HOMEWORK
ELEMENTARY STATISTICS & INFERENCE (STAT:1020; BOGNAR)

1. Suppose the weight of bags of M&M's follow a normal distribution with mean μ ounces and standard deviation $\sigma = 0.10$ ounces. A random sample of 4 bags had an average weight $\bar{x} = 16.10$ ounces. Suppose we wish to test $H_0 : \mu = 16$ vs $H_a : \mu > 16$ at the $\alpha = 0.05$ significance level.

   (a) What is the $p-$value for this test?

   (b) Is the mean weight μ significantly more than 16 ounces? Why?

   (c) Suppose the significance level $\alpha = 0.01$. Is the mean weight μ significantly more than 16 ounces? Why?

2. 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.

   (a) Test $H_0 : \mu = 5.5$ vs. $H_a : \mu > 5.5$ 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.*

   (b) Approximate the $p-$value for the test in 2a.

   (c) Based upon your answer in 2b, is the population mean weight loss μ significantly more than 5.5 pounds? Why?

3. Suppose cholesterol levels of athletes follow a $N(\mu, \sigma)$ distribution. The average cholesterol level of 31 randomly selected athletes was $\bar{x} = 130.3726$ with standard deviation $s = 12$. Suppose we wish to test $H_0 : \mu = 135$ versus $H_a : \mu < 135$ at the $\alpha = 0.01$ significance level.

   (a) Find the $p-$value for this test.

   (b) Is the mean cholesterol level μ significantly less than 135? Why?

   (c) Suppose the significance level $\alpha = 0.05$. Is the mean cholesterol level μ significantly less than 135? Why?

4. A sociologist collected a random sample of 13 statistics majors and 14 sociology majors. The students were asked about how many hours per week they spend socializing. The results are summarized in the following table. Assume that the amount of socialization for statistics majors follows a normal distribution with mean μ_1 and standard deviation σ_1, while the amount of socialization for sociology majors follows a normal distribution with mean μ_2 and standard deviation σ_2 . Because the sample standard deviations s_1 and s_2 are quite similar, lets make the reasonable assumption that $\sigma_1 = \sigma_2$.

Statistics:	$n_1 = 13$	$\bar{x}_1 = 32.1$	$s_1 = 10$
Sociology:	$n_2 = 14$	$\bar{x}_2 = 23.0$	$s_2 = 12$

   (a) Find a 95% confidence interval for $\mu_1 - \mu_2$.

   (b) Based upon your answer in 4a, is there a significant difference in the mean time spent socializing between statistics and sociology majors? Why?

   (c) Suppose we wish to test $H_0 : \mu_1 = \mu_2$ versus $H_a : \mu_1 \neq \mu_2$ at the $\alpha = 0.05$ significance level. Based upon your answer in 4a, will H_0 be rejected? Why?

   (d) Based upon your answer in 4c, will the $p-$value be less than 0.05 or greater than 0.05? Why?

   (e) Test $H_0 : \mu_1 = \mu_2$ versus $H_a : \mu_1 \neq \mu_2$ 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.*

   (f) Based upon your answer in 4e, is there a significant difference between μ_1 and μ_2? Why?

   (g) Approximate the $p-$value for the test in 4e.

   (h) Use the $t-$Probability Applet at

   `http://www.stat.uiowa.edu/~mbognar/applets/t.html`

   to precisely determine the $p-$value for the test in 4e.

   (i) Consider the test $H_0 : \mu_1 = \mu_2$ versus $H_a : \mu_1 \neq \mu_2$ at the $\alpha = 0.01$ significance level. Based upon your answer in 4g and 4h, do you reject H_0? Why?

5. A researcher recently examined the studying habits of college students. It is known that the number of hours per week spent studying by Communications majors follows a $N(\mu_1, \sigma_1)$ distribution. Also, it is known that the number of hours per week spent studying by English majors follows a $N(\mu_2, \sigma_2)$ distribution. A random sample of 16 Communications majors and 26 English majors found:

$$\begin{array}{rccc} \text{Communications:} & n_1 = 16 & \bar{x}_1 = 5.5 & s_1 = 2.0 \\ \text{English:} & n_2 = 26 & \bar{x}_2 = 7.3 & s_2 = 2.4 \end{array}$$

Assume the population standard deviations are equal, i.e. $\sigma_1 = \sigma_2$.

(a) Suppose we wish to test $H_0 : \mu_1 = \mu_2$ vs. $H_a : \mu_1 \neq \mu_2$ at the $\alpha = 0.01$ significance level. Approximate the $p-$value for this test.

(b) (*3 pts*) Based upon your answer in 5a, is there a significant difference between μ_1 and μ_2? Why?

(c) Use the $t-$Probability Applet at

`http://www.stat.uiowa.edu/~mbognar/applets/t.html`

to precisely determine the $p-$value for the test in 5a.

(d) Find a 99% confidence interval for $\mu_1 - \mu_2$.

(e) (*3 pts*) Based upon your answer in 5d, is there a significant difference in the population mean study times? Why?