Time Series Analysis, Assignment 1

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Problem 6

First, I import the data directly from FRED using `getSymbols` function of quantmod

```
library(quantmod)

getSymbols('T10Y3MM',src='FRED') # monthly observation from 1982-01-01 to 2018-03-01
T10Y3MM= T10Y3MM['/2017-12-01'] # select end period
```

```
head(T10Y3MM) # show head
```

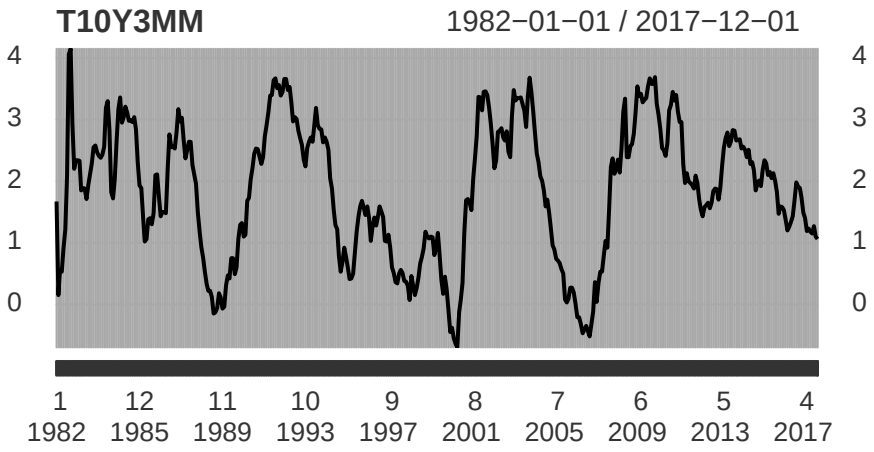
```
##            T10Y3MM
## 1982-01-01    1.67
## 1982-02-01    0.15
## 1982-03-01    0.55
## 1982-04-01    0.53
## 1982-05-01    0.91
## 1982-06-01    1.22
```

```
tail(T10Y3MM) # show tail
```

```
##            T10Y3MM
## 2017-07-01    1.23
## 2017-08-01    1.18
## 2017-09-01    1.15
## 2017-10-01    1.27
## 2017-11-01    1.10
## 2017-12-01    1.06
```

(a) Draw a time series plot of the original monthly series $\{y_t\}$

```
plot(T10Y3MM)
```



(b) Modify the series so that

1. $x_\tau = y_{3\tau}$

2. $x_\tau = (1/3)\sum_{j=1}^{3} y_{3\tau+1-j}$
3. $x_\tau = y_{12\tau}$
4. $x_\tau = (1/12)\sum_{j=1}^{12} y_{12\tau+1-j}$

```
quat=3*1:(length(T10Y3MM)/3) # 3,6,9,...
quatStock=T10Y3MM[quat] # Stock aggregate, quartely
year=12*1:(length(T10Y3MM)/12) # 12,24,...
yearStock=T10Y3MM[year] # SA, yearly
```

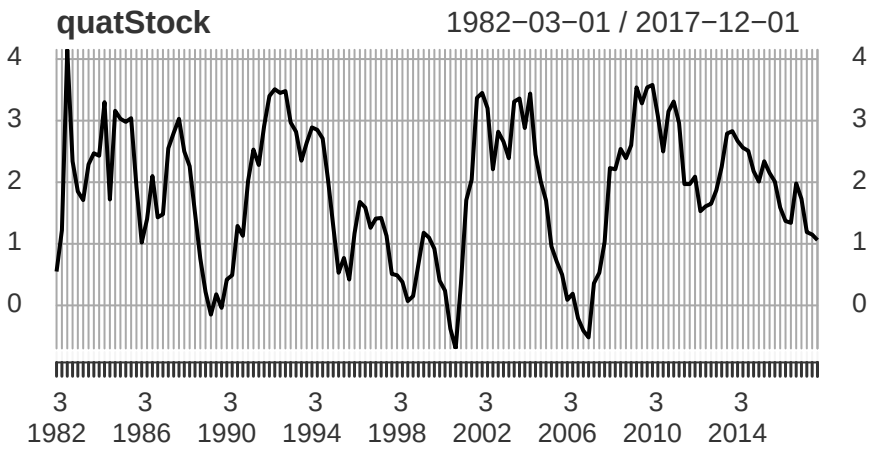
```
# flow aggregate, quartely
quatFlow=as.xts(ts(NA, start = c(1982,1),end = c(2017,4), frequency=4))
for (i in 1:length(quatFlow)){
  quatFlow[i]=(T10Y3MM[[3*i]]+T10Y3MM[[3*i-1]]+T10Y3MM[[3*i-2]])/3
}
head(quatFlow)
```

```
##              [,1]
## 1982 Q1 0.7900000
## 1982 Q2 0.8866667
## 1982 Q3 3.4333333
## 1982 Q4 2.4933333
## 1983 Q1 2.1733333
## 1983 Q2 1.8266667
```

