

# Homework7

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Problem 2 (a)

```
library(quantreg)
```

```
## Warning: package 'quantreg' was built under R version 3.4.4
```

```
## Loading required package: SparseM
```

```
## Warning: package 'SparseM' was built under R version 3.4.4
```

```
##
```

```
## Attaching package: 'SparseM'
```

```
## The following object is masked from 'package:base':
```

```
##
```

```
##      backsolve
```

```
library(quantmod)
```

```
## Loading required package: xts
```

```
## Warning: package 'xts' was built under R version 3.4.4
```

```
## Loading required package: zoo
```

```
## Warning: package 'zoo' was built under R version 3.4.4
```

```
##
```

```
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
##      as.Date, as.Date.numeric
```

```
## Loading required package: TTR
```

```
## Warning: package 'TTR' was built under R version 3.4.4
```

```
## Version 0.4-0 included new data defaults. See ?getSymbols.
```

```
data(barro)
```

```
A=getSymbols('AAPL',from = '2008-1-1', to = "2008-12-31",auto.assign=FALSE)[,6]
```

```
## '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.
```

```
b=getSymbols('^ixic', from = '2008-1-1', to = "2008-12-31",auto.assign=FALSE)[,6]
```

```
summary(A)
```

```
##      Index      AAPL.Adjusted
```

```
## Min.      :2008-01-02  Min.      :10.00
```

```
## 1st Qu.:2008-04-02 1st Qu.:13.80
## Median :2008-07-01 Median :18.48
## Mean :2008-07-01 Mean :17.68
## 3rd Qu.:2008-09-30 3rd Qu.:21.54
## Max. :2008-12-30 Max. :24.23
```

```
summary(b)
```

```
##      Index      IXIC.Adjusted
## Min. :2008-01-02 Min. :1316
## 1st Qu.:2008-04-02 1st Qu.:2048
## Median :2008-07-01 Median :2305
## Mean :2008-07-01 Mean :2164
## 3rd Qu.:2008-09-30 3rd Qu.:2402
## Max. :2008-12-30 Max. :2610
```

```
lA=ROC(A)*100
```

```
lB=ROC(b)*100
```

```
beta1=coefficients(lm(lA~lB))[2]
```

```
beta1
```

```
##      lB
```

```
## 1.078192
```

```
data1=cbind(lA,lB)
```

```
f=function(r){
```

```
  set.seed(r)
```

```
  sample=data1[sample(nrow(data1), size = nrow(A), replace = TRUE),]
```

```
  return (coef(summary(lm(AAPL.Adjusted~IXIC.Adjusted, data = sample)))[2,2])
```

```
}
```

```
mean(sapply(c(1:100), f))
```

```
## [1] 0.05956966
```

```
(b)
```

```
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 3.4.4
```

```
##
```

```
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:xts':
```

```
##
```

```
##      first, last
```

```
## The following objects are masked from 'package:stats':
```

```
##
```

```
##      filter, lag
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
##      intersect, setdiff, setequal, union
```

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.4.4
```

```
C=matrix(0,nrow = 1000,ncol = 5)
```

```
data2=read.table("Sensory.dat.txt",fill = T)
```

```
data2=as.matrix(data2[-c(1:2), ])
for (i in 1:10) {
  data2[3*i-1,]=c(i,data2[3*i-1,1:5])
  data2[3*i,]=c(i,data2[3*i,1:5])
}
print(data2)
```

