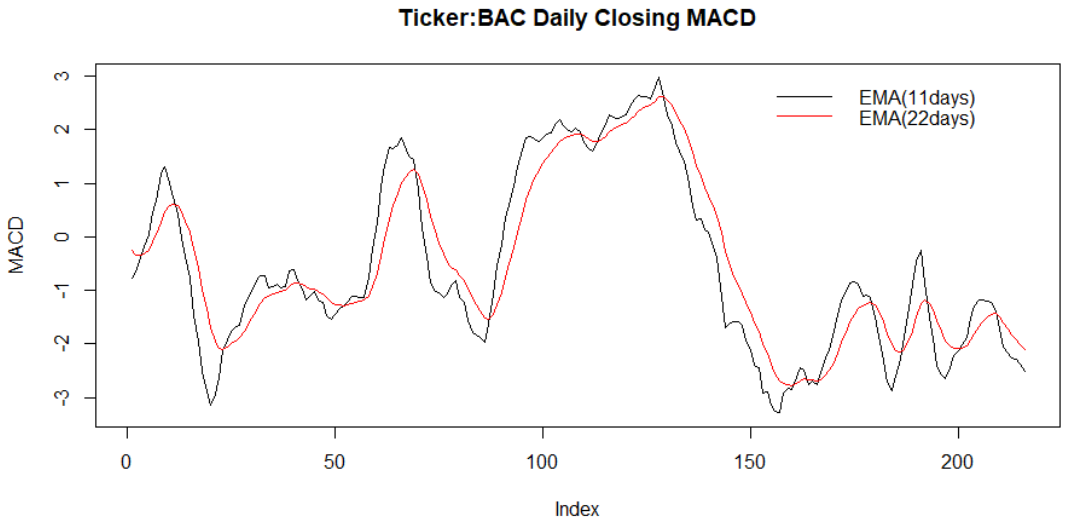
FE570 Homework Assignment #3
Shiyi Wang

Problem 1

(1) Build a momentum trading strategy based on the Moving Average Convergence/Divergence (MACD) method. Note that you need to use the fast EMA (11 days) and the slow EMA (22 days) for this assignment.



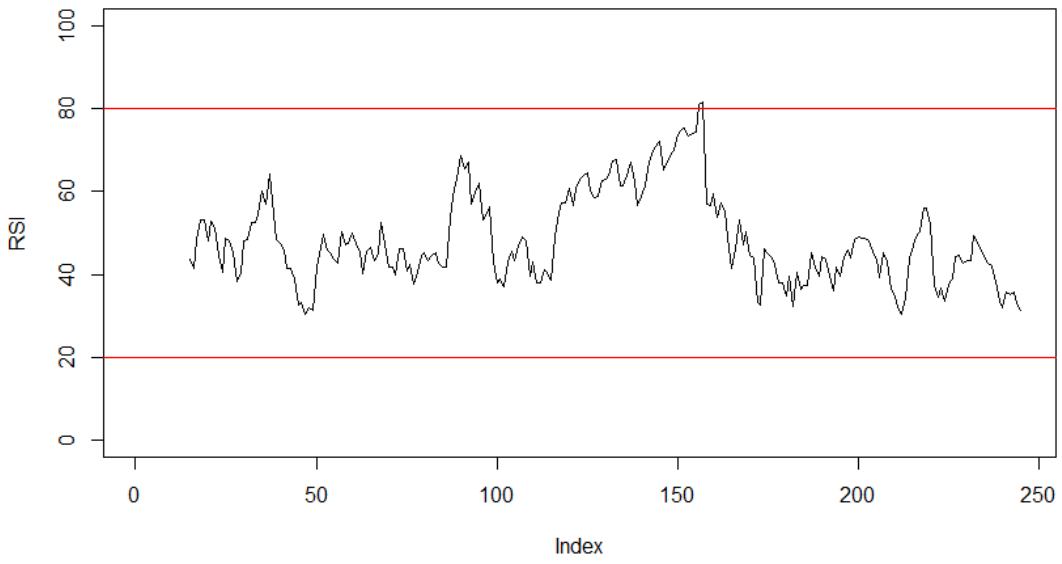
According to the plot, I observe that there are many crossing points which means buying or selling signals.

To find these crossing points, I use 1 and -1 to represent relationship between long and short MACD. 1 is that the short MACD is larger than long one and -1 is that the short MACD is smaller than long one. When difference between this time and next time is 2 or -2 meaning the crossing, there is buying or selling signal.

Then, I get 15 signals including 8 selling signals and 7 buying signals.

