**Home Work # 2. AMS 380**

**Name:_____SBU ID:_____**

**Dear all, the homework is due on Thursday, Sep 9, 2021, at 11:59 PM. Please submit your homework to the Blackboard in a pdf or word (.doc) document. Rmarkdown is highly recommended.**

**Please include (1) R code; (2) Output from R; (3) Answers to all the questions asked.**

1. Please generate 100 random samples following Poisson distribution with $\lambda = 5$, use histogram to show the distribution of samples.

2. Calculate following probability
   a. $6 < X < 8$ if X follows an exponential distribution with rate is 3
   b. $X > 10$ if X follows a normal distribution with mean is 8 and standard is 3
   c. $X^2 < 5$ if X follows a binomial distribution with size 20 and prob is 0.4

3. Suppose there is a 300-question question bank, and each test draws 110 questions (*surely must be different questions) from the bank. What is the probability that 2 people receive at least 50% of the same questions?

4. Dr. Oz has a crazy hypothesis. He hypothesized that the average weight of adult US men and US women are equal. A group of smart Stony Brook University students do not agree with this hypothesis, and they got the SBU IRB (https://www.stonybrook.edu/commcms/research-compliance/) approval to draw two independent random samples of 9 adult men and 9 adult women. The measured weight (in kg) is as the following:

| ID | group | weight |
|---|---|---|
| 1 | Woman | 38.9 |
| 2 | Woman | 61.2 |
| 3 | Woman | 73.3 |
| 4 | Woman | 21.8 |
| 5 | Woman | 63.4 |
| 6 | Woman | 64.6 |
| 7 | Woman | 48.4 |
| 8 | Woman | 48.8 |
| 9 | Woman | 48.5 |
| 10 | Man | 67.8 |
| 11 | Man | 60.0 |
| 12 | Man | 63.4 |
| 13 | Man | 76.0 |
| 14 | Man | 89.4 |
| 15 | Man | 73.3 |
| 16 | Man | 67.3 |
| 17 | Man | 61.3 |
| 18 | Man | 62.4 |

Please answer the following questions – and follow the following website for the R procedures:
http://www.sthda.com/english/wiki/unpaired-two-samples-t-test-in-r

(a). Please visualize the two groups using the Box plot in R.
(b). Please test the normality and equal variance assumptions using R.
(c). Please perform the correct test comparing whether the two means are equal or not at significance level 0.05 using R. Please report the p-value of your test. Please also construct the 95% confidence interval for the mean difference using R. Please also include your conclusion of the test.

5. While most of the time we wish to reduce our weight, there are times when we wish to gain some weight. The MiraGro Co. has developed just such a weight gain formula and they tested it on 10 mice. The weight of the mice before and after the treatments are as follows (in unknown unit):

| | ID | group | weight |
|---|---|---|---|
| 1 | before | | 200.1 |
| 2 | before | | 190.9 |
| 3 | before | | 192.7 |
| 4 | before | | 213.0 |
| 5 | before | | 241.4 |
| 6 | before | | 196.9 |
| 7 | before | | 172.2 |
| 8 | before | | 185.5 |
| 9 | before | | 205.2 |
| 10 | before | | 193.7 |
| 1 | after | | 392.9 |
| 2 | after | | 393.2 |
| 3 | after | | 345.1 |
| 4 | after | | 393.0 |
| 5 | after | | 434.0 |
| 6 | after | | 427.9 |
| 7 | after | | 422.0 |
| 8 | after | | 383.9 |
| 9 | after | | 392.3 |
| 10 | after | | 352.2 |

Please answer the following questions – and follow the following website for the R procedures:
http://www.sthda.com/english/wiki/paired-samples-t-test-in-r

(a). Please visualize the two groups using the Box plot in R.
(b). Please test the normality assumption using R.
(c). Please perform the correct test examining whether the mean difference is zero or not at significance level 0.10 using R. Please report the p-value of your test. Please also construct the 90% confidence interval for the mean difference using R. Please also include your conclusion of the test.