Name: _____

MAT 222
Fall 2019
Homework 3

"I'm pretty, but tough like a diamond. Or beef jerky in a ball gown."
– Titus Andromedon, Unbreakable Kimmy Schmidt

Problem 1: A study on contaminated soil in the Netherlands looked at eighty-two 300g soil specimens, which were dried and analyzed for cyanide contamination. Contamination of cyanide (measured in mg/kg) in each soil sample was measured. The sample mean level of cyanide was found to be 85 mg/kg. It is known from previous samples of the soil that the standard deviation of cyanide contamination levels is 11.3 mg/kg.

If 5 years ago the soil contained an average cyanide level of 88 mg/kg, use a significance level of 5% to test the hypothesis that the contamination level has decreased over time. Be sure to state your null and alternative hypotheses, the critical value, test statistic with its p-value, and state the conclusions in the context of the problem.

Problem 2: As part of their training routine, a group of competitive cyclists spend time in a hyperbaric oxygen chamber to improve their competition performance. Given their previous training routines, the athletes had to spend an average of 8 hrs in the chamber each week (with standard deviation 3 hrs). However for an upcoming year of competition, the team needs to change their training routine. Sampling the athletes, they find an average time spent in the chamber to meet their required O_2 levels was approximately 6.9 hrs. This was based on a sample of size 37.

Construct a 99% confidence interval for the mean time needed to be spent in the chamber under this new training routine. Then use a significance level of 1% to test the hypothesis that there has been a change in the time required to spend in the chamber under this new training routine. Be sure to state your null and alternative hypotheses, the critical value, test statistic with its p-value, and state the conclusions in the context of the problem. Also, explain how you could have reached your decision using the confidence interval you constructed.

Problem 3: An outside management firm was hired to determine if there is a disparity in the pay between women of color and the average employee within a company. The overall pay in the company is approximately distributed as $N(37.3, 5.8)$, where the pay is measured in thousands of USD. A sample of 12 women of color was taken and they were found to have an average pay of \$33,000. Use a significance level of 1% to test the hypothesis that women of color at this company earn less than the average employee. Be sure to state your null and alternative hypotheses, the critical value, test statistic with its p-value, and state the conclusions in the context of the problem. Would you make the same conclusion if $\alpha = 0.05$? What about $\alpha = 0.001$? Explain.