Homework 10 for STA 250/MTH 342 – Fall 2017

Due at the beginning of class on November 29, 2017

1. D&S (4th Ed.) Exercise 9.5.8 (page 586)
2. D&S (4th Ed.) Exercise 9.5.12 (page 586) The book uses U instead of T to represent the t-statistic. Also, to find the corresponding p-value, you don't need to apply Theorem 9.5.2 in the textbook. Instead, you can just use the definition of p-value, i.e. the smallest Type I error rate α at which the null hypothesis will be rejected.
3. D&S (4th Ed.) Exercise 9.6.4 (page 596)
4. D&S (4th Ed.) Exercise 9.6.6 (page 596)
5. D&S (4th Ed.) Exercise 9.6.10 (page 596) For this problem, carry out two tests—first assume that the variances of the two groups are the same, the second assuming unequal variance. In addition, give the corresponding p-value for each test.
6. More on p-values. Suppose 1000 studies are independently carried out. In each study, the investigator test a null hypothesis H_0 and gets a p-value. Suppose also for each study, the null hypothesis H_0 is indeed true.
   (a) What is the probability that at least one of the studies report a p-value less than 0.01?
   (b) What is the probability that at least one of the studies report a p-value less than 0.0001?
   (c) Either prove or verify numerically using `R` that the probability that at least one of the studies report a p-value less than $\alpha/1000$ is no larger than α. For numerical verification, you may compute the probability for a grid of α values in [0,1], and make a plot.
   (d) Now let us assume that for all studies that give "significant" results at the 1% level—that is, the corresponding H_0 is rejected at the 1% level—the investigator will carry out a follow-up study that test the H_0 again using *newly* collected data. What is the probability that there is at least one study whose p-value is less than 0.01 for both the original study and the follow-up study.