DATA 605 - Final Exam

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## Problem 1 :

Using R, generate a random variable X that has 10,000 random uniform numbers from 1 to N, where N can be any number of your choosing greater than or equal to 6. Then generate a random variable Y that has 10,000 random normal numbers with a mean of mean=std=(N+1)/2

#10,000 random uniform numbers from 1 to N  
N=9  
# 10,000 random uniform numbers from 1 to N  
X = runif(10000, 1,N)  
# 10,000 random normal numbers with a mean of mean=std=(N+1)/2  
mu <- (N+1)/2  
std <- (N+1)/2  
Y = rnorm(10000, mean = mu,sd = std)

## Probability

Calculate as a minimum the below probabilities a through c. Assume the small letter “x” is estimated as the median of the X variable, and the small letter “y” is estimated as the 1st quartile of the Y variable. Interpret the meaning of all probabilities

XY<- cbind(X,Y)  
var <- nrow(XY)  
x <- median(X)  
y <- quantile(Y, 0.25,names=FALSE)

### A:

XGy <- length(which(X>y))  
XGy\_XGx <- length(which(X>y & X>x))  
XGy\_XGx/XGy  
## [1] 0.5343022

### B:

We know the statistics of half of the values in X are above the median, and 75% of the values in Y are above the first quartile

### C:

XGy <- length(which(X>y))  
XGy\_xGX <- length(which(X>y & X<x))  
  
XGy\_xGX/XGy  
## [1] 0.4656978

Investigate whether P(X>x and Y>y)=P(X>x)P(Y>y) by building a table and evaluating the marginal and joint probabilities.

tab <- c(sum(X<x & Y < y),  
 sum(X < x & Y == y),  
 sum(X < x & Y > y))  
tab <- rbind(tab,  
 c(sum(X==x & Y < y),  
 sum(X == x & Y == y),  
 sum(X == x & Y > y))  
   
 )  
tab <- rbind(tab,  
 c(sum(X>x & Y < y),  
 sum(X > x & Y == y),  
 sum(X > x & Y > y))  
 )  
tab <- cbind(tab, tab[,1] + tab[,2] + tab[,3])  
tab <- rbind(tab, tab[1,] + tab[2,] + tab[3,])  
colnames(tab) <- c("Y<y", "Y=y", "Y>y", "Total")  
rownames(tab) <- c("X<x", "X=x", "X>x", "Total")  
knitr::kable(tab)

Y<y

Y=y

Y>y

Total

X<x

1258

0

3742

5000

X=x

0

0

0

0

X>x

1242

0

3758

5000

Total

2500

0

7500

10000