HW4Q2.R

board

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setwd("C:/Users/board/Desktop/Kaggle/Scenario Analysis")  
Data <- read.csv("MSFT\_AAPL\_Log\_Returns.csv",header=TRUE)  
  
###############################################################################################  
###Corporate Risk Management HW3 Q2 Part I###  
############################################################################################  
  
#Log-returns  
MSFT\_Log\_R <- Data$MSFT.Log.Return[!is.na(Data$MSFT.Log.Return)]   
APPL\_Log\_R <- Data$AAPL.Log.Return[!is.na(Data$AAPL.Log.Return)]  
  
#Portfolio parameters  
Val\_Port <- 1000000 #Portfolio Value  
M\_Cap\_MSFT <- 448.77   
M\_Cap\_APPL <- 577.1  
# W\_MSFT <- M\_Cap\_MSFT/(M\_Cap\_MSFT+M\_Cap\_APPL)#0.4383 ?slides  
# W\_APPL <- 1-W\_MSFT #0.5617 ?slides  
  
W\_MSFT <- 0.5617  
W\_APPL <- 0.4383  
Alpha <- 0.95 #Confidence  
lambda <- 0.97  
M <- 500 #Initial days EWMA  
K <- 20 #K parameter for K-day VaR  
length(MSFT\_Log\_R)==length(APPL\_Log\_R) #Check if if both have same # of obs.

## [1] TRUE

n <- length(MSFT\_Log\_R) #Number of observations  
  
#for-loop   
mu\_MSFT <- NULL  
mu\_APPL <- NULL  
sigma\_MSFT <- NULL  
sigma\_APPL <- NULL  
cov\_sigma<- NULL  
  
# Initialize first numbers for EWMA for mu and covariance  
mu\_MSFT[1]<- mean(MSFT\_Log\_R[1:(M-1)])  
mu\_APPL[1]<- mean(APPL\_Log\_R[1:(M-1)])  
sigma\_MSFT[1]<-var(MSFT\_Log\_R[1:(M-1)])  
sigma\_APPL[1]<-var(APPL\_Log\_R[1:(M-1)])  
cov\_sigma[1]<-cov(MSFT\_Log\_R[1:(M-1)],APPL\_Log\_R[1:(M-1)])  
  
# For loop for EWMA mu and covariance matrix  
for(i in 1:(n-M-1)){  
 previous\_day = M+i-1   
   
 #EWMA update for mu   
 mu\_MSFT[i+1]<- lambda\*mu\_MSFT[(i)] +(1-lambda)\*MSFT\_Log\_R[(previous\_day)]  
 mu\_APPL[i+1]<- lambda\*mu\_APPL[(i)]+(1-lambda)\*APPL\_Log\_R[(previous\_day)]  
 mu\_mat <- matrix(c(mu\_MSFT[i+1],mu\_APPL[i+1]),nrow=2,ncol=1)  
   
 # EWMA update for covariance matrix   
 sigma\_MSFT[i+1]<-lambda\*sigma\_MSFT[(i)] + (1-lambda)\*  
 (MSFT\_Log\_R[(previous\_day)]-mu\_MSFT[i])^2  
 sigma\_APPL[i+1]<-lambda\*sigma\_APPL[i] + (1-lambda)\*  
 (APPL\_Log\_R[(previous\_day)]-mu\_APPL[i])^2  
   
 cov\_sigma[i+1]<-lambda\*cov\_sigma[i] + (1-lambda)\*  
 (MSFT\_Log\_R[(previous\_day)]-mu\_MSFT[i])\*(APPL\_Log\_R[(previous\_day)]-mu\_APPL[i])  
   
 cov\_mat <- matrix(c(sigma\_MSFT[i+1],rep(cov\_sigma[i+1],2),  
 sigma\_APPL[i+1]),nrow=2,ncol=2)  
}  
  
#VaR calculations  
weight\_matrix <- matrix(c(W\_MSFT,W\_APPL),nrow=2,ncol=1) #MSFT AAPL weight matrix  
Port\_Dollar <- -Val\_Port\*weight\_matrix # ct  
(VaR <- (t(Port\_Dollar)%\*%mu\_mat) +   
 (sqrt(t(Port\_Dollar)%\*%cov\_mat%\*%Port\_Dollar))\*qnorm(Alpha)) #Lin VaR

## [,1]  
## [1,] 14440.67

(K\_VaR <- sqrt(K)\*VaR) #K-day VaR

## [,1]  
## [1,] 64580.62

(Reg\_Cap <- 3\*(sqrt(K/2)\*VaR)) #Regulatory Capital Change

## [,1]  
## [1,] 136996.2

#sim <- mvrnorm(50000, mu\_mat, cov\_mat)  
  
#compare solutions with the values on slide 47 Lecture 8  
  
##########################################################################  
#########################################################################  
#################### Question 3 #####################################  
##########################################################################  
#########################################################################  
library(MASS)