```
##      V1      V2      V3      V4      V5      V6
## 3  "1"    "4.3"  "4.9"  "3.3"  "5.3"  "4.4"
## 4  "1"    "4.3"  "4.5"  "4.0"  "5.5"  "3.3"
## 5  "1"    "4.1"  "5.3"  "3.4"  "5.7"  "4.7"
## 6  "2"    "6.0"  "5.3"  "4.5"  "5.9"  "4.7"
## 7  "2"    "4.9"  "6.3"  "4.2"  "5.5"  "4.9"
## 8  "2"    "6.0"  "5.9"  "4.7"  "6.3"  "4.6"
## 9  "3"    "2.4"  "2.5"  "2.3"  "3.1"  "2.4"
## 10 "3"    "3.9"  "3.0"  "2.8"  "2.7"  "1.3"
## 11 "3"    "1.9"  "3.9"  "2.6"  "4.6"  "2.2"
## 12 "4"    "7.4"  "8.2"  "6.4"  "6.8"  "6.0"
## 13 "4"    "7.1"  "7.9"  "5.9"  "7.3"  "6.1"
## 14 "4"    "6.4"  "7.1"  "6.9"  "7.0"  "6.7"
## 15 "5"    "5.7"  "6.3"  "5.4"  "6.1"  "5.9"
## 16 "5"    "5.8"  "5.7"  "5.4"  "6.2"  "6.5"
## 17 "5"    "5.8"  "6.0"  "6.1"  "7.0"  "4.9"
## 18 "6"    "2.2"  "2.4"  "1.7"  "3.4"  "1.7"
## 19 "6"    "3.0"  "1.8"  "2.1"  "4.0"  "1.7"
## 20 "6"    "2.1"  "3.3"  "1.1"  "3.3"  "2.1"
## 21 "7"    "1.2"  "1.5"  "1.2"  "0.9"  "0.7"
## 22 "7"    "1.3"  "2.4"  "0.8"  "1.2"  "1.3"
## 23 "7"    "0.9"  "3.1"  "1.1"  "1.9"  "1.6"
## 24 "8"    "4.2"  "4.8"  "4.5"  "4.6"  "3.2"
## 25 "8"    "3.0"  "4.5"  "4.7"  "4.9"  "4.6"
## 26 "8"    "4.8"  "4.8"  "4.7"  "4.8"  "4.3"
## 27 "9"    "8.0"  "8.6"  "9.0"  "9.4"  "8.8"
## 28 "9"    "9.0"  "7.7"  "6.7"  "9.0"  "7.9"
## 29 "9"    "8.9"  "9.2"  "8.1"  "9.1"  "7.6"
## 30 "10"   "5.0"  "4.8"  "3.9"  "5.5"  "3.8"
## 31 "10"   "5.4"  "5.0"  "3.4"  "4.9"  "4.6"
## 32 "10"   "2.8"  "5.2"  "4.1"  "3.9"  "5.5"
```

```
data2=data2 %>% as.data.frame() %>% rename(item = V1,I1 = V2, I2= V3, I3= V4, I4= V5,I5 = V6) %>%
  mutate_if(is.factor, as.character) %>% mutate_if(is.character, as.numeric )
```

```
## Warning: package 'bindrcpp' was built under R version 3.4.4
```

```
print(data2)
```

```
##      item  I1  I2  I3  I4  I5
## 1      1  4.3  4.9  3.3  5.3  4.4
## 2      1  4.3  4.5  4.0  5.5  3.3
## 3      1  4.1  5.3  3.4  5.7  4.7
## 4      2  6.0  5.3  4.5  5.9  4.7
## 5      2  4.9  6.3  4.2  5.5  4.9
## 6      2  6.0  5.9  4.7  6.3  4.6
## 7      3  2.4  2.5  2.3  3.1  2.4
## 8      3  3.9  3.0  2.8  2.7  1.3
```

```
## 9      3 1.9 3.9 2.6 4.6 2.2
## 10     4 7.4 8.2 6.4 6.8 6.0
## 11     4 7.1 7.9 5.9 7.3 6.1
## 12     4 6.4 7.1 6.9 7.0 6.7
## 13     5 5.7 6.3 5.4 6.1 5.9
## 14     5 5.8 5.7 5.4 6.2 6.5
## 15     5 5.8 6.0 6.1 7.0 4.9
## 16     6 2.2 2.4 1.7 3.4 1.7
## 17     6 3.0 1.8 2.1 4.0 1.7
## 18     6 2.1 3.3 1.1 3.3 2.1
## 19     7 1.2 1.5 1.2 0.9 0.7
## 20     7 1.3 2.4 0.8 1.2 1.3
## 21     7 0.9 3.1 1.1 1.9 1.6
## 22     8 4.2 4.8 4.5 4.6 3.2
## 23     8 3.0 4.5 4.7 4.9 4.6
## 24     8 4.8 4.8 4.7 4.8 4.3
## 25     9 8.0 8.6 9.0 9.4 8.8
## 26     9 9.0 7.7 6.7 9.0 7.9
## 27     9 8.9 9.2 8.1 9.1 7.6
## 28    10 5.0 4.8 3.9 5.5 3.8
## 29    10 5.4 5.0 3.4 4.9 4.6
## 30    10 2.8 5.2 4.1 3.9 5.5
```

```
g=function(r){
  sample=data2[sample(nrow(data2), size = 100, replace = TRUE),2:6]
  return (coef(summary(lm(I1~I2+I3+I4+I5, data=data2)))[,1])
}
t1=Sys.time()
res=sapply(c(1:100),g)
t2=Sys.time()
t2-t1
```

