STAT 540: Test 1

1. Generate the following sequences. You will receive full credit if you use only one line of code for each sequence and you minimize the use of `c()`. 20 pts.

   (a) 1,2,3,4,1,2,3,4,1,2,3,4,1,2,3,4

   (b) 1,3,5,7,1,3,5,7,1,3,5,7,1,3,5,7

   (c) "a","a","b","b","c","c"

2. Write the outcome after each step of the following commands. 20 pts.

   (a) `m1=matrix(3,3,2)`

   (b) `m2=matrix(1:6,3,2)`

   (c) `rbind(m1,m2)`

   (d) Graduate Students. `m3=matrix(1:4,3,2); cbind(2*m1,m2)`

3. Refer to the attached code for the Gamblers Ruin simulation. You do not need to change the output object `out` (or its `names`) when answering the following questions. 20 pts.

   (a) Modify the function argument so that users can input an initial positive bankroll `B`.

   (b) Modify the function to compute a character variable `Outcome` that stores "Busted" or "Congratulations" if losses exceed or never exceed the initial bankroll at any point during the game.

   (c) Graduate students. Create another variable–a numeric value that stores the first trial at which the player went broke. If the player does not go broke, a missing value should be returned.

4. The following code prints a simple scatterplot of verbal SAT scores and math SAT scores. 20 pts.

```
vsat=c(480,560,580,440,580,740,500,570,680,510,550,550,570,650,730)
msat=c(580,630,750,620,680,710,640,650,700,630,630,680,570,590,670)
plot(vsat,msat,main=SAT scatterplot,xlim=c(400,800),ylim=c(400,800))
```

   (a) Add a separate line of code that will add to the plot a red reference line with a slope of 1.

   (b) What will be the default names for the x and y axes? Add arguments to the `plot` command to print improved labels.

5. Refer to the attached information on the data frame `mtcars` to answer the following questions. 20 pts.

   (a) Extract the first 8 records.

(b) Assume the variable CYL is a factor. Extract all records for 8-cylinder cars using a logical operator.

(c) Order the records in the dataframe from highest gas mileage to lowest gas mileage.

(d) Write code to store the minimum miles per gallon (MPG) for each value of CYL.

(e) Graduate students. The `xor` (exclusive or) function in R returns TRUE if either one of two statements is T, but not both. Write a set of logical statements to find all records for cars with standard transmission or horsepower less than 150, but not both.

Description

The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973–74 models).

Format

A data frame with 32 observations on 11 variables.

Name	Definition
MPG	Miles per Gallon
CYL	Number of cylinders (4,6,8)
DISP	Displacement (cubic inches)
HP	Gross horsepower
DRAT	Rear axle ratio
WT	Weight (lb/1000)
QSEC	1/4 mile time
VS	V/S
AM	Transmission (0=automatic, 1=manual)
GEAR	Number of forward gears (3,4,5)
CARB	Number of carbureors (1,2,3,4,6,8)

```
# Random walk code. p is .5 by default
rwalk=function(n,p=.5) {
# Reset the graphics window
dev.off()
windows()
par(mfrow =c(2,1))

# Change Bernoulli outcomes to +1 or -1 outcomes
X = 2*rbinom(n,1,p)-1
S = cumsum(X)

# Study behavior of the cumulative sum
ts.plot(X,xlab="Step",ylab="Winnings",ylim=c(-2,2))
abline(h=0,col="red")
title("Individual Steps")
ts.plot(S,xlab="Step",ylab="Total Winnings")
title("Random Walk")
abline(h=0,col="red")

# Some useful statistics
Smin=min(S)
Sfin=S[n]
SReturn=sum(S==0)

out <- list(X,S,Sfin,Smin,SReturn)
names(out) <- c("Trials","Random Walk","Final Winnings",
 "Maximum Losses","Returns")
out
}
```