Homework
Elementary Statistics & Inference (STAT:1020; Bognar)

1. The gain of a certain type of JFET transistor follows a normal distribution with mean μ and standard deviation σ. An electrical engineer randomly selected 7 transistors, and computed $\bar{x} = 116.2$ and $s = 7.8$.
   (a) Find a 95% confidence interval for μ.
   (b) If we were to test $H_0 : \mu = 125$ vs. $H_a : \mu \neq 125$ at the $\alpha = 0.05$ significance level, would you reject H_0? Why?
   (c) Test $H_0 : \mu = 125$ vs. $H_a : \mu \neq 125$ at the $\alpha = 0.05$ significance level. *Find the test statistic and critical value, plot the rejection region, and state your decision and final conclusion.*
   (d) Find the $p-$value for the test in 1c.

2. The amount of time per day (in hours) office workers spend working on a computer can be modeled by a normal distribution with mean μ and standard deviation σ. A manager wants to infer about the population mean μ, so he randomly selects 5 employees and observes their work habits. The raw data is:

   $$6.5,\ 7.1,\ 5.9,\ 6.2,\ 6.3$$

   (a) Compute the sample mean $\bar{x}$ and the sample standard deviation s.
   (b) Test $H_0 : \mu = 6$ vs. $H_a : \mu \neq 6$ at the $\alpha = 0.01$ significance level. *Find the test statistic and critical value, plot the rejection region, and state your decision and final conclusion.*
   (c) Based upon your answer in 2b, does the population mean computer time μ significantly differ from 6 hours? Why?
   (d) Find the $p-$value for the test in 2b.
   (e) Find a 99% confidence interval for μ.

3. Wood et. al (1988) studied the efficacy of diet for losing weight. The study, which lasted one year, involved only men. The weight loss for dieting men follows a normal distribution with mean μ and standard deviation σ. A group of $n = 16$ dieting men lost an average of $\bar{x} = 7.2$ pounds with standard deviation $s = 4.4$ pounds. *This problem will highlight the fact that a one-sided test has more statistical power than a two-sided test.*
   (a) Find a 90% confidence interval for μ.
   (b) Based upon your answer in 3a, does the population mean weight loss μ significantly differ from 5.5 pounds? Why?
   (c) Test $H_0 : \mu = 5.5$ vs. $H_a : \mu \neq 5.5$ at the $\alpha = 0.10$ significance level. *Find the test statistic and critical value, plot the rejection region, and state your decision and final conclusion.*
   (d) Approximate the $p-$value for the test in 3c.
   (e) Based upon your answer in 3d, does the population mean weight loss μ significantly differ from 5.5 pounds? Why?

4. The resistance (in Ohms) of a certain type of resistor (an electronic device) follows a normal distribution with mean μ and standard deviation σ. A technician randomly selected 25 resistors; the mean resistance was $\bar{x} = 971$ with standard deviation $s = 68$.
   (a) Find a 95% confidence interval for μ.
   (b) Based upon your answer in 4a, does the mean resistance μ significantly differ from 1,000? Why?
   (c) Suppose we wish to test $H_0 : \mu = 1{,}000$ versus $H_a : \mu \neq 1{,}000$ at the $\alpha = 0.05$ significance level. What is the $p-$value for the test?
   (d) Based upon your answer in 4c, does the mean resistance μ significantly differ from 1,000? Why?
   (e) Suppose the significance level $\alpha = 0.10$. Does the mean resistance μ significantly differ from 1,000? Why? *Hint: No further computations are necessary; you can answer this question based on the* $p-$value *in part (4c).*
   (f) Suppose the significance level $\alpha = 0.01$. Does the mean resistance μ significantly differ from 1,000? Why? *Hint: No further computations are necessary; you can answer this question based on the* $p-$value *in part (4c).*