```
## Time difference of 0.5350311 secs
```

```
res=res %>% as.data.frame() %>% rename(I2=V2,I3=V3,I4=V4,I5=V5,
                                       Intercep = V1)
summary(res)
```

##	Intercep	I2	I3
##	Min. : -0.57913	Min. : -0.57913	Min. : -0.57913
##	1st Qu.: -0.12963	1st Qu.: -0.12963	1st Qu.: -0.12963
##	Median : 0.25241	Median : 0.25241	Median : 0.25241
##	Mean : 0.09043	Mean : 0.09043	Mean : 0.09043
##	3rd Qu.: 0.34132	3rd Qu.: 0.34132	3rd Qu.: 0.34132
##	Max. : 0.56720	Max. : 0.56720	Max. : 0.56720
##	I4	I5	V6
##	Min. : -0.57913	Min. : -0.57913	Min. : -0.57913
##	1st Qu.: -0.12963	1st Qu.: -0.12963	1st Qu.: -0.12963
##	Median : 0.25241	Median : 0.25241	Median : 0.25241
##	Mean : 0.09043	Mean : 0.09043	Mean : 0.09043
##	3rd Qu.: 0.34132	3rd Qu.: 0.34132	3rd Qu.: 0.34132
##	Max. : 0.56720	Max. : 0.56720	Max. : 0.56720
##	V7	V8	V9
##	Min. : -0.57913	Min. : -0.57913	Min. : -0.57913
##	1st Qu.: -0.12963	1st Qu.: -0.12963	1st Qu.: -0.12963
##	Median : 0.25241	Median : 0.25241	Median : 0.25241

[illegible]

[illegible]

[illegible]

[illegible]



```
## Median : 0.25241
## Mean   : 0.09043
## 3rd Qu.: 0.34132
## Max.   : 0.56720
```

(c)

```
library(parallel)
library(foreach)
library(doParallel)
```

```
## Loading required package: iterators
```

```
cs=detectCores()
cl=makeCluster(cs[1]-1)
registerDoParallel(cl)

h=function(r){
  set.seed(r)
  sample=data2[sample(nrow(data2), size = 100, replace = TRUE),2:6]
  return (coef(summary(lm(I1~I2+I3+I4+I5, data =data2)))[,1])
}
tt1=Sys.time()
res=sapply(c(1:100),h)
tt2=Sys.time()
tt2-tt1
```

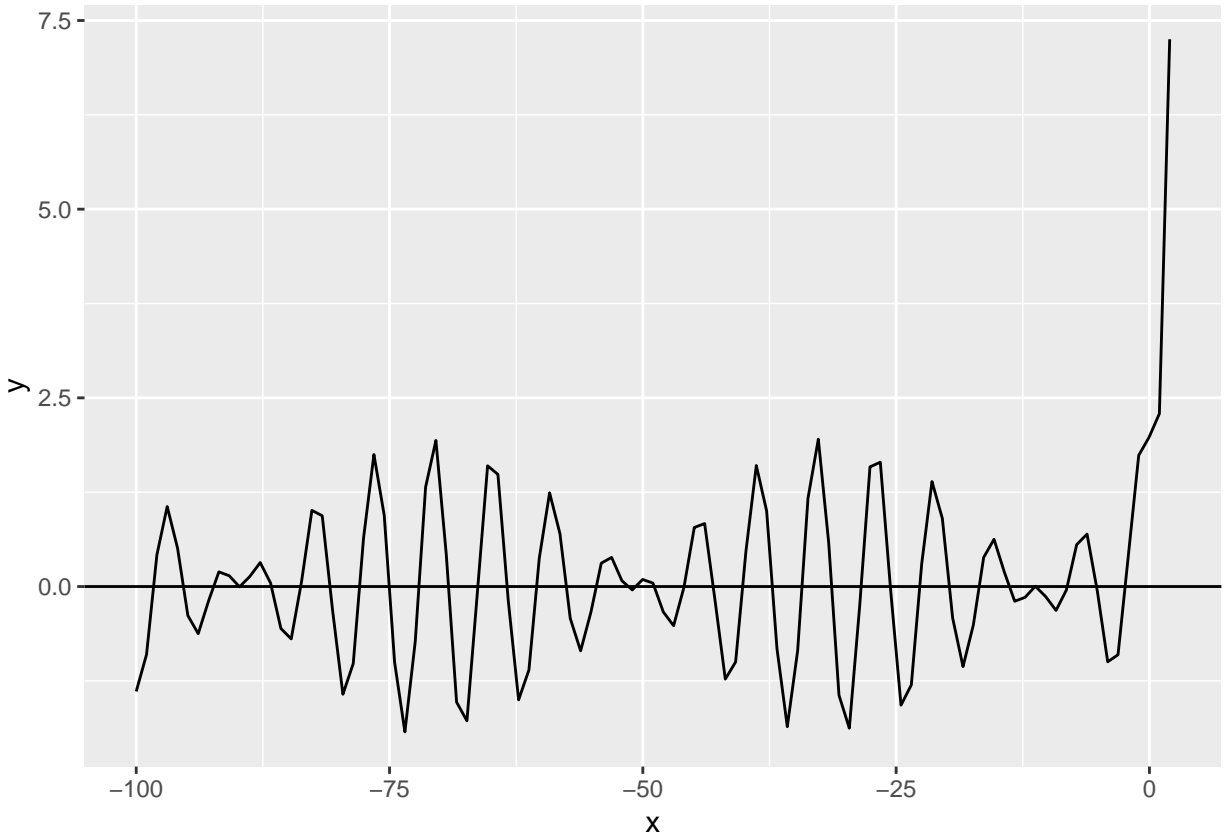
```
## Time difference of 0.558032 secs
```

