Introduction:
Here we are trying to determine whether CAPM applies to a stock. To do that, we need the market return, risk free return rates, and the stock tickers. We will run linear regressions on them to determine if the stock's *alpha*, or abnormal extra return of that stock over the market at a certain risk level, is equal to 0. If it is equal to zero, that means there is no abnormal extra return, thereby showing CAPM applies.

Methodology:
Reading in the data, we place the data with columns named SP500 (market) and X3mTCM (3-month Treasury) in the dataset named data1, and the stock log returns with column names of the 10 stocks' tickers in data2.

```
#monthly S&P 500 log returns and 3 month T-bill returns
data1<-read.table('m_sp500ret_3mtcm.txt',header=T)
#monthly log returns of ten stocks
data2<-read.table('m_logret_10stocks-1.txt',header=T)


head(round(data1[2:3],4),5)
head(round(data2[2:11],4),5)
```

The head() function then outputs the first 5 months of log returns (rounded to 4 digits for easy reading) of the market and 10 stocks, as well as the risk free return rate.

```
head(round(data1[2:3],4),5)
  sp500 X3mTCM
 0.0139   2.98
-0.0132   3.25
-0.0203   3.50
 0.0050   3.68
 0.0054   4.14
head(round(data2[2:11],4),5)
    AAPL    ADBE     ADP    AMD    DELL     GTW      HP     IBM    MSFT    ORCL
 0.0489  0.1353 -0.0229 0.0623 -0.0126  0.0892 -0.0043  0.0000  0.0235  0.0491
 0.0488 -0.0149 -0.0095 0.0207  0.0596 -0.0022 -0.0144 -0.0268 -0.0135  0.0108
-0.0408 -0.0789  0.0009 0.1623  0.0000 -0.0714 -0.0079  0.0142  0.0116 -0.0108
-0.0444  0.0419  0.0022 -0.0734 -0.0596 -0.1179  0.0023  0.0223  0.0384 -0.0311
-0.0096  0.0319  0.0158 0.0101  0.1217 -0.0183  0.0034  0.0414  0.0649  0.0576
```

From there, we use the diff() function to compute the month-to-month differences between the log returns and subtract from those differences the 3-month treasury rate daily rate. To get the daily rate, the annual rate is divided by the 253 days a year the market is open for trading and divided by a 100 to convert from % to decimal.

```
#Fit CAPM for each stock + Determine if CAPM applies to each
attach(data1)
attach(data2)
logsp500 <- diff(sp500)-X3mTCM[1:156]/(100*12)
logAAPL <- diff(AAPL)-X3mTCM[1:156]/(100*12)
logADBE <- diff(ADBE)-X3mTCM[1:156]/(100*12)
logADP <- diff(ADP)-X3mTCM[1:156]/(100*12)
logAMD <- diff(AMD)-X3mTCM[1:156]/(100*12)
logDELL <- diff(DELL)-X3mTCM[1:156]/(100*12)
logGTW <- diff(GTW)-X3mTCM[1:156]/(100*12)
logHP <- diff(HP)-X3mTCM[1:156]/(100*12)
logIBM <- diff(IBM)-X3mTCM[1:156]/(100*12)
logMSFT <- diff(MSFT)-X3mTCM[1:156]/(100*12)
logRCL <- diff(ORCL)-X3mTCM[1:156]/(100*12)
```

After that, all that's left is the run the linear model and see if CAPM holds true. We can tell it holds true if the p-value of the Intercept (Pr>|t|) is larger than 1%.

Take Apple(AAPL) for example:

```
lmAAPL<-lm(logAAPL~logsp500)
summary(lmAAPL)
```

As you can see, the p-value for the intercept is 0.841, which is far larger than 1%, and so we can safely say alpha is 0, or insignificant, and that CAPM holds.

```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.001414   0.007049   0.201    0.841
logsp500    1.496843   0.272985   5.483 1.67e-07 ***
```

We repeat this for other values, and find that CAPM applies to all the stocks, as the p-values are high.

```
lmAAPL<-lm(logAAPL~logsp500)
summary(lmAAPL)
lmADBE<-lm(logADBE~logsp500)
summary(lmADBE)
lmADP<-lm(logADP~logsp500)
summary(lmADP)
lmAMD<-lm(logAMD~logsp500)
summary(lmAMD)
lmDELL<-lm(logDELL~logsp500)
summary(lmDELL)
lmGTW<-lm(logGTW~logsp500)
summary(lmGTW)
lmHP<-lm(logHP~logsp500)
summary(lmHP)
lmIBM<-lm(logIBM~logsp500)
summary(lmIBM)
lmMSFT<-lm(logMSFT~logsp500)
summary(lmMSFT)
lmRCL<-lm(logRCL~logsp500)
summary(lmRCL)
```

The summary output for each stock is listed here:

ADBE:
```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0001416  0.0070287  -0.020    0.984
logsp500     1.4039800  0.2722013   5.158 7.58e-07 ***
```

ADP:
```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.0001553  0.0027490   0.056    0.955
logsp500    0.8908050  0.1064588   8.368 3.32e-14 ***
```

AMD:
```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.003522   0.007740   0.455     0.65
logsp500    2.194412   0.299749   7.321 1.28e-11 ***
```

DELL:
```
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.003666   0.005740   0.639    0.524
logsp500    1.904968   0.222309   8.569 1.02e-14 ***
```

GTW:
```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.002802   0.008163   0.343    0.732
logsp500    2.035847   0.316115   6.440 1.44e-09 ***
```

HP:
```
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.0001168  0.0050298   0.023    0.982
logsp500    1.0449997  0.1947901   5.365 2.92e-07 ***
```

IBM:
```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.001830   0.003501   0.523    0.602
logsp500    1.469543   0.135582  10.839   <2e-16 ***
```

MSFT:
```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.002219   0.004454   0.498    0.619
logsp500    1.675425   0.172471   9.714   <2e-16 ***
```

RCL:
```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.0009692  0.0063358   0.153    0.879
logsp500    1.4623103  0.2453655   5.960 1.66e-08 ***
```