MTH 150 Test 4
Fall 2017

Elementary Statistics

Name _____

Justify all answers by showing your work or by providing a coherent explanation. Please circle your answers

The first four questions refer to the following situation.

DDT is an insecticide that accumulates up the food chain. Predator birds can be contaminated with quite high levels of the chemical by eating many lightly contaminated prey. One effect of DDT upon birds is to inhibit the production of the enzyme carbonic anhydrase, which controls calcium metabolism. It is believed that this causes eggshells to be thinner and weaker than normal and makes the eggs more prone to breakage. (This is one of the-reasons why the condor in California is near extinction.) An experiment was conducted where 16 sparrow hawks were fed a mixture of 3 ppm dieldrin and 15 ppm DDT (a combination often found in contaminated prey). The first egg laid by each bird was measured, and the mean shell thickness was found to be 0.19 mm with a standard deviation of 0.01 mm. A "normal" eggshell has a mean thickness of 0.2 mm.

1. The null and alternative hypotheses are

a. $H_0: \mu = 0.2 \quad vs \quad H_a: \mu < 0.2$
b. $H_0: \mu < 0.2 \quad vs \quad H_a: \mu = 0.2$
c. $H_0: \bar{x} = 0.2 \quad vs \quad H_a: \bar{x} < 0.2$
d. $H_0: \bar{x} = 0.19 \quad vs \quad H_a: \bar{x} = 0.2$
e. $H_0: \mu = 0.2 \quad vs \quad H_a: \mu \neq 0.2$

2. The value of the test statistic is

a. -1.00 **b.** -4.00 **c.** 0.01 **d.** 1.96 **e.** 1.75

3. The null hypothesis will be rejected ($\alpha = 0.05$) if the test statistic is less than (note that if the rejection region is two sided only one side has been shown)

a. -2.131 **b.** -1.753 **c.** -1.960 **d.** -1.645 **e.** -1.746

4. It is important to detect a decrease in the average thickness to 0.18 mm because the eggs are so fragile that few will survive. What sample size would be needed to be more than 80% sure of detecting this decrease at $\alpha = 0.05$?

a. 8 **b.** > 128 **c.** 34 **d.** 27 **e.** > 101

5. True or False? (Explain)

If we would reject a null hypothesis at the 5% level, we would also reject it at the 1% level.

6. Resting pulse rate is an important measure of the fitness of a person's cardiovascular system with a lower rate indicative of greater fitness. The mean pulse rate for all adult males is approximately 72 beats per minute. A random sample of 25 male students currently enrolled in the School of Agriculture was selected and the mean pulse resting pulse rate was found to be 80 beats per minute with a standard deviation of 20 beats per minute. The experimenter wishes to test if the students are less fit, on average, than the general population. Can the researcher substantiate his claim at $\alpha = 0.05$?

7. A random sample of 100 recorded deaths in the United States during the past year showed an average of 71.8 years. Assuming a population standard deviation of 8.9 year, does this seem to indicate that the mean life span today is greater than 70 years? Use a 0.05 level of significance.

8. The manager of a private clinic claims that the mean time of the patient-doctor visit in his clinic is 8 minutes. Test the hypothesis that $\mu =$ 8 minutes against the alternative that $\mu \neq$ 8 minutes if a random sample of 50 patient-doctor visits yielded a mean time of 7.8 minutes with a standard deviation of 0.5 minutes. It is assumed that the distribution of the time of this type of visits is normal. Use a 0.01 level of significance.

9. Suppose in a sample of 25 people, the mean height was observed to be 70 inches. Suppose also $\sigma = 3$.

a) Would you reject the hypothesis $H_0 : \mu = 71$ *vs* $H_a : \mu \neq 71$ on the basis of the observations, when testing at level $\alpha = .05$?

b) Would you reject the hypothesis $H_0 : \mu = 72$ *vs* $H_a : \mu \neq 72$ on the basis of the observations, when testing at level $\alpha = .05$?

c) Would you reject the hypothesis $H_0 : \mu = 69$ *vs* $H_a : \mu > 69$ on the basis of your observations, when testing at level $\alpha = .05$?

10. The calculated nitrogen content of pure benzanilide is 7.10%. Five repeat analyses of "representative" samples yielded values of 7.11%, 7.08%, 7.06%, 7.06%, and 7.04% ($\bar{x} = 7.07\%$, $s = 0.03\%$). Using an α level of size 5%, can we conclude that the experimental mean differs from the expected value? Assume that the measured values are approximately normally distributed.