```
stopCluster(cl)
```

Problem 3

(a)

```
library(ggplot2)
f=function(x){
  y=3^x-sin(x)+cos(5*x)
  return(y)
}
g=function(x){
  y=3^x*log(3)-cos(x)-5*sin(5*x)
  return(y)
}
ggplot(data=data.frame(x = 0,y = 0), mapping = aes(x = x)) +
  stat_function(fun=f) +
  xlim(-100, 2) +
  geom_abline(intercept = 0, slope = 0)
```



```
froot=function(x) {while (abs(f(x)-0) > 1e-6) {
  z=x-f(x)/g(x)
  return(z)
}}
froot(2.5)
```

```
## [1] 1.624361
```

```
T1=Sys.time()
sapply(c(-100:0), froot)
```

```
##      [1] -100.4342823 -99.1621869 -99.1194764 -97.1339503 -96.0600686
##      [6] -95.0360278 -93.9858536 -92.4718422 -91.9017118 -90.7854984
##     [11] -89.9448030 -88.7373202 -79.4194620 -86.8382937 -85.2054910
##     [16] -85.2805280 -83.6248825 -84.5068908 -82.0718857 -78.0191884
##     [21] -80.3665802 -78.9212411 -78.4727334 -77.1700302 -78.6124263
##     [26] -75.1450525 -74.0658592 -73.0469512 -71.9948163 -70.8415352
##     [31] -69.9096796 -68.8049472 -67.9508221 -66.7513732 -62.9865812
##     [36] -64.8463570 -63.2799074 -63.3045042 -61.6468717 -62.8322827
##     [41] -60.0807903 -56.8890831 -58.3873681 -56.9335988 -56.5168884
##     [46] -55.1781686 -45.6419139 -53.1566295 -52.0716457 -51.0586646
##     [51] -50.0036762 -48.9132195 -47.9175624 -46.8227015 -45.9569161
##     [56] -44.7646308 -42.1826879 -42.8541247 -41.3425789 -41.3315821
##     [61] -39.6669051 -41.3348749 -38.0899064 -35.3656540 -36.4100880
##     [66] -34.9450991 -34.5682344 -33.1866305 -30.3864667 -31.1687461
##     [71] -30.0774495 -29.0713459 -28.0124650 -26.9458953 -25.9253854
##     [76] -24.8390328 -23.9631295 -22.7771810 -20.7057779 -20.8616251
```

```
## [81] -19.3961502 -19.3625183 -17.6852583 -20.2150144 -16.0992802
## [86] -13.6668824 -14.4350523 -12.9559035 -12.6288192 -11.1954467
## [91] -9.1096109 -9.1814838 -8.0833255 -7.0850801 -6.0209859
## [96] -4.9613203 -3.9357074 -2.8641956 -1.9168900 -0.7064704
## [101] -20.2814480
```

```
T2=Sys.time()
```

```
T2-T1
```

```
## Time difference of 0.03600216 secs
```

(b)

```
T3=Sys.time()
```

```
mclapply(-100:0, froot, mc.cores = 1)
```

```
## [[1]]
## [1] -100.4343
##
## [[2]]
## [1] -99.16219
##
## [[3]]
## [1] -99.11948
##
## [[4]]
## [1] -97.13395
##
## [[5]]
## [1] -96.06007
##
## [[6]]
## [1] -95.03603
##
## [[7]]
## [1] -93.98585
##
## [[8]]
## [1] -92.47184
##
## [[9]]
## [1] -91.90171
##
## [[10]]
## [1] -90.7855
##
## [[11]]
## [1] -89.9448
##
## [[12]]
## [1] -88.73732
##
## [[13]]
## [1] -79.41946
##
## [[14]]
```