	Date	Ticker	Open	High	Low	Close	Volume	signalBAC
11408	20091021	BAC	16.99	17.17	16.460	16.51	2193439	sell
11419	20091112	BAC	16.36	16.57	15.990	16.06	1537994	buy
11436	20091208	BAC	15.72	15.86	15.370	15.41	3122967	sell
11454	20100105	BAC	15.74	16.21	15.700	16.20	2095212	buy
11476	20100205	BAC	14.84	15.06	14.310	15.00	2976832	sell
11480	20100211	BAC	14.67	14.80	14.540	14.63	1410862	buy
11495	20100305	BAC	16.53	16.75	16.450	16.70	1724689	sell
11527	20100421	BAC	18.67	18.91	18.110	18.28	2021599	buy
11530	20100426	BAC	18.41	18.44	18.025	18.05	1608729	sell
11533	20100429	BAC	18.04	18.40	17.990	18.30	1772962	buy
11546	20100518	BAC	16.72	16.75	15.670	15.95	2160636	sell
11553	20100527	BAC	15.81	16.20	15.590	16.18	1634907	buy
11559	20100607	BAC	15.36	15.40	14.770	14.83	1589590	sell
11567	20100617	BAC	15.96	16.07	15.590	15.82	1271363	buy
11576	20100630	BAC	14.62	14.80	14.300	14.37	1389779	sell

(2) Build a momentum trading strategy based on the Relative Strength Index (RSI) method. Note that you need to use N=14 days for this assignment, and use overbought and oversold market parameter of 80 and 20 respectively.



The line rising above 80 means selling signal, while dropping 20 means buying signal. But this situation did not exist buying signal.

	Date	Ticker	Open	High	Low	Close	Volume	sigRSI
11510	20100326	BAC	17.98	18.23	17.75	17.90	2209706	sell
11516	20100406	BAC	18.16	18.54	18.10	18.49	1603165	sell

There are 2 selling signals without buying signals.

(2) Compare and contrast the differences of these two strategies. Write your analysis and recommendation.

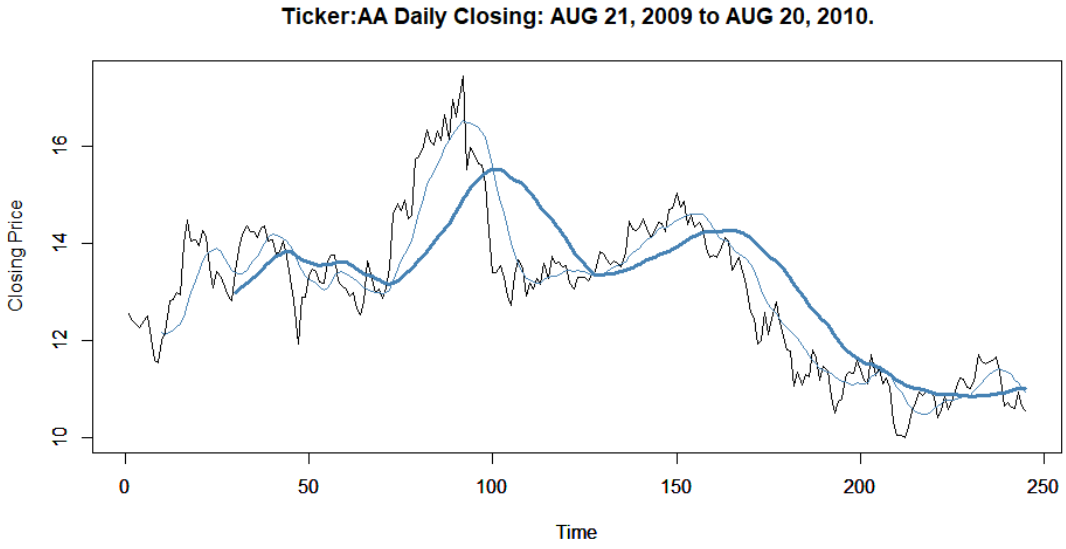
Form the numbers of signals' perspective, MACD represents 15 signals including 8 selling signals and 7 buying signals but the RSI just shows 2 selling signals without buying signals. More signals mean MACD method is sensitive to price's changing and there are more opportunities to trade frequently. One of the reasons for RSI model is related to choosing threshold. Obviously, 80 for it is too high and 20 for it is too low.