## Warning: package 'MASS' was built under R version 3.1.3

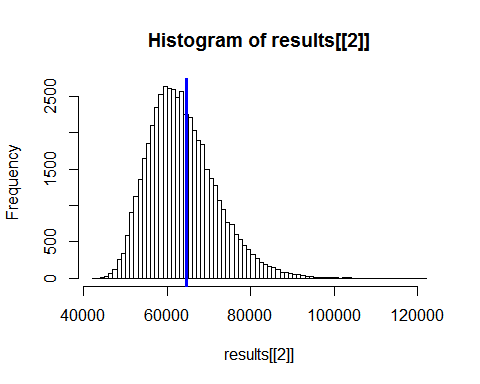
multiVar <- function (mu\_mat, cov\_mat, K, weight\_matrix, ValPort, Alpha = 0.95, lambda = 0.97){  
   
# Reset mu, covariance matrix for EWMA   
mu\_MSFT <- NULL  
mu\_APPL <- NULL  
mu\_MSFT[1] <- mu\_mat[1]  
mu\_APPL[1] <- mu\_mat[2]  
  
sigma\_MSFT <- NULL  
sigma\_APPL <- NULL  
cov\_sigma <- NULL  
sigma\_MSFT[1] <- cov\_mat[1,1]  
sigma\_APPL[1] <- cov\_mat[2,2]  
cov\_sigma[1] <- cov\_mat[1,2]  
  
# Initialize return matrix for K days   
Returns\_sum1 <- rep(0, K)  
Returns\_sum2 <- rep(0, K)  
  
# First observations for the shock   
Xtplusdelta = mvrnorm(n=1,mu\_mat,cov\_mat)  
Xtplusdelta[2] = mu\_mat[2] - 5\* (cov\_mat[2,2]) #shock  
  
  
for(i in 1:(K-1)) { # For each day after the shock   
   
 # Update mu with new observations   
 mu\_MSFT[i+1]<- lambda\*mu\_MSFT[i]+(1-lambda)\*Xtplusdelta[1]  
 mu\_APPL[i+1]<- lambda\*mu\_APPL[i]+(1-lambda)\*Xtplusdelta[2]  
 mu\_mat <- matrix(c(mu\_MSFT[i+1],mu\_APPL[i+1]),nrow=2,ncol=1)  
   
 # Update EWMA covariance matrix with new observations   
 sigma\_MSFT[i+1]<-lambda\*sigma\_MSFT[i] + (1-lambda)\*  
 (Xtplusdelta[1]-mu\_MSFT[i])^2  
 sigma\_APPL[i+1]<-lambda\*sigma\_APPL[i] + (1-lambda)\*  
 (Xtplusdelta[2]-mu\_APPL[i])^2  
 cov\_sigma[i+1]<-lambda\*cov\_sigma[i] + (1-lambda)\*  
 (Xtplusdelta[1]-mu\_MSFT[i])\*(Xtplusdelta[2]-mu\_APPL[i])  
 cov\_mat <- matrix(c(sigma\_MSFT[i+1],rep(cov\_sigma[i+1],2),  
 sigma\_APPL[i+1]),nrow=2,ncol=2)  
   
 # Store returns  
 Returns\_sum1[i+1] = Returns\_sum1[i]+ Xtplusdelta[1]   
 Returns\_sum2[i+1] = Returns\_sum2[i]+ Xtplusdelta[2]  
   
 # Redraw from multivariate distribution with new mu and covariance matrix   
 Xtplusdelta = mvrnorm(n=1,mu\_mat,cov\_mat)  
}  
  
# VaR Calculations   
# weight\_matrix <- matrix(c(W\_MSFT,W\_APPL),nrow=2,ncol=1) #MSFT AAPL weight matrix  
Port\_Dollar <- -Val\_Port\*weight\_matrix # ct  
(VaR <- (t(Port\_Dollar)%\*%mu\_mat) +   
 (sqrt(t(Port\_Dollar)%\*%cov\_mat%\*%Port\_Dollar))\*qnorm(Alpha)) #Lin VaR  
(K\_VaR <- sqrt(K)\*VaR) #K-day VaR  
# (Reg\_Cap <- 3\*(sqrt(K/2)\*VaR)) #Regulatory Capital Change  
(Loss\_kplusdelta = Port\_Dollar[1]\*Returns\_sum1[K] +Port\_Dollar[2]\*Returns\_sum2[K])  
  
return (c(Loss\_kplusdelta, K\_VaR))  
}  
  
M\_hat <- 50000  
# Pre allocate space   
results <- data.frame(matrix(0,nrow = M\_hat, ncol = 2))  
names(results)[1:2] <- c("Loss", "K\_Var")  
# MC  
  
for (sample in 1:M\_hat){   
  
results[sample,] <- multiVar(mu\_mat, cov\_mat, K, weight\_matrix, ValPort)  
}  
  
# Exceedance   
# Kday Var Exceedances  
(K\_Var\_exceedances <- sum(results[[2]] > rep(K\_VaR,M\_hat)) )

## [1] 20528

# Regulatory Cap exceedances   
(Reg\_cap\_exceedances <- sum(results[[2]] > rep(Reg\_Cap,M\_hat)) )

## [1] 0

# Quick Plots...   
hist(results[[2]], breaks = 100)  
abline(v = K\_VaR, col = "blue", lwd = 3)  
abline(v = Reg\_Cap, col = "red", lwd = 3) # doesn't even show up -- too far right



# Frequencies   
(100/M\_hat) \* K\_Var\_exceedances

## [1] 41.056

(100/M\_hat) \* Reg\_cap\_exceedances

## [1] 0