

STEVENS INSTITUTE OF TECHNOLOGY
FA 570 Homework 2
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Homework 2

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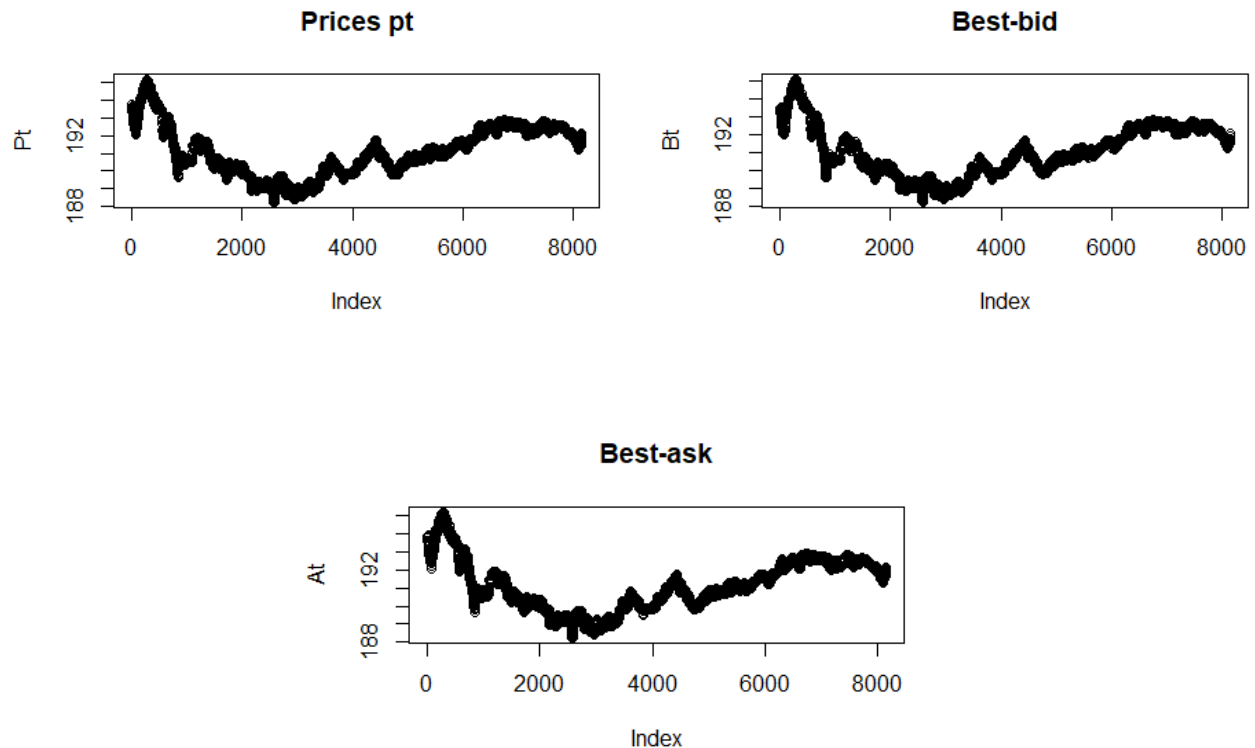
1 Problem 1

```
1 library(xts)
2 library(highfrequency)
3
4 options(digits=3)
5
6 load("sampleTQdata.RData")
7
8 Sys.setenv(TZ='GMT')
9 head(tqdata)
10 tail(tqdata)
11
12 n.trades <- length(tqdata$SIZE)
13 plot(as.numeric(tqdata$PRICE))
14 plot(as.numeric(tqdata$BID))
15 plot(as.numeric(tqdata$OFR))
16
17 newdata <- (subset(tqdata[100:200, ]))
18 plot(as.numeric(newdata$PRICE))
19 plot(as.numeric(newdata$BID))
20 plot(as.numeric(newdata$OFR))
```

