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**Problem Assignment 1**

1. **Solve the Monte Hall problem either theoretically or with R (presented in the minilectures)**

Monte Hall problem Scenario: In a TV show, the host Monte Hall, gives you an opportunity to select any one of the given 3 closed doors, one of which has a prize behind it. The other 2 doors also have things stored behind them but they are worthless (things like llama and a goat). Now, you have to choose the correct door in order to win the prize. When you select a door, before opening the chosen door, Monte will open another door which does not have the prize and will ask you if you want to switch the chosen door with the door he didn’t open, or stay with your first pick. Now, we need to know if we should stay or switch and the probability of choosing the correct door.

Solution: The probability of each door having the prize is 1/3. So, if we choose door 1 and if it is the correct door, then the probability of winning is 1/3. Now, when we select door 1, Monte will open door 2 or 3 (let’s say door 3). He will then ask to choose to stay or switch. If we decide to stay with door 1, then the probability of winning remains the same, i.e. 1/3. But, if we decide to switch to the other door (door 2), which Monte has not opened, then the probability of us winning will increase to 2/3. How? When we select to switch, we already know that door 3 does not have the prize. And, the sum of probability of winning for door 2 and door 3 is 2/3 (because each door has probability 1/3). As we know that door 3 does not have the prize (i.e. probability of door 3 having the prize is 0), now, the probability of door 2 having the prize increases to 2/3. And, probability of door 1 having the prize still remains the same (i.e. 1/3) because we do not have any information about it, yet. Hence, if we decide to stay, then we will choose the door with less probability of winning (i.e. 1/3). But, if we switch, our chances of winning the prize increases. Hence, we should select to switch.

**2.) Comment the code provided in minilecture 1.3.**

monte.hall <-function(N,n=3){ **#Declaration of function.**

winswitch<-NULL **#Initializing value of winswitch to NULL. Variable to store count of wins after switching the door.**

winstay<-NULL **#Initializing value of winstay to NULL. Variable to store count of wins after choosing the same door.**

for(i in 1:N){ **#Starting “for” loop for N number of decisions.**

true.door<-sample(n,n) **#Selecting n random numbers (from 1 to n) using sample function and assigning generated random array to true.door.**

choice.door<-sample(n,1) **#Selecting 1 random number from list of n numbers using sample function and assigning that value as chosen door.**

**#**Mdoor<-sample(true.door,1) **#This variable is not used anywhere in the code. Hence, useless line.**

if(choice.door==true.door[1]) **# Comparing value of chosen door with the first value in array of true door. (The values of true.door[1] and choice.door are generated randomly, so for each “for” loop, this condition will defer.)**

{ **#if chosen door is true door,**

winswitch<-c(winswitch,0) **# switch will not be done and winswtich will be counted 0.**

winstay<-c(winstay,1) **# stay will be done and winstay will be counted 1.**

}

else{ **#if chosen door is not true door,**

winswitch<-c(winswitch,1/(n-2)) **# switch will be done and winswitch will be counted.**

winstay<-c(winstay,0) **#winstay will be counted 0.**

}

}

m1<-cbind(winswitch,winstay) **#Binding values of winswitch and winstay as columns and storing it as m1. m1 will be data frame containing values of winswitch and winstay.**

apply(m1,2,sum)/N **#Adding the values of winswitch and winstay (column wise) and then returning the total value.**

}