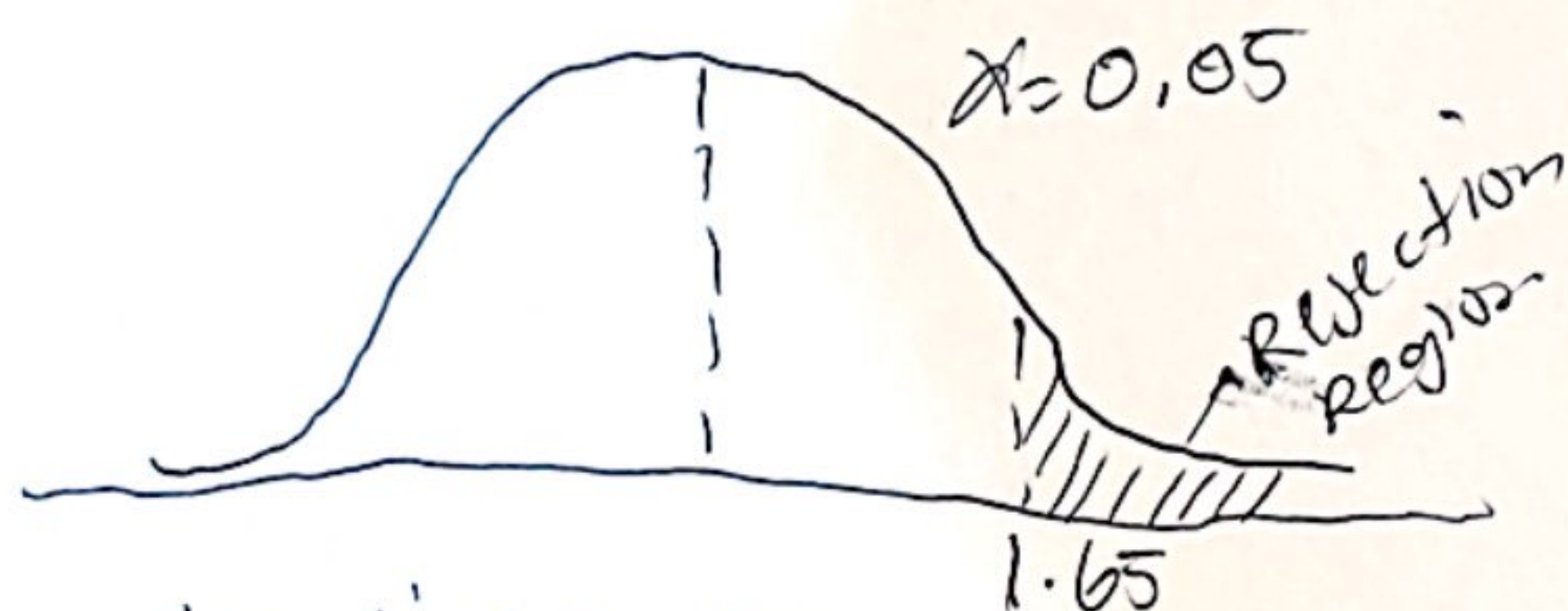
The Coronavirus Pandemic has affected nearly every aspect of our lives. As we continue to get new treatments and vaccines, the world can begin to recover and rebuild. An important branch of statistics is Hypothesis Testing, where claims about the efficacy of treatments can be supported or rejected with certain levels of confidence. The following problems are hypothetical scenarios where it is necessary to perform hypothesis tests to either support or reject a claim made by a researcher trying to develop treatments for the Coronavirus. For the following scenarios, conduct a full hypothesis test where you write down all relevant statistics and parameters, check the conditions of the CLT for normality, state the null and alternative hypothesis and which type of test is being used, calculate the test statistic, draw and label a picture of the bell curve, make a decision based on the classical or P-value approach, and write conclusion in a complete sentence.

1. (25 points) In the search for a cure for the Coronavirus, it is important to determine what proportion of the population has antibodies, which would likely make them immune to the effects of the disease. A researcher claims that more than 60% of Americans have antibodies for the Coronavirus, whether from vaccination or past infection. Suppose that you take a simple random sample of 850 Americans, test their blood, and find that 540 of them have antibodies. Use a 0.05 significance level to test the researcher's claim.

$$H_0: p \leq 0.6$$

$$H_1: p > 0.6$$

$$n = 850$$



No. of people with antibodies = 540

→ sample portion given by

$$\hat{p} = \frac{540}{850} = 0.6353$$

→ The test statistic is given by

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

$$Z = \frac{0.6353 - 0.60}{\sqrt{\frac{0.60(1-0.60)}{850}}}$$

$$Z = 2.10077$$

Since Z value is 2.10077 which is greater than the critical value 1.65, we reject the null hypothesis and conclude that there is significant evidence to accept the researcher's claim that more than 60% of Americans have antibodies for coronavirus at 5% significance level.

