Assignment 9 **Team: Technopreneurs**
Data Science Project Date: 15 April 2015

Problem Statement*

Simulate an experiment with 10000 trials.

- Flip 3 coins in each trial
- For each trial, compute the number of coins that come up "heads".
- Write this data to a file, then read it back into R.
- Find the fraction of trials where at least 1 coin comes up heads.
- How close is this to your theoretical prediction

Theoretical Prediction

For the given problem, the sample space is $\Omega = \{H, T\}$, where both outcomes are equally likely. On this space we can then define a random variable X as,

$$X = \begin{cases} 1 & \text{if at least 1 Head} \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

For 3 flips, probability of at least 1 head is given as,

$$Pr(X = 1) = 1 - \left(\frac{1}{2}\right)^3 = \frac{7}{8} \tag{2}$$

For a random variable X that takes on a finite set of possible values, the expected value is,

$$E[X] = \sum_x xPr(X = x) \tag{3}$$

Hence for 10000 trials, the expected number of trials in which at least 1 coin comes up heads is given as,

$$E[X] = \sum_{i=1}^{10000} x_i * Pr(X = x_i) \tag{4}$$

Since $x_i = 1 \ \forall i$, $E[X] = 8750$.

Actual Output

When run using R, the actual number of trials in which at least 1 coin comes up heads turned out to be 8742. Hence the value generated using R is within 0.1% of the expected theoretical value.

The output generated using RStudio can be found on next page of the document. The complete code and number of coins in which head came up in each trial can be found here: `http://goo.gl/b646Au`

*As given in tutorial slides

Assignment_9.r

pulkit

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```
#Language: R

#number of trials
trialCount = 10000

#create an empty list
headCount=list()

for(i in 1:trialCount)
{
  coin <- c("Heads", "Tails")
  tempSample <- sample(coin, size = 3, replace = TRUE) #store result of sample
  headCount[i] <- length(tempSample[tempSample=="Heads"]) #calculate number of heads
}

#This file stores the number of heads in each trial
myFile <- "headCount.txt"
if (file.exists(myFile))
  invisible(file.remove(myFile))

#Write the data to file, use invisible to suppress output of lapply on console
invisible(lapply(headCount, write, myFile, append=TRUE))

#Read data from file
headCountNew <- read.table(myFile, header=FALSE)

#if number of heads>=1, mark as 1
headCountNew[headCountNew >= 1] <- 1

#count number of 1, hence count number of occurances of at least 1 head
ans<-length(headCountNew[headCountNew==1])

cat("Fraction = ",ans,"/",trialCount)
```

```
## Fraction =  8742 / 10000
```