FA542 - Lecture #4 In-Class Assignment

I pledge my honor that I have abided by the Stevens Honor System.

Sid Bhatia

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```
library(quantmod)
```

```
## Loading required package: xts
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
##
## ###################################### WARNING ######################################
## # We noticed you have dplyr installed. The dplyr lag() function breaks how    #
## # base R's lag() function is supposed to work, which breaks lag(my_xts).      #
## #                                                                              #
## # If you call library(dplyr) later in this session, then calls to lag(my_xts) #
## # that you enter or source() into this session won't work correctly.           #
## #                                                                              #
## # All package code is unaffected because it is protected by the R namespace   #
## # mechanism.                                                                   #
## #                                                                              #
## # Set `options(xts.warn_dplyr_breaks_lag = FALSE)` to suppress this warning.  #
## #                                                                              #
## # You can use stats::lag() to make sure you're not using dplyr::lag(), or you #
## # can add conflictRules('dplyr', exclude = 'lag') to your .Rprofile to stop   #
## # dplyr from breaking base R's lag() function.                                 #
## ###################################### WARNING ######################################
```

```
## Loading required package: TTR
```

```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

```
library(moments)
```

Problem 1

```
start_date <- as.Date("2016-01-01")
end_date <- as.Date("2021-12-31")
```

```r
getSymbols("IBM", src = "yahoo", from = start_date, to = end_date)
```

i)

```
## [1] "IBM"
```

```r
log_returns <- na.omit(diff(log(Cl(IBM)), lag = 1))
head(log_returns)
```

ii)

```
##                IBM.Close
## 2016-01-05 -0.0007357892
## 2016-01-06 -0.0050181299
## 2016-01-07 -0.0172372974
## 2016-01-08 -0.0093009472
## 2016-01-11  0.0120819689
## 2016-01-12 -0.0024799571
```

```r
mean_log_return <- mean(log_returns)
std_dev_log_return <- sd(log_returns)

skewness_log_return <- skewness(log_returns)

# Kurtosis is excess kurtosis
kurtosis_log_return <- kurtosis(log_returns)
```

```r
cat("Sample mean of log returns:", mean_log_return, "\n")
```

```
## Sample mean of log returns: 1.978409e-05
```

```r
cat("Standard deviation of log returns:", std_dev_log_return, "\n")
```

```
## Standard deviation of log returns: 0.0161449
```

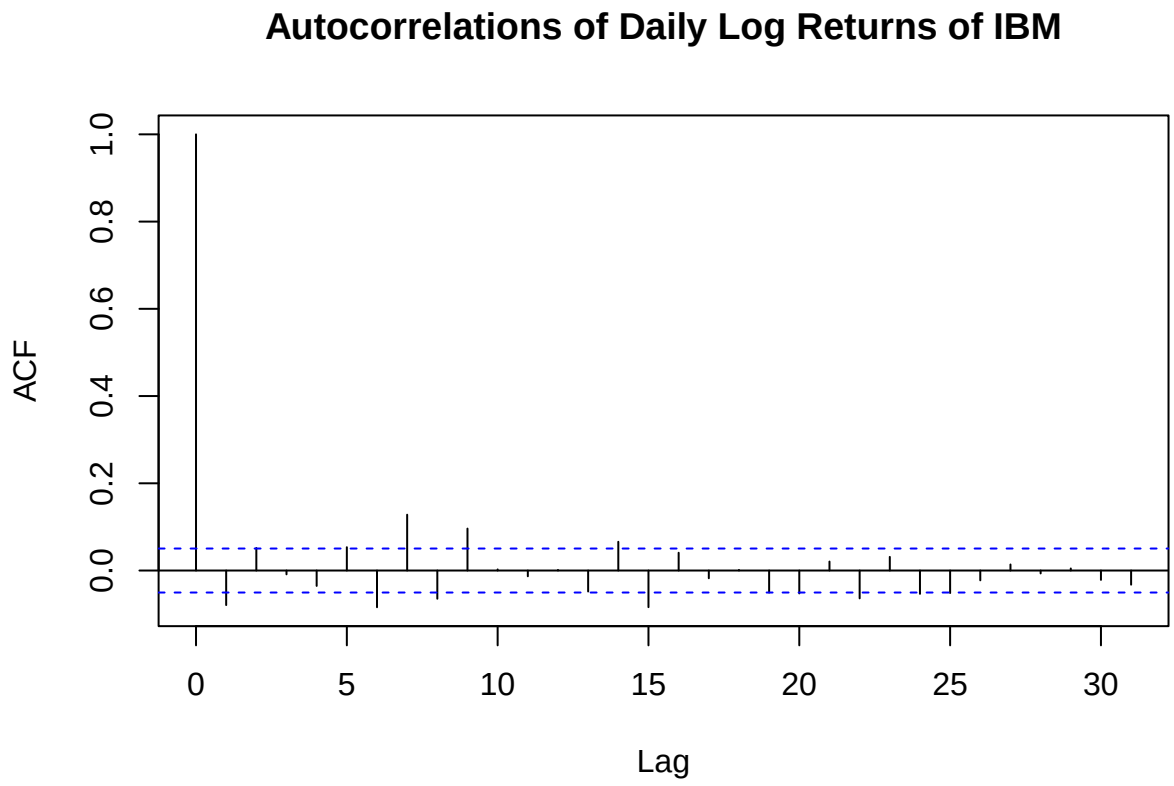
```r
cat("Skewness of log returns:", skewness_log_return, "\n")
```

```
## Skewness of log returns: -0.8428739
```

```r
cat("Excess kurtosis of log returns:", kurtosis_log_return, "\n")
```

```
## Excess kurtosis of log returns: 14.17068
```

```r
# Compute and plot autocorrelations
acf(log_returns, na.action = na.omit, main = "Autocorrelations of Daily Log Returns of IBM")
```



iii)

```
lag_1_test <- Box.test(log_returns, lag = 1, type = "Ljung-Box")
lag_1_test$p.value
```

iv)

```
## [1] 0.002070484
```

Since the p-value is less than 0.05, we reject the null hypothesis that the lag-1 autocorrelation equals zero.

```
lag_3_test <- Box.test(log_returns, lag = 3, type = "Ljung-Box")
lag_7_test <- Box.test(log_returns, lag = 7, type = "Ljung-Box")
lag_20_test <- Box.test(log_returns, lag = 20, type = "Ljung-Box")

lag_3_test$p.value
```

v)

```
## [1] 0.003439863
```

```
lag_7_test$p.value
```

```
## [1] 1.184213e-09
```

```
lag_20_test$p.value
```

```
## [1] 4.085621e-14
```

Since the p-values for each tests (lag = 3, 7, 20) are less than 0.05, we reject the null hypothesis that all of the autocorrelations up to that respective lag (3, 7, 20) are equal to zero. As such, this suggest at least one of the autocorrelations up to those lags (3, 7, 20) are significantly different from zero.