For their returns, I sum up the close prices' differences between selling and buying to represent their revenues. For MACD method, I get negative number, -1.52, means if I always follow these trading signals, I will incur loss. For RSI method, it is 5.03 means earn money. Though the RSI method shows exchanging is not too frequent like the former way, it is suitable for investors for long period trading.

```
> MACDbuy <- subset(BAC2, signalBAC == "buy")
> MACDsell <- subset(BAC2, signalBAC == "sell")
> MACDbuy <- rbind(MACDbuy, BAC2[nrow(BAC2), ])
> MACDresult <- sum(MACDsell[, "Close"] - MACDbuy[, "Close"])
> MACDresult
[1] -1.52
>
> RSIbuy <- subset(BAC3, sigRSI == "buy")
> RSIsell <- subset(BAC3, sigRSI == "sell")
> RSIbuy <- rbind(RSIbuy, BAC2[nrow(BAC3), ])
> RSIresult <- RSIsell[1, "Close"] - RSIbuy[, "Close"]
> RSIresult
[1] 5.03
```

Problem 2

(1) Write R code to identify this pattern based on the five consecutive extreme values: E1,E2,E3,E4,andE5.

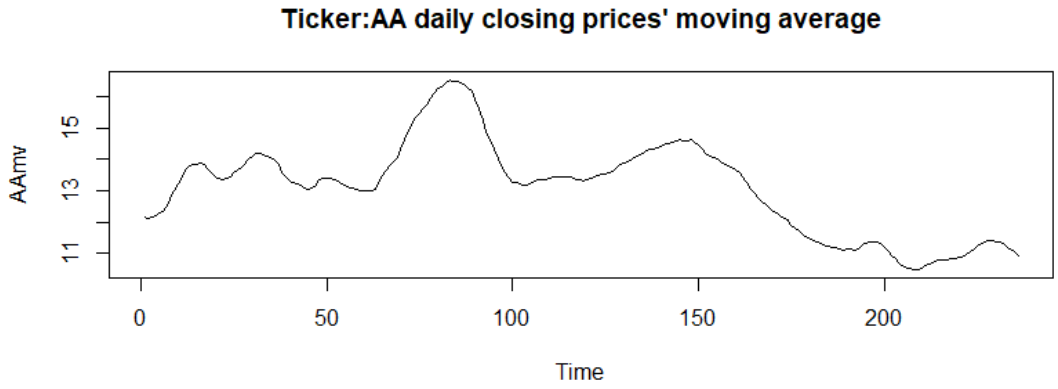


Firstly, I will find the shoulders and head.

The maximum is 17.45 which is the 92nd value.

```
> x <- AAclose[,1]
> order(x,decreasing=TRUE)[1]
[1] 92
> x[order(x,decreasing=TRUE)[1]]
[1] 17.45
```

Because some unimportant trendies which could be ignored, it is convenient and reasonable to smooth the line of closing price by using *runMean* function to get moving average.




```
> E3 <- which.max(AAmv[,2])
> AAmv[E3, ]
  Time   AAmv
83.000 16.538
```

I find the maximum is 16.538 in 83th order, so that E3 is 16.538.

According to the plot, I find that E1 must be in the range from 0 to 50. I order the first fifty numbers and find the maximum.

```
> AAmv[order(AAmv[c(0:50),2],decreasing=T),]
      Time   AAmv
 [1,]   31 14.183
 [2,]   32 14.173
 [3,]   33 14.135
```

E1 is 14.183 at time 31.

Then, applying the same way. E5 must be in range of [125,155]. There are two same points, and I just define one of them. E5 is 14.6110 at time 145.

```
 [25,]  145 14.61100
 [26,]  148 14.61100
```

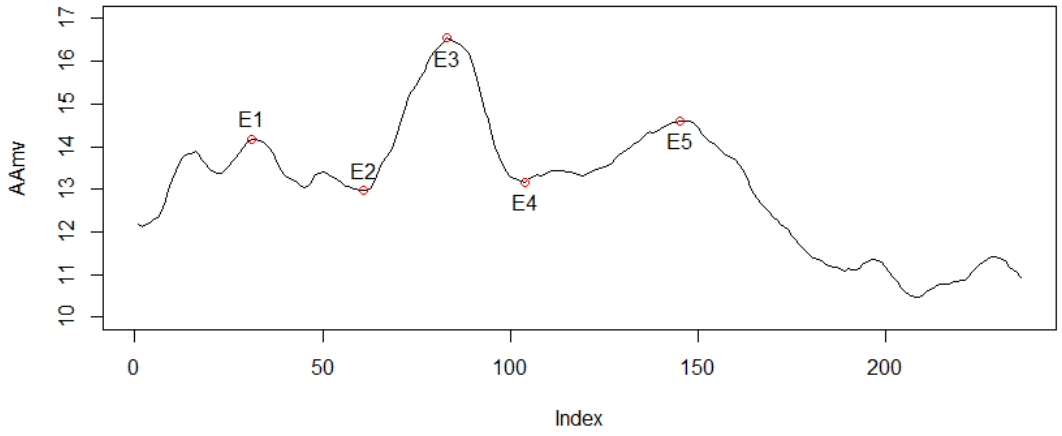
For E2 and E4, I find the minimum between 50 to 83, and 83 to 125.

```
[80,]  165 12.88800
[81,]   61 12.97200
[82,]    9 12.98300
```

E2 is 12.972 at time 61.

