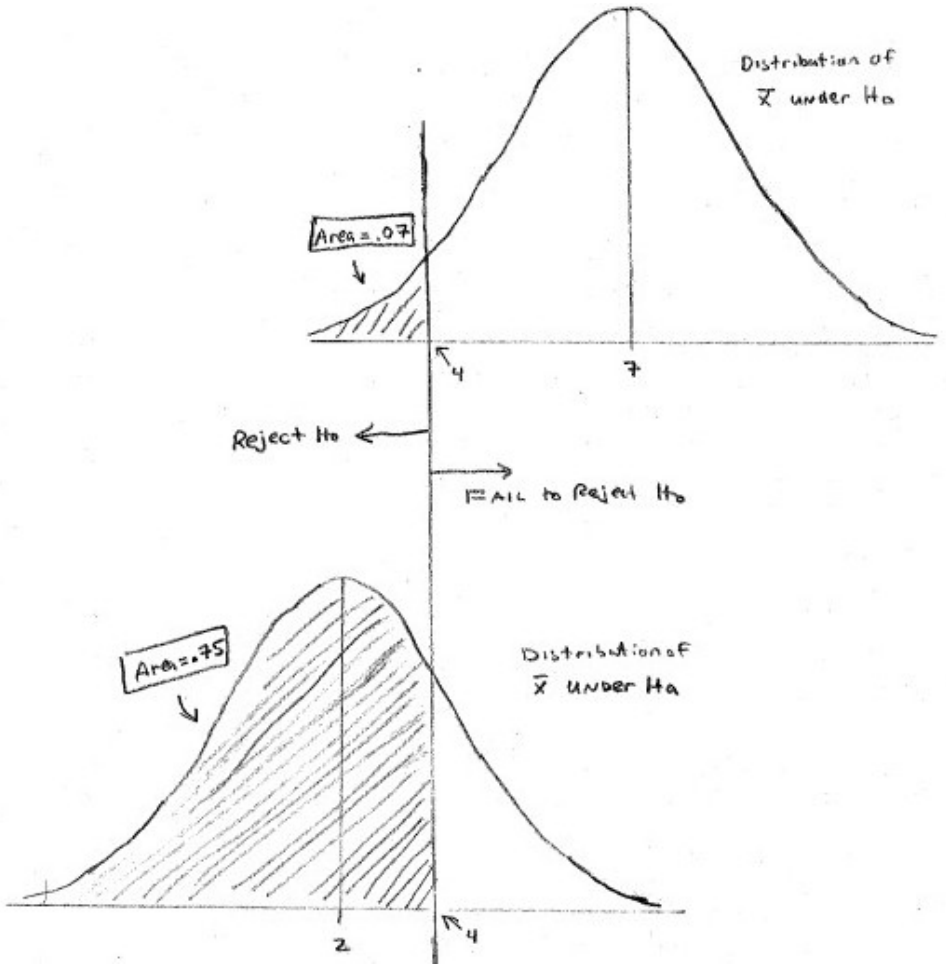
Math 10 – Power and Type II error **GW 17 Answers**

1. A researcher wants to support the claim that students spend less than 7 hours per week doing homework. The sample size for the test is 64 students. The drawing shown diagrams a hypothesis test for population mean under the Null Hypothesis (top drawing) and under the Alternative Hypothesis (bottom drawing).



   a. State the Null and Alternative Hypotheses.
   Ho: $\mu \geq 7$ Ha: $\mu < 7$

   b. What is the design probability associated with Type I error?
   α=.07

   c. What is the design probability associated with Type II error?
   β=1-.75=.25

   d. What is the critical value for the test statistic $(\bar{X}_c)$?
   CV would be at X-Bar=4

   e. What is the power of the test shown in this graph?
   Power = .75

   f. If the p-value of the test came out to be .08, what would the decision be?
   FTR Ho because pvalue is not less than α=.07

   g. What is the value of the mean under the Alternative Hypothesis?
   μ_α = 2

   h. What is the effect difference $|\mu_o - \mu_a|$ of this test? Explain what it means.
   $|\mu_o - \mu_a| = 5$

   i. If the sample size was changed to 100, would the shaded area on the bottom graph increase, decrease or stay the same?
   Shaded area (power) would increase. If sample size increases, power would also increase.

2. A study claims residents in a suburban town spend 1.8 hours per weekday commuting. A researcher wanted to see if this claim was true by sampling 101 adults. The mean and standard deviation of time spent commuting per weekday is shown below:

$\overline{X} = 2.1 \qquad s = 0.5$

a. Test the alternative hypothesis (α=.05) that the mean time spent commuting per weekday is more than 1.8 hours. Show all steps (Design, Data, Conclusion).

Ho: The mean commuting time is not more than 1.8 hours per weekday

Ha: The mean commuting time is more than 1.8 hours per weekday

Ho: $\mu \leq 1.8$ Ha: $\mu > 1.8$

α = 5% **Model: One sample t test of mean** $Z \approx t = \dfrac{\overline{X} - \mu_o}{s/\sqrt{n}}$

Reject Z > 1.645 or Reject Ho if p-value <.05

$$Z = \frac{2.1 - 1.8}{0.5/\sqrt{101}} = 6.03$$

or

$$pvalue = P(Z > 6.03) \approx .0000$$

Reject Ho

The mean commuting time is more than 1.8 hours per weekday.

b. In designing the test shown in part a, the researcher was concerned about the power of the test if the actual time commuting was 1.9 hours. Under the test described in Part a, Power was calculated to be only 64%. Determine the probability of making Type II error in this design.

β = 1-Power = 1-.64 = .36

How would the following modifications to the design affect the power (circle one answer)?

i. Change the sample size to 200: **increase power**

ii. Change significance level to 1%: **reduce power**

iii. Change actual commuting time to 1.95 hours: **increase power**