Stat W 4201, Spring 2016

Assignment #3: Due February 17, 2016

1. Chapter 4, problem 30

2. Chapter 4, problem 32

3. Chapter 5, problem 19

4. Consider the Bumpus's data in Chapter 2, compute the power of the two-sided two sample t-test of size 0.05 (i.e., reject the null hypothesis if the absolute value the t-statistic is greater than or equal to 2), under the alternative that $\mu_x - \mu_y = \bar{x} - \bar{y} = 0.01$ and $\sigma = s_p = 0.0214$.

5. Show that the two-sided two sample t-test is equivalent to the anova F-test, if the number of groups is two.

6. Consider $X_1, ..., X_{10}$ are i.i.d. $N(0, \sigma^2)$, $Y_1, ..., Y_{10}$ are i.i.d. $N(\mu, \sigma^2)$ and hypothesis testing:

$$
\begin{aligned}
H_0 &: \quad \mu = 0, \\
H_A &: \quad \mu \neq 0.
\end{aligned}
$$

Compute the power of a two sided two sample t-test of size 0.05 when $\sigma^2 = 1$ and $\mu = 0.1, 0.5, 1$, and 2. Plot the power as a function of μ. Then, increase the sample size in each group to 20 and draw the power function in the same plot as that of the sample size 10.

7. Under the setting of the previous problem, show that, under the null hypothesis, the p-value follows the uniform distribution on the interval $[0, 1]$ and perform simulations to confirm it.