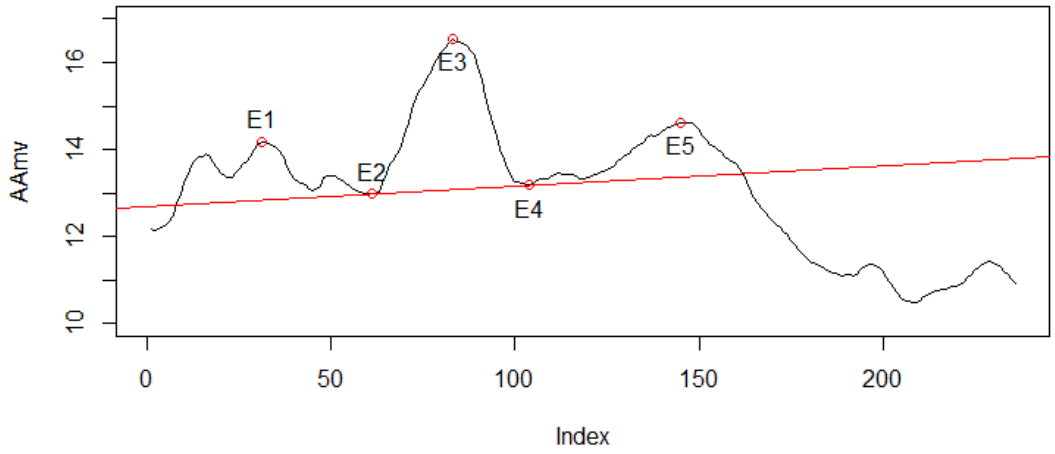
```
 [95,]   47 13.17000
 [96,]  104 13.17600
 [97,]   43 13.18100
```

E4 is 13.176 at time 104.



(2) Compute the neckline using R code.

The neckline crosses E2 and E4, so that I use these two points to get neckline.




```
slope <- (12.972 - 13.176) / (61 - 104)
intercept <- 12.972 - 61 * slope
abline(intercept, slope, col = "red")
```

(3) Describe your trading strategy accordingly and compute your price objective.

The price objective is calculated by subtracting the price at which the pattern breaks the neckline by the difference between the head and the neckline.

The distance from E3 to neck line is 3.779014.

```
> line <- slope * x + intercept
> dis <- 16.538 - line[83]
> dis
[1] 3.779014
```

I find the first time to break the neck line is at time 167.

```
> which(AAmvt[,2] < line)
  [1]   1   2   3   4   5   6   7   8 167 168 169 170 171 172 173 174 175 176 177 178 179
 [22] 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200
 [43] 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221
 [64] 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242
 [85] 243
```

So that the price objective is $8.969.

```
> priceobjective <- line[167] - dis
> priceobjective
[1] 8.968681
```

```
library(xts)
library(quantmod)
library(TTR)
read.csv("sp500hst.txt")
alldata <- read.csv("sp500hst.txt")
#1-1
BAC <- subset(alldata, Ticker == "BAC")
?MACD
MACD <- MACD(BAC[,"Close"], 11, 22, 9, maType = "EMA")
MACD <- na.omit(MACD)
plot(MACD[,1], type = "l", col = "1", ylab = "MACD", main = "Ticker:BAC Daily Closing MACD")
lines(MACD[,2], type = "l", col = "2")
legend(150, 3, c("EMA(11days)", "EMA(22days)"), lty = c(1,1), col = c(1, 2), bty = "n")
Cp <- c()
Cp <- rep(0, 33)
for (i in 34 : nrow(MACD))
   {
   if (MACD[i,1] > MACD[i,2]){Cp[i] <- 1}
   else {Cp[i] <- -1}
}
Cp
signalBAC <- rep(0,245)
for(i in 34 : nrow(MACD))
{
   if ((Cp[i] - Cp[i - 1]) == 2)
   {signalBAC[i] <- 'buy'}
   else if((Cp[i] - Cp[i - 1]) == -2)
   {signalBAC[i] <- 'sell'}
}
BAC2 <- cbind(BAC, signalBAC)
SignalSet <- subset(BAC2, signalBAC != 0)
SignalSet
```

