STATS183 Project 1

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a. Use http://shiny.stat.ucla.edu:3838/c183c283/ Enter the tickers as follows: ^GSPC,AAPL,IBM,. . . .

Done

b You will download the adjusted close prices for 30 stocks plus the S&P500 in a csv file. Import the data in R and convert the adjusted close prices into returns. (Use the first 5-year data only!)

```
#Read your csv file:
a <- read.csv("/Users/takaooba/STATS 183/stockData.csv", sep=",", header=TRUE)
train <- a[1:60,]
test <- a[61:dim(a)[1],]

#Convert adjusted close prices into returns:
r <- (train[-1,3:ncol(train)]-train[-nrow(train),3:ncol(train)])/train[-nrow(train),3:ncol(train)]
```

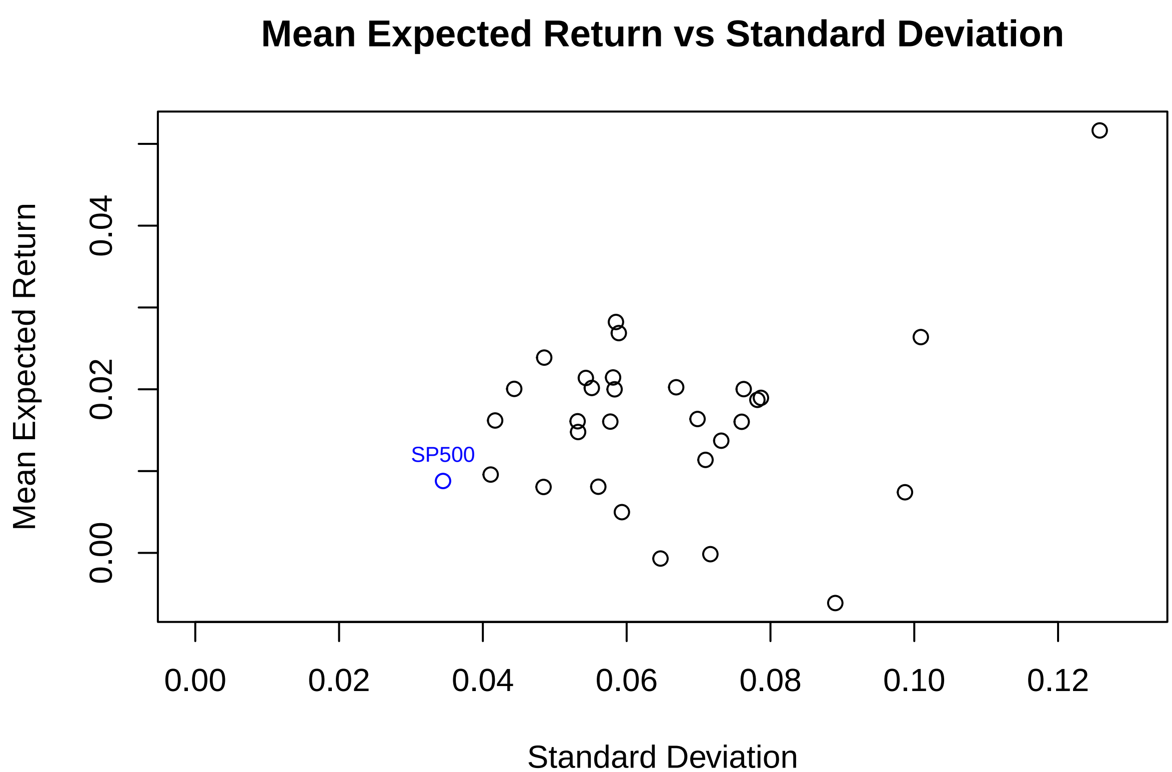
c. Compute the means of the 31 assets, the standard deviations, and the variance covariance matrix.

```
#Compute mean vector:
means <- colMeans(r[-1]) #Without ^GSPC

#Compute variance covariance matrix:
covmat <- cov(r[-1]) #Without ^GSPC

#Compute correlation matrix:
cormat <- cor(r[-1]) #Without ^GSPC

#Compute the vector of variances:
variances <- diag(covmat)

#Compute the vector of standard deviations:
```

```r
stdev <- diag(covmat)^.5


# mean vector of SP500
means_sp500 <- mean(r[,1])
stdev_sp500 <- sd(r[,1])
```

d. Plot the 31 assets on the space expected return against standard deviation.

```r
m_return <- colMeans(r[-1])
# m_return

plot(stdev, m_return, main = "Mean Expected Return vs Standard Deviation",
     ylab = "Mean Expected Return", xlab = "Standard Deviation", ,xlim=c(0,0.13))

points(stdev_sp500, means_sp500, col = "blue") # add sp500 point
text(stdev_sp500, means_sp500, "SP500", col = "blue", pos = 3, cex  = 0.65)
```



e. Assume equal allocation portfolio using the 30 stocks. Compute the mean and standard deviation of this portfolio and add it on the plot of question (d).

```
eq = rep(1/30, 30)
sum(eq) # sum is 1 as with the budget constraint
```

