Name (Last, First) ANSWER KEY Email ID: _____@psu.edu

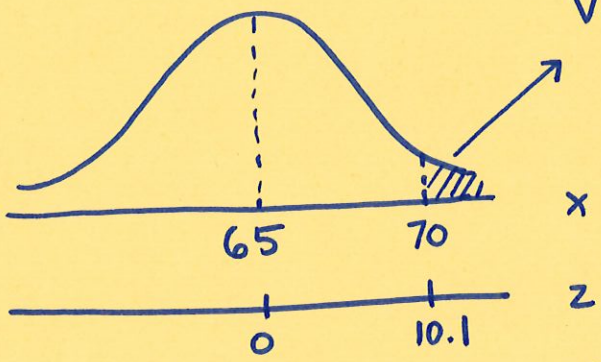
**ECON 306**
Homework 1
*Due: Thursday, January 26, 2017*
30 points

**Instructions:** Please print out and complete the following assignment writing your answers clearly and showing your work directly on the assignment. Follow directions carefully (underlining or circling your answers). Be sure to turn the assignment in at the beginning of class on Thursday, January 26th. Late homeworks cannot be accepted.

1. The mean height of a woman is 65 inches with a standard deviation of 3.5 inches. Assume we take a random sample of 50 women and find that mean height is 70 inches. What is the associated z-score? Given that the heights are normally distributed, what is the probability of this finding a random sample with this average? Draw a picture. (Hint: Note that we are dealing with the sampling distribution of means, so we will need to use "n" in our transformation) (5 points total)

$\mu = 65$
$\sigma = 3.5$
$n = 50$
$\bar{x} = 70$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{70 - 65}{3.5/\sqrt{50}} = 10.1$$




Very small probability: Less than 1%

**NOTE**: The probability of observing an exact value on a continuous distribution is effectively **ZERO**

2. Mickey's Burgers is a franchise fast-food restaurant in the Southeast. The Sales Department of Mickey's Burgers Inc. finds that the distribution of daily sales for restaurants follows the normal distribution and that the population standard deviation is $3,000. A sample of 40 restaurants showed the mean daily sales to be $20,000.

Develop a 99 percent confidence interval for the population mean. Show your work. (5 points total)

$\bar{x} = \$20{,}000$
$\sigma = \$3{,}000$
$n = 40$
99% C.I. $\rightarrow z = \pm 2.58$

$$\bar{x} \pm z\frac{\sigma}{\sqrt{n}}$$

$$\$20{,}000 \pm (2.58)\frac{\$3{,}000}{\sqrt{40}}$$

$$\$20{,}000 \pm \$1224$$

**$18,776 up to $21,224**

3. The Sweet Baby Ray's barbecue sauce factory uses a machine to put 16 ounces of its sauce into each container. After using the machine for many years, the Sweet Baby Ray's company knows that the amount of product in each container follows a normal distribution with a mean of 16 ounces and a standard deviation of 0.15 ounce. A sample of 50 containers filled last hour revealed that the mean amount per container was 16.017 ounces. Does this evidence suggest that the mean amount dispensed is different from 16 ounces? Use the .05 significant level. (10 points total: 2 points each)

a) State the null and the alternate hypothesis:

$H_0: \mu = 16.0$

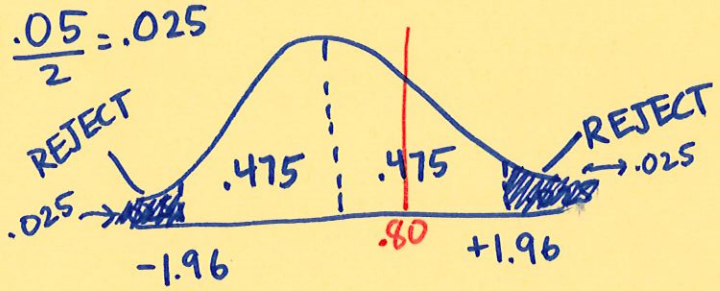
$H_1: \mu \neq 16.0$

b) Is this a one-tailed or two-tailed test? Why?

Two-tailed -- because we are testing that the amount is "different from"

b) Give the decision rule (when to reject), and draw a picture:

$\alpha = \frac{.05}{2} = .025$




Reject if test stat > 1.96
or test stat < -1.96

c) Compute the test statistic. Show work:

$$Z = \frac{16.017 - 16}{0.15/\sqrt{50}} = \frac{.017}{.0212} = 0.80$$

d) What is your decision regarding the null hypothesis? Give evidence:

Do not reject because $-1.96 < .80 < +1.96$
We cannot conclude that the mean amount dispensed is different from 16.0 ounces

4. The mean life of an Energizer battery used in a calculator is 305 days. The lives of batteries follow the normal distribution. The battery was recently modified to last longer. A sample of 20 of the new batteries had a mean life of 311 days with a standard deviation of 12 days. Did the modification increase the mean life of the battery? (10 points total: 2 points each) Use .05 significance level.

a) State the null and the alternate hypothesis:

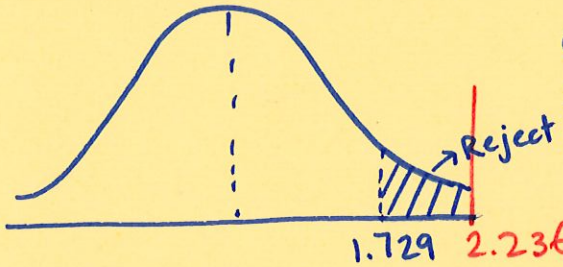
$H_0: \mu \leq 305$

$H_1: \mu > 305$

b) How many degrees of freedom are there? Show work.

$df = n - 1 = 20 - 1 = 19$

b) Give the decision rule, and draw a picture:




$df = 19$

$\alpha = .05$, one tailed

Reject if $t > 1.729$

c) Compute the test statistic. Show work:

$$t = \frac{\bar{X} - M}{S/\sqrt{n}} = \frac{311 - 305}{12/\sqrt{20}} = 2.236$$

d) What is your decision regarding the null hypothesis? Give evidence:

Reject $H_0$ because $2.236 > 1.729$