#1.2RIS

```
RSI <- RSI(BAC[,"Close"], n = 14)
plot(RSI, type = 'l', ylim = c(0,100), col = 1)
abline(h = 20, col = 2)
abline(h = 80, col = 2)
state <- rep(0, length(RSI))
for (i in 15:length(RSI)) {
   if(RSI[i] < 20){
      state[i] <- -1
   } else if (RSI[i] > 70){
      state[i] <- 1
   }
}
sigRSI <- rep(0,245)
for(i in 15 : length(RSI))
{
   if((state[i] - state[i - 1] == 1) & (state[i - 1] == 0))
   {sigRSI[i] <- 'sell'}
   else if((state[i] - state[i - 1] == -1) & (state[i - 1] == 0))
   {sigRSI[i] <- 'buy'}
}
BAC3 <- cbind(BAC, sigRSI)
SignalSet2 <- subset(BAC3, sigRSI != 0)
SignalSet2

#1.3 comparing
MACDbuy <- subset(BAC2, signalBAC == "buy")
MACDsell <- subset(BAC2, signalBAC == "sell")
MACDbuy <- rbind(MACDbuy, BAC2[nrow(BAC2), ])
MACDresult <- sum(MACDsell[, "Close"] - MACDbuy[, "Close"])
MACDresult
BAC2[nrow(BAC2), ]

RSIbuy <- subset(BAC3, sigRSI == "buy")
RSIsell <- subset(BAC3, sigRSI == "sell")
RSIbuy <- rbind(RSIbuy, BAC2[nrow(BAC3), ])
RSIresult <- RSIsell[1, "Close"] - RSIbuy[, "Close"]
RSIresult

#########2########
#2.1
AA <- subset(alldata, Ticker == "AA")
AAclose <- data.frame(Price = AA[, "Close"])
AA.min <- min(AAclose)
AA.min
```

```
AA.max <- max(AAclose)
AA.max
plot(ts(AAclose), ylim=c(AA.min, AA.max), ylab="")
par(new=T)
aa.sma10 <- SMA(AAclose, n=10)
plot(ts(aa.sma10), ylim=c(AA.min, AA.max), ylab="", col = "steelblue", lwd=1)
par(new=T)
aa.sma30 <- SMA(AAclose, n=30)
plot(ts(aa.sma30), ylim=c(AA.min, AA.max), ylab="Closing Price", col = "steelblue", lwd=3,
main="Ticker:AA Daily Closing: AUG 21, 2009 to AUG 20, 2010.")
#find max
x <- AAclose[,1]
order(x,decreasing=TRUE)[1]
x[order(x,decreasing=TRUE)[1]]

#smooth
AAmv <- runMean(AAclose, n = 10)
AAmv <- na.omit(AAmv)
plot(AAmv, type = "l",col = 1, main = "Ticker:AA daily closing prices' moving average")
AAmvt <- cbind(Time = c(1 : length(AAmv)),AAmv)
#max E3
E3 <- which.max(AAmvt[,2])
AAmvt[E3, ]

#E2



#E1
AAmvt[order(AAmvt[c(0:50),2],decreasing=T),]
#E5
AAmvt[order(AAmvt[c(100:175),2],decreasing=T),]
AAmvt[order(AAmvt[,2],decreasing=T),]
AAmvt[order(AAmvt[,2],decreasing=F),]

#plot
plot(AAmvt[,2], ylim = c(10,17), type = "l", ylab = "AAmv")
points(31, 14.183, col = 2)
text(31, 14.183, pos = 3, "E1")
points(61, 12.972, col = 2)
text(61, 12.972, pos = 3, "E2")
points(83, 16.538, col = 2)
text(83, 16.538, pos = 1, "E3")
points(104, 13.176, col = 2)
```

```
text(104, 13.176, pos = 1, "E4")
points(145, 14.611, col = 2)
text(145, 14.611, pos = 1, "E5")

#2.2
slope <- (12.972 - 13.176) / (61 - 104)
intercept <- 12.972 - 61 * slope
abline(intercept, slope, col = "red")

#(3) Describe your trading strategy accordingly and compute your price objective.
x < 1 : 245
line <- slope * x + intercept
dis <- 16.538 - line[83]
dis
which(AAmvt[,2] < line)
priceobjective <- line[167] - dis
priceobjective
```