Homework 6

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1. Obtain the monthly data of interest rate (aka. annual yield) of different U.S. treasury bonds with maturities 1-month, 3-month, 6-month, 1-year, 2-year, 3-year, 5-year, 7-year, 10-year, 20-year, and 30-years.

```
## 'getSymbols' currently uses auto.assign=TRUE by default, but will
## use auto.assign=FALSE in 0.5-0. You will still be able to use
## 'loadSymbols' to automatically load data. getOption("getSymbols.env")
## and getOption("getSymbols.auto.assign") will still be checked for
## alternate defaults.
##
## This message is shown once per session and may be disabled by setting
## options("getSymbols.warning4.0"=FALSE). See ?getSymbols for details.
```

```
##  [1] "GS1M" "GS3M" "GS6M" "GS1"  "GS2"  "GS3"  "GS5"  "GS7"  "GS10" "GS20"
## [11] "GS30"
```

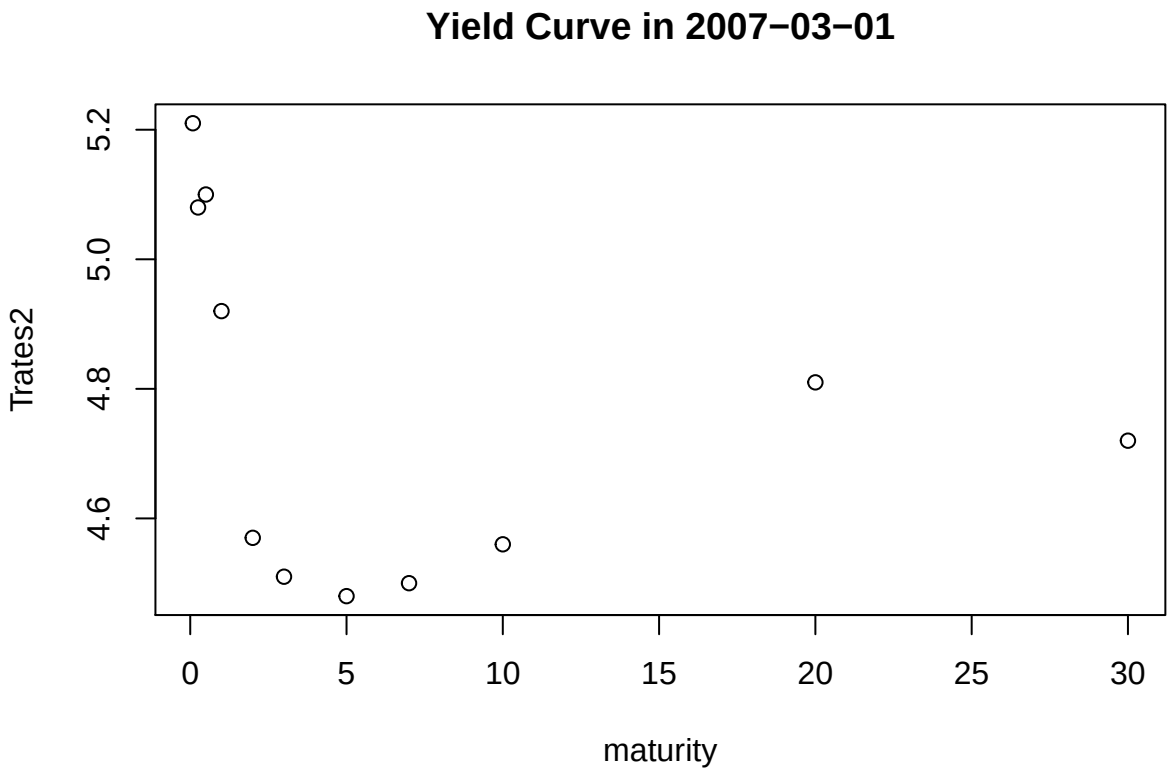
NOT SURE HOW/WHAT TO DISPLAY FOR THIS, MAYBE HEAD OF EACH BOND?

2. Find the (annual) yield of a 3-month T-bill in March 2007. Then find the (annual) yield of 20-year T-bond in the same month. (Find those numbers from the time series you loaded into R in the last question. Note that the unit of the yield data stored in R is percentage point. That is if you get a 4 from your data it means a 4% or 0.04 annual yield.) What would you comment on those numbers?

```
##            GS3M GS20
## 2007-03-01 5.08 4.81
```

There is a slightly higher yield for a 3 month T-bill in March 2007 than a 20 year T-bond. This means the return on the 3 month T-bill is higher than the reteun on the 20 year T-bond.

3. Now, draw a scatter plot of the yield data of all bonds in March 2007 against their maturity dates (you will have 11 data points in the scatter plot).



4. Fit a yield curve using the Nelson-Siegel model for March 2007. Interpret your β_0 and β_1 estimates. Also, find the sign of your β_2 estimate. What does the sign tell you?

```
##              beta_0    beta_1    beta_2    lambda
## 2007-03-01 4.919922 0.3399517 -2.023063 0.4391611
```

β_0 is the long-term interest rate. β_1 is the long-to-short-term spread, which means the difference between the long term interest rate and the short term interest rate. β_2 is the curvature parameter and since β_2 is less than 0, the curve produces a trough, which means it is inverted.

5. What does your Nelson-Siegel model predict about the annual yield of U.S. treasury bonds in the secondary market in March 2007 that has 2.5 years left to maturity?

```
##                X2.5
## 2007-03-01 4.573102
```

Our Nelson-Siegel model predicts 4.57310156508595% as the annual yield of a US treasury bond in the secondary market in March 2007 with 2.5 years left to maturity.

6. 6. Suppose there is a zero-coupon bond with face value $1000 that in March 2007 has 2.5 years left to maturity. Calculate the predicted price of this zero-coupon bond using your predicted yield in the last question.

```
## [1] 894.2316
```