2. (25 points) It is very important that treatments are developed to save the lives of those who are critically ill from Covid-19. Critically ill patients often require mechanical ventilators, which use positive pressure to assist or push a breath into the lungs. Pressure Support is a common type of breathing support used when a patient needs partial support. The amount of Pressure Support delivered is measured in cm H_2O and ranges between 5 (minimal support) and 30 (total support). Source: London Health Sciences Center. Suppose that a new treatment is being tested and a simple random sample of 8 patients who are using mechanical ventilators and receive the treatment are selected. The following table shows the Pressure Support levels required before the treatment and one day after the treatment for the 8 different patients.

Pressure Support Before Treatment	20	12	17	10	30	23	15	5
Pressure Support After Treatment	17	13	11	6	22	15	8	0
Difference d	-3	1	-6	-4	-8	-7	-5	-40
d^2	9	1	36	16	64	49	25	1600

Use a 0.01 significance level to test the claim that there is a reduction in Pressure Support (and hence an improvement in condition) using this new treatment.

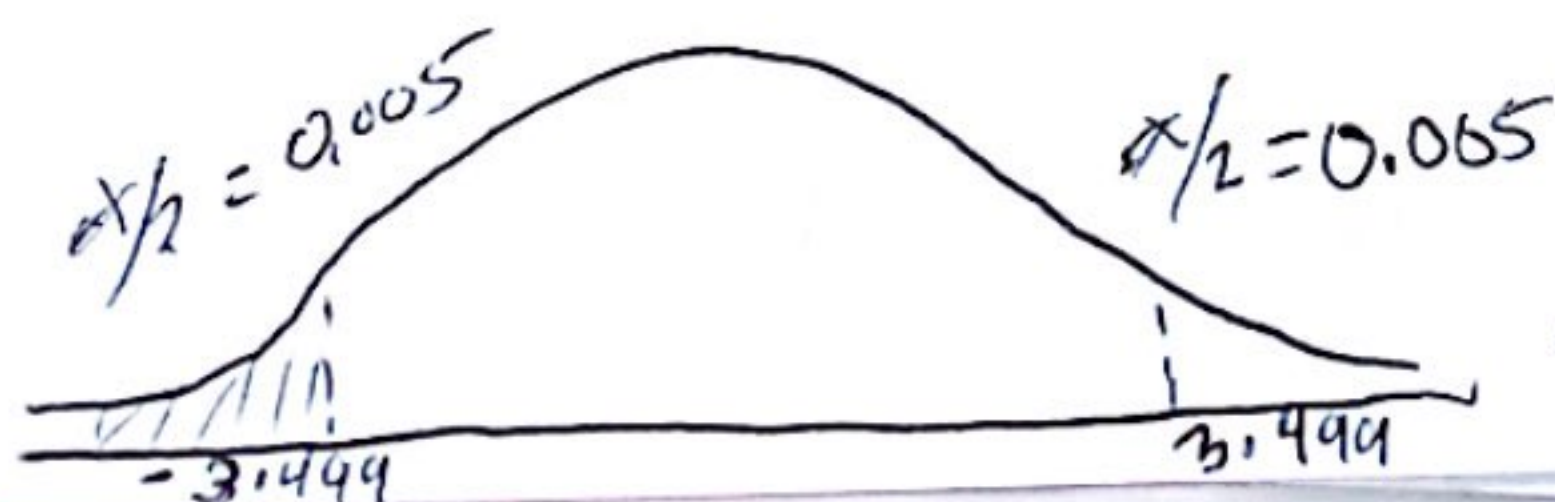
Since calculated t value -4.6771 is outside the interval ± 3.499 of the critical t value, we reject the null hypothesis and conclude that there is statistically significant evidence to accept the claim that there is no difference between the means at 0.01 significance level.

$$t = \frac{(\sum d)/N}{\sqrt{\frac{\sum d^2 - (\sum d)^2/N}{N-1}}}$$

$$t = \frac{-40/8}{\sqrt{\frac{264 - \frac{(-40)^2}{8}}{(8-1)(8)}}}$$

$$t = -4.6771$$

$$\text{Degrees of Freedom} = n - 1 = 7$$



T -critical is ± 3.499