STAT 540: Test 1

1. (20 pts) You will receive full credit if you minimize the number of lines of code for each sequence and you minimize the use of `c()`.

   (a) Generate the following sequence two different ways: 3,3,2,2,1,1

   (b) What sequence would the following command generate? rep(seq(1,8,by=2),4)

   (c) Graduate Students. Generate the following sequence: 1,2,2,3,3,3

2. (30 pts) Write the outcome after each step of the following commands.

   (a)
   ```
   m1=matrix((3:8)^2,2,3)
   m2=t(m1)
   rbind(t(m2),m1)
   cbind(m2,t(m1))
   ```

   (b) Graduate Students. Suppose you had a 3x3 matrix m1, a 1x3 vector r1, a 3x1 vector c1, and a scalar x11. Show the commands you would use to create the 4x4 matrix m3

   $$\text{m3} = \begin{array}{|c|c|}\hline \text{m1} & \text{c1} \\ \hline \text{r1} & \text{x11} \\ \hline \end{array}$$

3. (20 pts) The following code simulates n tosses in Buffons needle experiment (see accompanying diagram showing two sample tosses of needles), which can be used to provide an estimate of π. You don't need to understand all the steps in the code to work this problem. Let

   $$\begin{aligned} d &= \text{distance between lines} \\ l &= \text{length of needle} \\ \theta &= \text{angle between needle and line} \\ c &= \text{center of needle} \end{aligned}$$

```
d=4
l=3
n=100
theta=runif(n,0,pi)
c=runif(n,0,d/2)
crossing=(c<(l/2)*sin(theta))
crossing_phat=sum(crossing)/n
pihat=(2*l)/(d*crossing_phat)
```

   (a) Suppose we wanted to incorporate this code into a function called "Buffon" so that the user could specify the spacing between the lines (d), the number of tosses (n), and the length of the needle (l). Modify and edit the code above to create the function Buffon.

(b) Add commands(s) to output the estimate of π (the variable pihat).

4. (30 pts) 31 baby chickens on 4 different diets were weighed 11 times. Suppose we have the numeric vectors `Time` (day of measurement) and `Weight` (grams) and the factors `Chicken` and `Diet`. The variable `Diet` has 4 levels, labelled 1 through 4. List the commands for each of the following tasks.

   (a) Create a dataframe named ChickenWeight.df from these 4 variables. Use ChickenWeight as the dataframe for the remaining tasks.

   (b) Extract rows where weight is greater than 100 grams

   (c) Now extract rows where the weight is greater than 100 grams and time of measurement is fewer than 10 days.

   (d) Order the records for each baby chicken from smallest weight to largest weight.

   (e) Compute the mean weight for each diet.

   (f) Graduate students. Find the weight gain for each baby chicken.

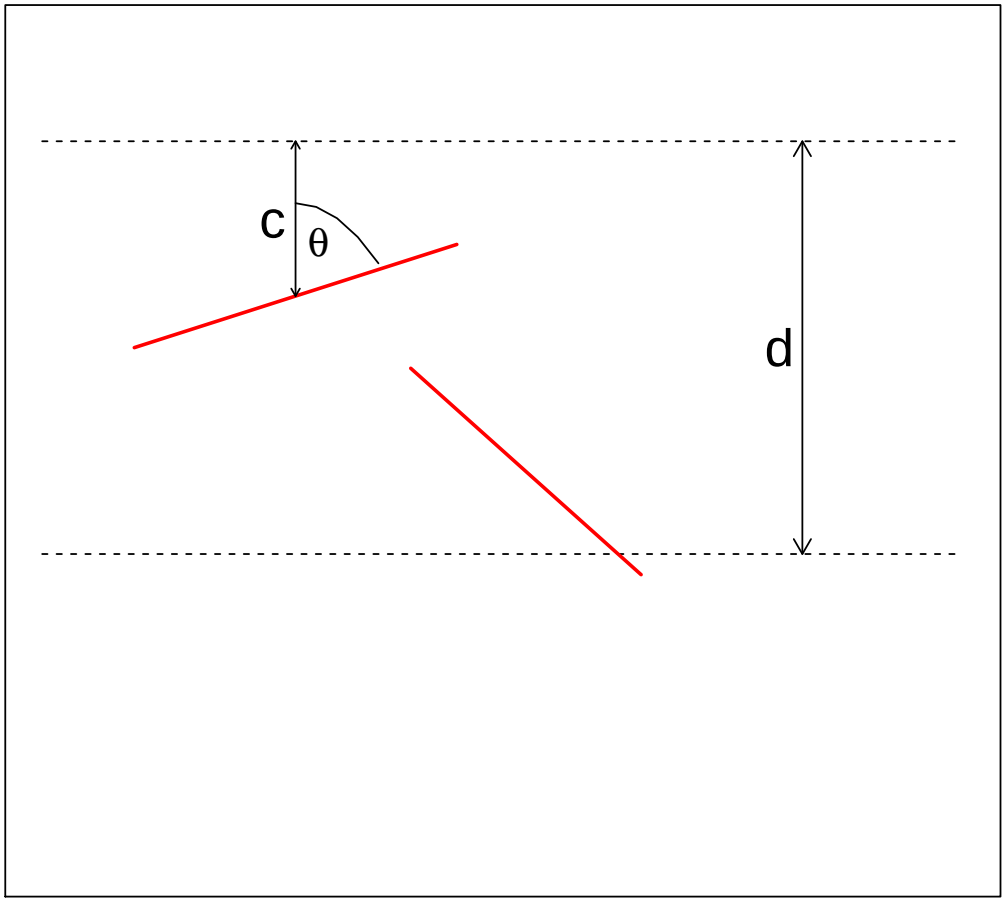

Figure 1: Buffon's Needle Diagram