Homework 11

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## Summary

This assignment focuses on calculating illustrating volatility of the S&P500 over time. The code uses a custom fucntion to assign a volatility score to each daily return for the respective index being processed. The volatility scores are then plotted over time to show spikes in index volatitlity.

### Github Repository

The code and markdown documents for this assignment can be found on GitHub using the URL below: <https://github.com/georgesturrock/IndexVolatility/blob/master/paper/SP500GS.md>

### Install packages and load libraries

The "tseries" library is required to get market close quotes and calculate daily returns as input in to the volatility calculation. The chunk below will only install the "tseries" package if it has not already been installed in the host environment.

# install "tseries" if not already installed  
verifyinstall <- "tseries"  
new.packages <- verifyinstall[!("tseries" %in% installed.packages()[,"Package"])]  
if(length(new.packages))   
 install.packages(new.packages)  
  
library(tseries)

### Instantiate Volatility Function

get  
Vol <- function(d, logrets)  
{  
 var = 0  
 lam = 0  
 varlist <- c()  
  
 for (r in logrets) {  
 lam = lam\*(1 - 1/d) + 1  
  
 var = (1 - 1/lam)\*var + (1/lam)\*r^2  
 varlist <- c(varlist, var)  
 }  
 sqrt(varlist)  
}

### Download data from Yahoo Finance

# Download S&P500 data  
SNPdata <- get.hist.quote('^gspc',quote="Close")

### Calculate Log Returns

Log returns are used for this data set to accurately report gains and losses and to account for the relatively long time series.

# Calculate S&P500 log returns  
SNPret <- log(lag(SNPdata)) - log(SNPdata)

### Calculate Volatility Measure

The volatility calculation takes the standard deviation of the returns, multiplies it by 250 and multiplies that by 100 to arrive at a whole number percentage. 250 is used because there are approximately 250 trading days in the fiscal year.

# Calculate S&P500 volatility measure  
SNPvol <- sd(SNPret) \* sqrt(250) \* 100

### Calculate volatility over time for three different decay factors

Decay factors of 10, 30 and 100 are used to estimate volatility of S&P500 returns over time.

# calculate S&P500 volatility over time with three different decay factors  
volest <- Vol(10,SNPret)  
volest2 <- Vol(30,SNPret)  
volest3 <- Vol(100,SNPret)

### Analysis and Plots

In the S&P500 plots, higher decay factors lead to smoother trend lines. This is to the expected outcome. The SP500 plots show a fairly steady return trend with relatively low volatility. Volatility for the S&P500 spiked during indices 4000 and 6000.

# Plot S&P500 volatility resutls by decay factory  
plot(volest,type="l", main = "SP500 Volatility", ylab = "Volatility")  
lines(volest2,type="l",col="red")  
lines(volest3, type = "l", col="blue")

