STA 2023 - Test Your Understanding – Inference A

1. According to a University of Florida wildlife ecology and conservation researcher, the average level of mercury uptake in wading birds in the Everglades has declined over the past several years (UF News, 12.15.00). Ten years ago, the average level was 15 parts per million.

   a) Give the null and alternate hypothesis for testing whether the average level today is less than 15 ppm.
   b) Describe a Type I Error for this test.
   c) Describe a Type II Error for this test.

2. The EPA sets a limit of 5 parts per million (ppm) on PCB (polychlorinated biphenyl, a dangerous substance) in water. A major manufacturing firm producing PCB for electrical insulation discharges small amounts from the plant. The company management, attempting to control the PCB in its discharge, has given instructions to halt the production if the mean amount of PCB in the effluent exceeds 3ppm. A random sample of 50 water specimens produced the following statistics: mean = 3.1 ppm and standard deviation = .5 ppm.

   a) Do these statistics provide sufficient evidence to halt the production process? Use $\alpha = .06$.
   b) Describe Type I and Type II Errors for this test. If you were the plant manager, would you want a small or large α for the test in part a? Explain.
   c) Calculate a 92% confidence interval for the mean amount of PCB in the company's discharge.

3. A random sample of 197 wasps, captured, frozen, and subjected to a series of genetic tests yielded a mean inbreeding coefficient of .044 with a standard deviation of .884. If a wasp has no tendency to inbreed, the true mean inbreeding coefficient for the species will equal 0. Test the hypothesis that the true mean inbreeding coefficient for this species of wasp exceeds 0. Use $\alpha = .01$.

4. If the p-value for a test is .0002, would you support the alternate hypothesis? Explain.

5. If the p-value for a test is .3438, would you support the alternate hypothesis? Explain.

STA 2023 – Test Your Understanding – Inference B

1. In a British study, 12 healthy college students deprived of one night's sleep received an array of tests intended to measure their thinking time. fluency, flexibility, and originality of thought. The overall test scores of the sleep-deprived students were compared with the average score expected from students who received their accustomed sleep. Suppose the overall scores of the 12 sleep-deprived students had a mean of 63 and standard deviation of 17. (Lower scores are associated with a decreased ability to think creatively.)

   a) Test the hypothesis that the true mean score of sleep-deprived subjects is less than 80, the mean score of subject who received sleep prior to taking the test. Use $\alpha = .05$.

   b) What assumption is required for the hypothesis test of part **a** to be valid?

   c) Calculate a 90% confidence interval for the true mean overall score of sleep-deprived subjects.

2. Using van-mounted state-of-the-art video technology, the Mississippi Department of Transportation collected data on the number of cracks (called *crack intensity*) in an undivided two-lane highway (*Journal of Infrastructure Systems*, March 1995). The mean number of cracks found in a sample of eight 50-meter sections of the highway was .210 with a variance of .011. Suppose the American Association of State Highway and Transportation Officials (AASHTO) recommends a maximum mean crack intensity of .100 for safety purposes.

   a) Test the hypothesis that the true mean crack intensity of the Mississippi highway exceeds the AASHTO recommended maximum. Use $\alpha = .01$.

   b) Define a Type I error and a Type II error for this study.

3. In a study conducted by the U.S. Department of Transportation on the level of cell phone use by drivers while they are in the act of driving a motor passenger vehicle. In a random sample of 1,165 drivers selected across the country, 35 were found using their cell phone.

   a) Conduct a test to determine whether the true driver cell phone use rate differs from .02. Use $\alpha = .06$

   b) Calculate a 94% confidence interval for the true driver cell phone use rate.