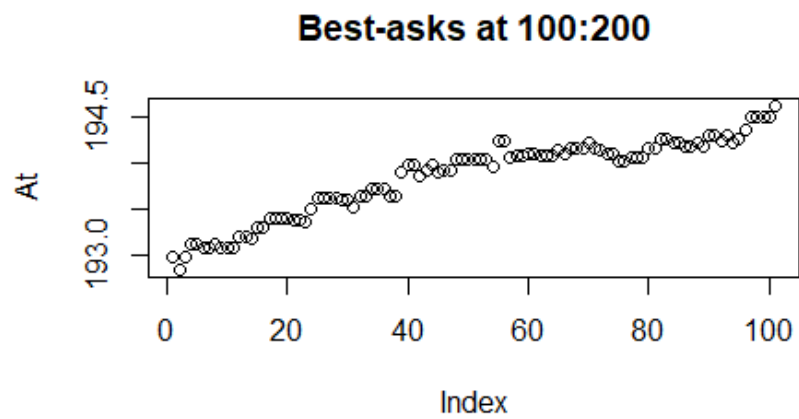
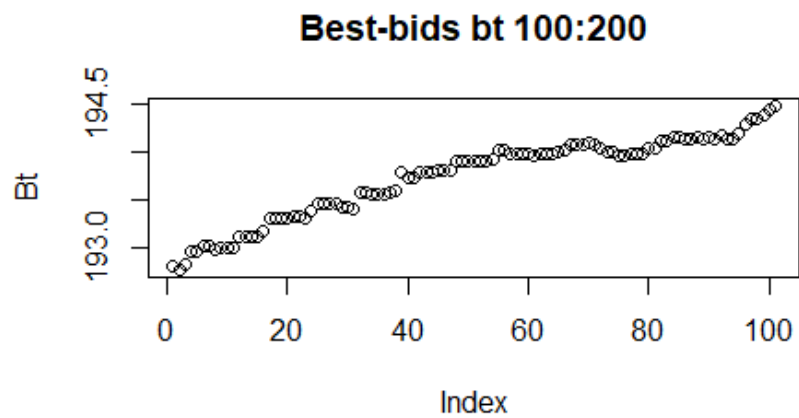
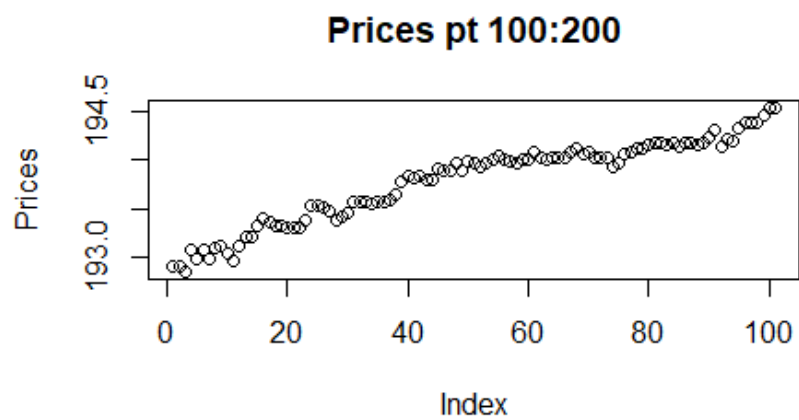
i) How many trades are in the dataset?

[1] 8153

ii) Plot the trade prices p_t and the best-bid b_t and best-ask prices a_t



iii) Same as in ii) but only for trades with counts 100:200



2 Problem 2

Count how many trades take place: i) within the spread, ii) at bid, iii) at ask

```
1 results = list("p_within" = 0, "b" = 0, "a" = 0, "p_outside" = 0)
2 b = tqdata[, 3]
3 a = tqdata[, 5]
4 p = tqdata[, 8]
5
6 for (i in 1:8153){
7   if(p[i]>b[i] & p[i]<a[i]){
8     results$p_within <- results$p_within + 1
9   } else if(p[i]==b[i]){
10    results$b <- results$b + 1
11  } else if (p[i]==a[i]){
12    results$a <- results$a + 1
13  } else {
14    results$p_outside <- results$p_outside + 1
15  }
16 }
17
18 results$p_within + results$b + results$a + results$p_outside
```

