Quantitative Exercise

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```
library(knitr)
opts_chunk$set(tidy.opts=list(width.cutoff=60),tidy=TRUE)
```

Introduction

We are looking at the Monty Hall problem.

Dataset

The dataset is generated by a C program that save the samples in a CSV files.

Setting the directory to the data directory.

```
getwd()
```

```
## [1] "/Users/Marine/Documents/1_KTH/4_Courses/3_RMSW/Assignments/Quantitative"
```

```
setwd("/Users/Marine/Documents/1_KTH/4_Courses/3_RMSW/Assignments/Quantitative")

getwd()
```

```
## [1] "/Users/Marine/Documents/1_KTH/4_Courses/3_RMSW/Assignments/Quantitative"
```

Read in data frame.

```
mdf <- read.csv("samples-100000.csv", header = T, sep = ",",
    stringsAsFactors = F)

# check what variables are there
names(mdf)
```

```
## [1] "CarDoor"  "Selected" "S"        "NS"
```

```
summary(mdf)
```

```
##    CarDoor            Selected              S
##  Length:100000      Length:100000      Length:100000
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##       NS
##  Length:100000
##  Class :character
##  Mode  :character
```

We can then factorize the data.

```
# factorize the data

mdf$Sf = as.factor(mdf$S)
```

```
mdf$NSf = as.factor(mdf$NS)
# summary(mdf)
```

The function countWin will count when the player wins and has changed his mind and when he has win without changing his mind.

```
# Count all the wins in 2 sets : Switch or No Switch
countWin <- function(df) {
    # df is a dataframe

    l1 <- length(df$NS)
    sumWinS <- 0
    sumWinNS <- 0

    for (i in 1:l1) {

        if (df$S[i] == "W" & df$NS[i] == "L") {
            sumWinS <- sumWinS + 1
            df$sumWinSwitched[i] <- sumWinS

            # Not changed:
            df$sumWinNotSwitched[i] <- sumWinNS
        } else if (df$S[i] == "L" & df$NS[i] == "W") {
            sumWinNS <- sumWinNS + 1
            df$sumWinNotSwitched[i] <- sumWinNS

            # Not changed:
            df$sumWinSwitched[i] <- sumWinS
        }
    }
    return(df)

}

mdf <- countWin(mdf)

summary(mdf)
```

```
##    CarDoor            Selected              S
##  Length:100000      Length:100000      Length:100000
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##       NS            Sf        NSf       sumWinNotSwitched sumWinSwitched
##  Length:100000      L:33212   L:66788   Min.   :    1     Min.   :    0
##  Class :character   W:66788   W:33212   1st Qu.: 8424     1st Qu.:16577
##  Mode  :character                       Median :16736     Median :33264
##                                         Mean   :16690     Mean   :33310
##                                         3rd Qu.:25012     3rd Qu.:49988
##                                         Max.   :33212     Max.   :66788
```

Variables

We only have very few variables for this problem that are relevant for the analysis. Those variables are:

- S : (equal to "W" or "L") this variable represent whether the player has Win or Lose IF he has Switch.
- NS : (equal to "W" or "L") this variable represent whether the player has Win or Lose IF he has Not Switch.

NS and S are dependent of each other: if one is "W" the other is "L". We could have kept only one of them but keeping both facilitates the comprehension and the display of the result.

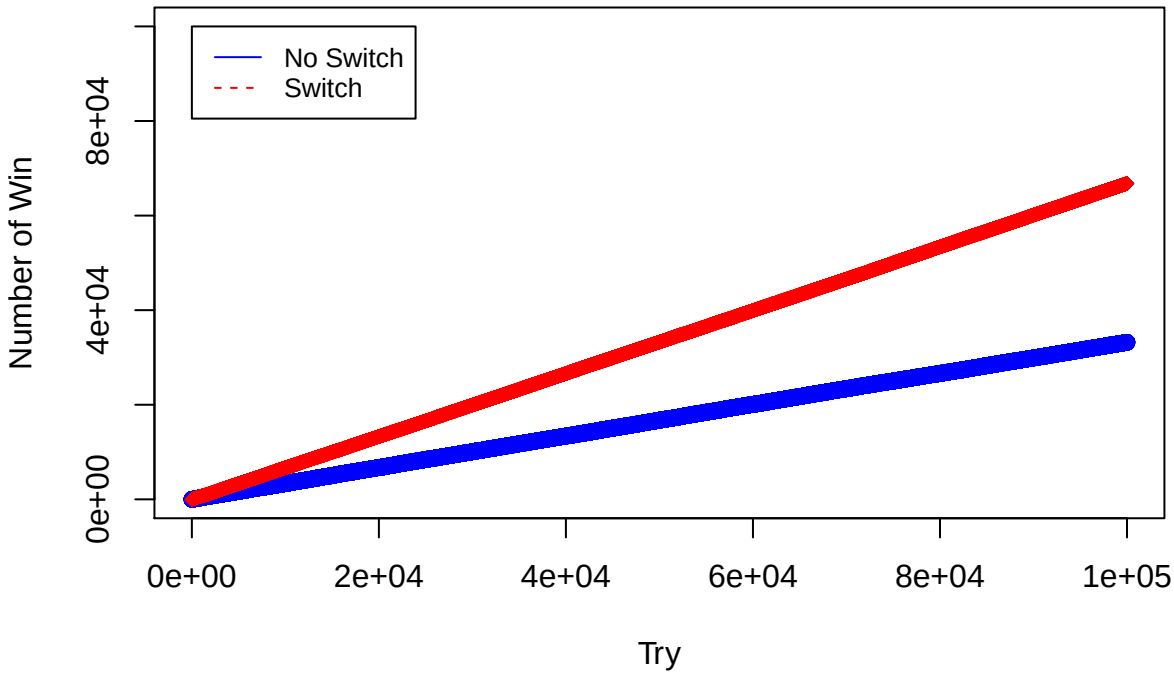
The other attributes of the data frame or either to the facilitate the analysis (sumWinSwitched and sumWinNotSwitched) or are required to understand the problem (CarDoor and Selected). The last ones are required for the generation.

Analysis

```
# Plot Win without switch
plot(mdf$sumWinNotSwitched, xlim = c(0, length(mdf$NS)), ylim = c(0,
    length(mdf$NS)), xlab = "Try", ylab = "Number of Win", col = "blue",
    type = "b", lty = 1)

# Add Win with switch
lines(mdf$sumWinSwitched, pch = 18, col = "red", type = "b",
    lty = 2)

# Legend
legend(0, length(mdf$NS) - 1, legend = c("No Switch", "Switch"),
    col = c("blue", "red"), lty = 1:2, cex = 0.8)
```



The probability of winning with a switch is in theory 2/3.

```
probWinWithSwitch = mdf$sumWinSwitched[length(mdf$NS)]/(length(mdf$NS))
```

We have for those samples the probability:

```
probWinWithSwitch
```

```
## [1] 0.66788
```

We can then conclude that our samples have the expected properties.