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

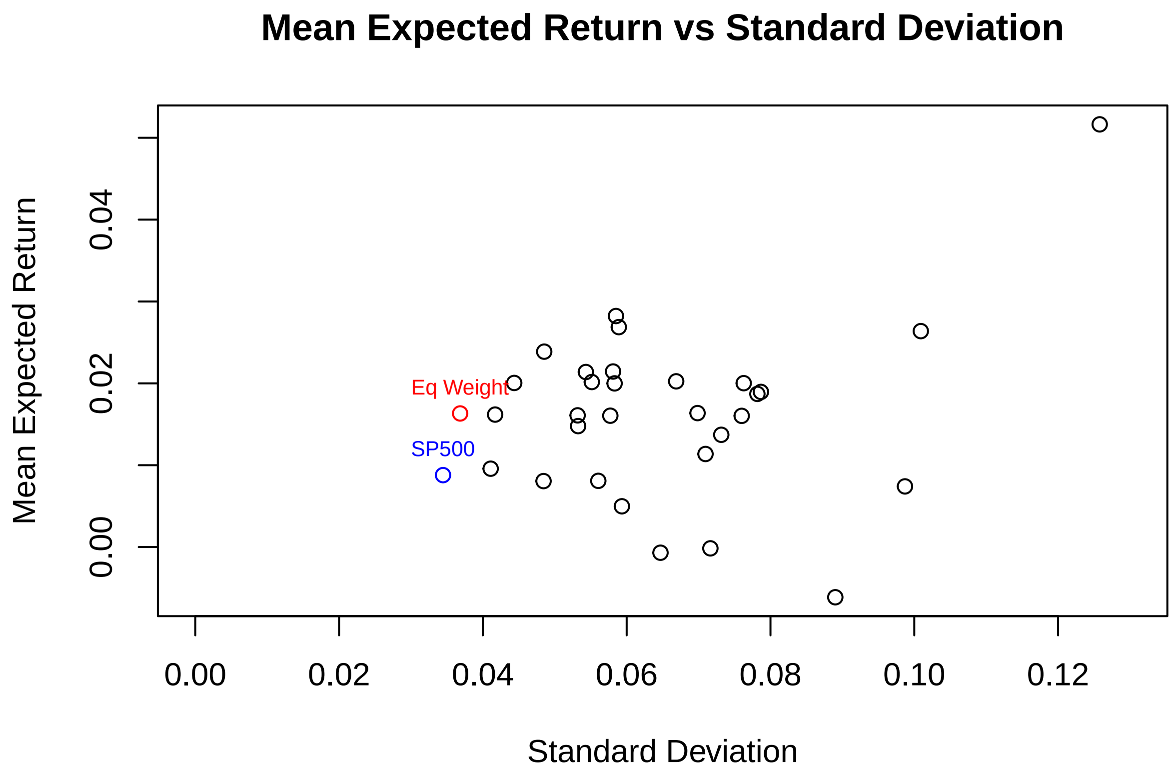
```
# mean of this portfolio
r_eq = t(eq) %*% means
r_eq
```

```
##            [,1]
## [1,] 0.01632285
```

```
# sd of this portfolio
sd_eq = sqrt(t(eq) %*% covmat %*% eq)
sd_eq
```

```
##            [,1]
## [1,] 0.03684095
```

```
# plotting on question (d)
plot(stdev, m_return, main = "Mean Expected Return vs Standard Deviation",
     ylab = "Mean Expected Return", xlab = "Standard Deviation", ,xlim=c(0,0.13))
points(stdev_sp500, means_sp500, col = "blue") # add sp500 point
text(stdev_sp500, means_sp500, "SP500", col = "blue", pos = 3, cex  = 0.65)
points(sd_eq, r_eq, col = "red") # equal allocation
text(sd_eq, r_eq, "Eq Weight", col = "red", pos = 3, cex  = 0.65)
```



f. Add on the plot the minimum risk portfolio.

$$X = \frac{\Sigma^{-1}1}{1^T\Sigma^{-1}1}$$

```
# We will use formula of minimum risk portfolio
ones <- rep(1,30)
mrp_weights = (solve(covmat) %*% ones) / (as.numeric(t(ones) %*% solve(covmat) %*% ones))
sum(mrp_weights) # Looks good
```

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

$$R_p = X^T R$$
$$E(R_p) = \bar{R}_p = X^T \bar{R}$$

```
# We have solved for the weights, thus, plugging back into the equation, we have
mrp_rp <- t(mrp_weights) %*% means
mrp_rp
```

```
##              [,1]
## [1,] 0.01568397
```

```r
# standard deviation
mrp_sd <- sqrt(t(mrp_weights) %*% covmat %*% mrp_weights)
mrp_sd
```

```
##              [,1]
## [1,] 0.02032877
```

Plotting

```r
plot(stdev, m_return, main = "Mean Expected Return vs Standard Deviation",
     ylab = "Mean Expected Return", xlab = "Standard Deviation", ,xlim=c(0,0.13))
points(stdev_sp500, means_sp500, col = "blue") # add sp500 point
text(stdev_sp500, means_sp500, "SP500", col = "blue", pos = 3, cex  = 0.65)
points(sd_eq, r_eq, col = "red") # equal allocation
text(sd_eq, r_eq, "Eq Weight", col = "red", pos = 3, cex  = 0.65)
points(mrp_sd, mrp_rp, col = "green")
text(mrp_sd, mrp_rp, "MRP", col = "green", pos = 3, cex  = 0.65)
```