Results:

(i) Within: 2832

(ii) At the touch $p_t = b_t$: 1709

(iii) At the touch $p_t = a_t$: 1370

(iv) Outside: 2242

3 Problem 3

Determine the “trade direction” dt of each trade, which shows if it is a buy ($dt = +1$) or a sell ($dt = -1$). There are two ways to do this, implement each of them in R.

3.1 (i) Tick test

```
1 #3. Trade directions
2 #i) Tick test.
3 data <- tqdata[, 8]
4 summary(data)
5 data$PREVIOUS <- c(NA, data[1:8152])
6
7 tk <- c("-1", NA, "+1")[sign(as.numeric(data$PRICE)-as.numeric(data$
8   PREVIOUS))+2]
9
10 for(i in 2:length(tk)) if (is.na(tk[i])) tk[i] <- tk[i-1]
11
12 data$TICK <- tk
13 head(data)
```

Result:

```
1 > head(data)
2
3      PRICE      PREVIOUS  TICK
4 2008-01-04 09:30:27 "193.710" NA      NA
5 2008-01-04 09:30:28 "193.590" "193.710" "-1"
6 2008-01-04 09:30:29 "193.445" "193.590" "-1"
7 2008-01-04 09:30:30 "193.380" "193.445" "-1"
8 2008-01-04 09:30:31 "193.340" "193.380" "-1"
9 2008-01-04 09:30:33 "193.520" "193.340" "+1"
```

Listing 1: R output

3.2 (ii) Lee-Ready rule

```
1 #First method
2
3 data1 <- tqdata[, 8]
4 summary(data1)
5 data1$PREVIOUS <- c(NA, data1[1:8152])
6 data1$MIDPOINTS <- (as.numeric(tqdata$BID) + as.numeric(tqdata$OFR))/2
7
8 d <- list()
9
10 for (i in 1:8153){
11   if(data1$PRICE[i] > data1$MIDPOINTS[i]){
12     d <- append(d, "1")
13   } else if(data1$PRICE[i] < data1$MIDPOINTS[i]){
14     d <- append(d, "-1")
15   } else if (data1$PRICE[i] == data1$MIDPOINTS[i]){
16     d <- append(d, data1$TICK[i])
17   }
18 }
19
20 data1$TICK <- d
21
22 head(data1)
```

Result:

```
1 > head(data1)
2
3      PRICE  PREVIOUS  MIDPOINTS  TICK
4 2008-01-04 09:30:27 193.710      NA    193.615    1
5 2008-01-04 09:30:28 193.590    193.710    193.615   -1
6 2008-01-04 09:30:29 193.445    193.590    193.530   -1
7 2008-01-04 09:30:30 193.380    193.445    193.550   -1
8 2008-01-04 09:30:31 193.340    193.380    193.550   -1
9 2008-01-04 09:30:33 193.520    193.340    193.470    1
```

Listing 2: R output

```

1 #Second method
2 directions <- getTradeDirection(tqdata)
3 View(directions)
4
5 comparing <- as.data.frame(directions)
6 comparing$d <- d
7
8 ifelse(comparing$directions == comparing$d, comparing$RESULT <- TRUE,
        comparing$RESULT <- FALSE)
9 head(comparing)
10 sum(comparing$RESULT)

```

Result:

```

1 > head(comparing)
2   directions  d RESULT
3 1           1  1  TRUE
4 2          -1 -1  TRUE
5 3          -1 -1  TRUE
6 4          -1 -1  TRUE
7 5          -1 -1  TRUE
8 6           1  1  TRUE
9 > sum(comparing$RESULT)
10 [1] 8153

```

Listing 3: R output

As a result, 100% of trades are classified the same way under the two tests.