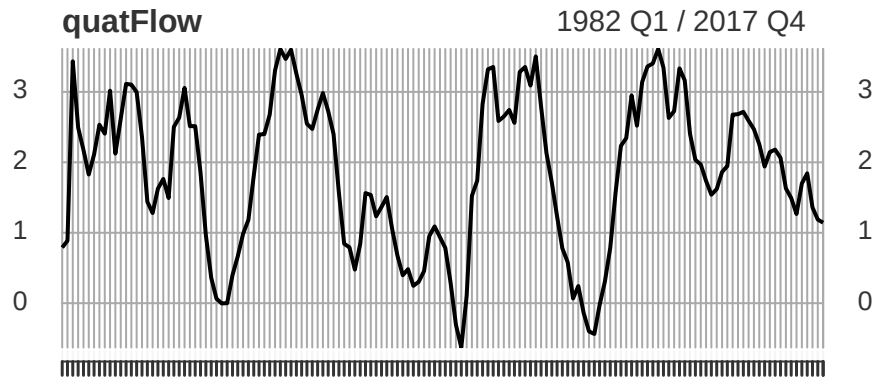
```
# flow aggregate, yearly
yearFlow=as.xts(ts(NA, start=1982, end=2017))
for(i in 1:length(yearFlow)){
  yearFlow[i]=(T10Y3MM[[12*i]]+T10Y3MM[[12*i-1]]+T10Y3MM[[12*i-2]]+T10Y3MM[[12*i-3]]+T10Y3MM[[12*i-4]]+T
}
head(yearFlow)
```

```
##                [,1]
## 1982-01-01 1.900833
## 1983-01-01 2.160833
## 1984-01-01 2.540833
## 1985-01-01 2.892500
## 1986-01-01 1.527500
## 1987-01-01 2.421667
```

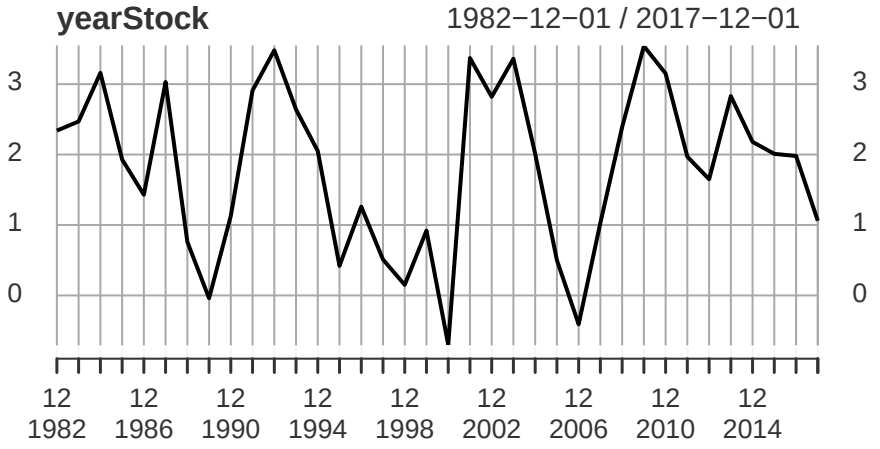
```
plot(quatStock) # type1
```



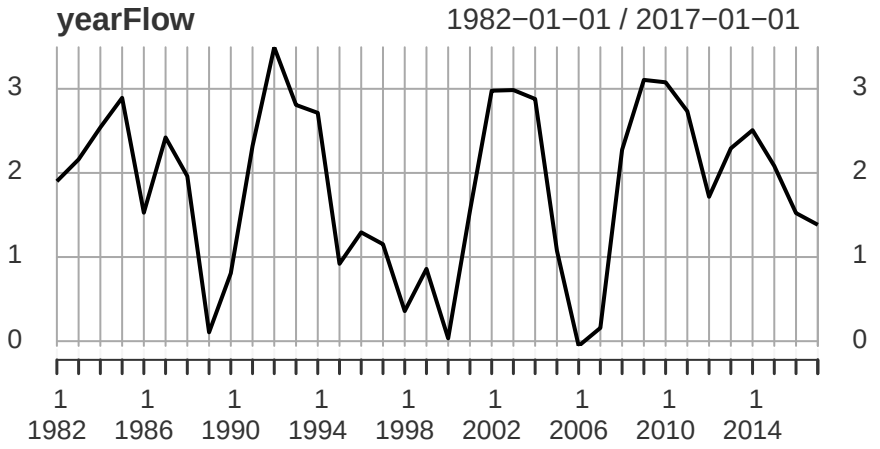
```r
plot(quatFlow) # type2
```




```r
plot(yearStock) # type3
```




```r
plot(yearFlow) # type4
```



(c) Coompute sample autocorrelation at lags 1,2,3 and 4 for the original series and four aggSeries in b

```r
acf(T10Y3MM, plot = F)[1:4] # original series
```

```
##
## Autocorrelations of series 'T10Y3MM', by lag
```

```
##
##     1     2     3     4
## 0.966 0.911 0.861 0.813
```

```
acf(quatStock, plot = F)[1:4] # stock aggegate, quartely
```

```
##
## Autocorrelations of series 'quatStock', by lag
##
##     1     2     3     4
## 0.845 0.691 0.554 0.398
```

```
acf(quatFlow, plot=F)[1:4] # flow aggregate, quately
```

```
##
## Autocorrelations of series 'quatFlow', by lag
##
##      1      2      3      4
##  0.435 -0.048 -0.376 -0.398
```

```
acf(yearStock,plot=F)[1:4] # SA, yearly
```

```
##
## Autocorrelations of series 'yearStock', by lag
##
##      1      2      3      4
##  0.411 -0.003 -0.353 -0.400
```

```
acf(yearFlow,plot=F)[1:4] # FA, yearly
```

```
##
## Autocorrelations of series 'yearFlow', by lag
##
##      1      2      3      4
##  0.533 -0.041 -0.407 -0.461
```

(d) The results suggest that autocorrelation is biggest for the original monthly data and the persistence decreases when data is aggregated. Also, when I compare stock aggregate and flow aggregate in the quartely data, persistence is higher in stock aggregate, which is consistent with the finding in Problem 1 and 2.