```
## [1] -86.83829
##
## [[15]]
## [1] -85.20549
##
## [[16]]
## [1] -85.28053
##
## [[17]]
## [1] -83.62488
##
## [[18]]
## [1] -84.50689
##
## [[19]]
## [1] -82.07189
##
## [[20]]
## [1] -78.01919
##
## [[21]]
## [1] -80.36658
##
## [[22]]
## [1] -78.92124
##
## [[23]]
## [1] -78.47273
##
## [[24]]
## [1] -77.17003
##
## [[25]]
## [1] -78.61243
##
## [[26]]
## [1] -75.14505
##
## [[27]]
## [1] -74.06586
##
## [[28]]
## [1] -73.04695
##
## [[29]]
## [1] -71.99482
##
## [[30]]
## [1] -70.84154
##
## [[31]]
## [1] -69.90968
##
## [[32]]
```

```
## [1] -68.80495
##
## [[33]]
## [1] -67.95082
##
## [[34]]
## [1] -66.75137
##
## [[35]]
## [1] -62.98658
##
## [[36]]
## [1] -64.84636
##
## [[37]]
## [1] -63.27991
##
## [[38]]
## [1] -63.3045
##
## [[39]]
## [1] -61.64687
##
## [[40]]
## [1] -62.83228
##
## [[41]]
## [1] -60.08079
##
## [[42]]
## [1] -56.88908
##
## [[43]]
## [1] -58.38737
##
## [[44]]
## [1] -56.9336
##
## [[45]]
## [1] -56.51689
##
## [[46]]
## [1] -55.17817
##
## [[47]]
## [1] -45.64191
##
## [[48]]
## [1] -53.15663
##
## [[49]]
## [1] -52.07165
##
## [[50]]
```

```
## [1] -51.05866
##
## [[51]]
## [1] -50.00368
##
## [[52]]
## [1] -48.91322
##
## [[53]]
## [1] -47.91756
##
## [[54]]
## [1] -46.8227
##
## [[55]]
## [1] -45.95692
##
## [[56]]
## [1] -44.76463
##
## [[57]]
## [1] -42.18269
##
## [[58]]
## [1] -42.85412
##
## [[59]]
## [1] -41.34258
##
## [[60]]
## [1] -41.33158
##
## [[61]]
## [1] -39.66691
##
## [[62]]
## [1] -41.33487
##
## [[63]]
## [1] -38.08991
##
## [[64]]
## [1] -35.36565
##
## [[65]]
## [1] -36.41009
##
## [[66]]
## [1] -34.9451
##
## [[67]]
## [1] -34.56823
##
## [[68]]
```

```
## [1] -33.18663
##
## [[69]]
## [1] -30.38647
##
## [[70]]
## [1] -31.16875
##
## [[71]]
## [1] -30.07745
##
## [[72]]
## [1] -29.07135
##
## [[73]]
## [1] -28.01246
##
## [[74]]
## [1] -26.9459
##
## [[75]]
## [1] -25.92539
##
## [[76]]
## [1] -24.83903
##
## [[77]]
## [1] -23.96313
##
## [[78]]
## [1] -22.77718
##
## [[79]]
## [1] -20.70578
##
## [[80]]
## [1] -20.86163
##
## [[81]]
## [1] -19.39615
##
## [[82]]
## [1] -19.36252
##
## [[83]]
## [1] -17.68526
##
## [[84]]
## [1] -20.21501
##
## [[85]]
## [1] -16.09928
##
## [[86]]
```

```
## [1] -13.66688
##
## [[87]]
## [1] -14.43505
##
## [[88]]
## [1] -12.9559
##
## [[89]]
## [1] -12.62882
##
## [[90]]
## [1] -11.19545
##
## [[91]]
## [1] -9.109611
##
## [[92]]
## [1] -9.181484
##
## [[93]]
## [1] -8.083326
##
## [[94]]
## [1] -7.08508
##
## [[95]]
## [1] -6.020986
##
## [[96]]
## [1] -4.96132
##
## [[97]]
## [1] -3.935707
##
## [[98]]
## [1] -2.864196
##
## [[99]]
## [1] -1.91689
##
## [[100]]
## [1] -0.7064704
##
## [[101]]
## [1] -20.28145
```

```
T4=Sys.time()
T3-T4
```

```
## Time difference of -0.01200104 secs
```