EXAM 1

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## R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

summary(cars)

## speed dist   
## Min. : 4.0 Min. : 2.00   
## 1st Qu.:12.0 1st Qu.: 26.00   
## Median :15.0 Median : 36.00   
## Mean :15.4 Mean : 42.98   
## 3rd Qu.:19.0 3rd Qu.: 56.00   
## Max. :25.0 Max. :120.00

## Including Plots

You can also embed plots, for example:



Note that the echo = FALSE parameter was added to the code chunk to prevent printing of the R code that generated the plot.

#Question 1

#This code gives me a warning but it still runs well  
deck = rep(c(1:10, "J", "Q", "K"), each = 4)  
  
#Replication   
n <- 10000 #Number of repetitions   
simlist <- numeric(n) #Initialize vector   
for (i in 1:n){  
 trial <- sample(deck, 2, replace = TRUE)  
 if ("9" %in% trial){  
 # Calculate sum of cards  
 sum\_cards <- sum(ifelse(trial %in% c("J", "Q", "K"), 10, as.numeric(trial)))  
 # Check if sum of cards is no more than 15  
 success = if(sum\_cards <= 15) 1 else 0  
 }  
 simlist[i] = success  
}

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## Warning in ifelse(trial %in% c("J", "Q", "K"), 10, as.numeric(trial)): NAs  
## introduced by coercion

mean(simlist)

## [1] 0.4715

#Question 2

rolls <- function(){  
 dice = sample(1:8, 7, replace = TRUE)  
   
 ans = if(sum(dice) > 43) 1 else 0   
}  
  
n = 10000   
success = sum(replicate(n, rolls()))  
prob\_success = success / n   
prob\_success

## [1] 0.0238

#Question 3

# Set the number of simulations  
n = 10000  
  
# Create a variable to count the number of times all three cards have the same rank  
count = 0  
  
# Run the simulation  
for (i in 1:n) {  
 # Generate a random sample of 3 cards from a deck of 52 cards  
 cards = sample(1:52, 3, replace = FALSE)  
   
 # Check if all three cards have the same rank   
 # using the unique function to make sure all 3 cards have the same ranks in 13 ranks   
 if (length(unique((cards - 1) %/% 4)) == 1) {  
 count = count + 1  
 }  
}  
  
# Calculate the probability of having all three cards of the same rank  
prob\_same\_rank <- count / n  
  
prob\_same\_rank

## [1] 0.0032

#Question 4

#a. Simulate the game 1000 times   
#set.seed(1000)  
n = 1000   
win = numeric(0)  
for(i in 1:n){  
 roll = sample(1:7, 2, replace = TRUE)  
 s = sum(roll)  
 if(s %in%c(2, 3, 4, 5)){  
 win[i] = 3   
 }  
 else if (s %in% c(7, 12)){  
 win[i] = 15  
 }  
 else if (s %in% c(14)){  
 win[i] = 25   
 }  
 else {  
 win[i] = -5  
 }  
}  
  
#b. Find the expected gain of the game   
mean(win)

## [1] 0.768

#Present a table of the 1000 games  
e = table(win)  
e

## win  
## -5 3 15 25   
## 599 201 184 16

*(d) This game is a good bet since the expected gain of the game is greater than 0.*