ps6

Kehsin Su Esther 3033114294

October 30, 2017

```r
knitr::opts_chunk$set(tidy = TRUE, cache = TRUE)
library(pryr)

## Warning:  package 'pryr' was built under R version 3.3.3
```

1 Q1

(Brief summary)
The goal of the simulation is to investigate the finite sample properties of the test. How fast does the test statistics(likelihood ratio statistics) converge in distribution to asympototic distribution and the power. They use power under different samples, proportion, alpha levels to assess their method.

The author has choosen EM algorithm to use maximum likelihood method to obtain 100 sets of parameters. The sample were generated from standard normal distribution. Those values and sample sizes that used to generate null sample may impact the result. Maybe the author should consider more about difference variance of the two components.

The table reveals enough information for the test results. For table 1, personally, I would recommend transfer the row into columns and combine the result of inadjusted test and adjusted test to compare the result more intutive. I would even calcuate the difference of powers. Also, plot some graphes might help reader understand the result better.

When the sample size increase, the it will coverge to alpha. Overall, he results makes more sense when sample size increase and D value decrease.

In my view, more simulation would be more powerful for the hyopetheis.Size of 10 might not strong enough. Most of the case, the size should at least be 100 to be representive, and not exceed 1000 for the efficency. (general 10% of the population)

2 Q2

```r
## @knitr database-access

library(RSQLite)
drv <- dbDriver("SQLite")
# relative or absolute path to where the .db file is
dir <- "C:/Users/Esther/Desktop/stat243-fall-2017-master/section/s07"
dbFilename <- "stackoverflow-2016.db"
db <- dbConnect(drv, dbname = file.path(dir, dbFilename))

## @knitr database-tables
```

```
dbListTables(db)
```

```
## [1] "answers"           "maxRepByQuestion" "questions"
## [4] "questionsAugment" "questions_tags"   "users"
```

```
dbListFields(db, "questions")
```

```
## [1] "questionid"   "creationdate" "score"        "viewcount"
## [5] "title"        "ownerid"
```

```
dbListFields(db, "users")
```

```
##  [1] "userid"         "creationdate"   "lastaccessdate" "location"
##  [5] "reputation"     "displayname"    "upvotes"        "downvotes"
##  [9] "age"            "accountid"
```

```
dbListFields(db, "questions_tags")
```

```
## [1] "questionid" "tag"
```

```
# simple query to get 5 rows from a table
dbGetQuery(db, "select * from questions limit 5")
```

```
##   questionid        creationdate score viewcount
## 1   34552550 2016-01-01 00:00:03     0       108
## 2   34552551 2016-01-01 00:00:07     1       151
## 3   34552552 2016-01-01 00:00:39     2      1942
## 4   34552554 2016-01-01 00:00:50     0       153
## 5   34552555 2016-01-01 00:00:51    -1        54
##                                                                                  title
## 1                                                                Scope between methods
## 2      Rails - Unknown Attribute - Unable to add a new field to a form on create/update
## 3 Selenium Firefox webdriver won't load a blank page after changing Firefox preferences
## 4                                                        Android Studio styles.xml Error
## 5                        Java: reference to non-finial local variables inside a thread
##   ownerid
## 1 5684416
## 2 2457617
## 3 5732525
## 4 5735112
## 5 4646288
```

```
dbGetQuery(db, "select * from users limit 5")
```

```
##   userid        creationdate      lastaccessdate
## 1     13 2008-08-01 04:18:04 2017-03-13 21:03:28
## 2     24 2008-08-01 12:12:53 2017-03-10 22:11:55
## 3     36 2008-08-01 12:43:55 2017-03-13 20:33:22
## 4     37 2008-08-01 12:44:00 2017-03-13 18:08:20
## 5     39 2008-08-01 12:44:55 2017-03-11 13:17:47
##                     location reputation        displayname upvotes
## 1 Raleigh, NC, United States     157267 Chris Jester-Young    5198
## 2     London, United Kingdom       2321          sanmiguel     535
## 3              San Diego, CA       4038                Pat     423
## 4         Georgetown, Canada       4269      Wally Lawless     257
## 5           Istanbul, Turkey      10172           huseyint     523
##   downvotes age accountid
## 1       210  37         9
## 2         3  34        17
## 3        10  36        27
## 4        18  36        28
## 5        21  32        30
```

```
dbGetQuery(db, "select * from questions_tags limit 5")

##   questionid        tag
## 1   34552711         c#
## 2   34552711      razor
## 3   34552711      flags
## 4   34552829 javascript
## 5   34552829       rxjs

# select the unique userid that ask questions contain both python and r,
# then exclude those contain python.
result <- dbGetQuery(db, "select distinct userid from
          questions Q
          join questions_tags T on Q.questionid = T.questionid
          join users U on Q.ownerid = U.userid
          where tag = 'r' or tag = 'python'
          except
          select distinct userid from
          questions Q
          join questions_tags T on Q.questionid = T.questionid
          join users U on Q.ownerid = U.userid
          where tag = 'python'
          ")
# summary the result
dim(result)

## [1] 18611     1
```

3 Q3

The following codes are refer from chapter 8.

```
#from pyspark import SparkFiles
dir = '/global/scratch/paciorek/wikistats_full'
#dir=$HOME
#lines = sc.textFile(dir+'/'+ 'newdir')
lines = sc.textFile(dir + '/' + 'dated')

lines.getNumPartitions()  # 16590 (480 input files) for full dataset

# note delayed evaluation
lines.count()
testLines = lines.take(10)
testLines[0]
testLines[9]

### filter to sites of interest ###

import re
from operator import add

def find(line, regex = "Disney", language = None):
    vals = line.split(' ')
    if len(vals) < 6:
        return(False)
    tmp = re.search(regex, vals[3])
    if tmp is None or (language != None and vals[2] != language):
        return(False)
    else:
        return(True)

lines.filter(find).take(100) # pretty quick

# not clear if should repartition; will likely have small partitions if not
obama = lines.filter(find).repartition(480) # ~ 18 minutes for full dataset (but remember lazy evaluati
obama.count()  # 433k observations for full dataset
mydir = '/global/scratch/esther730'
outputDir = mydir+'/' + 'Dinsney-counts'
obama.saveAsTextFile(outputDir)
## @knitr map-reduce

### map-reduce step to sum hits across date-time-language triplets ###

def stratify(line):
    # create key-value pairs where:
    #   key = date-time-language
    #   value = number of website hits
    vals = line.split(' ')
    return(vals[0] + '-' + vals[1] + '-' + vals[2], int(vals[4]))

# sum number of hits for each date-time-language value
counts = obama.map(stratify).reduceByKey(add)  # 5 minutes
# 128889 for full dataset

### map step to prepare output ###

def transform(vals):
    # split key info back into separate fields
    key = vals[0].split('-')
    return(",".join((key[0], key[1], key[2], str(vals[1]))))

### output to file ###

# have one partition because one file per partition is written out
mydir = '/global/scratch/esther730'
outputDir = mydir+'/' + 'Dinsney-counts'
counts.map(transform).repartition(1).saveAsTextFile(outputDir)
```

After above action, I got Disney data from the wikipages.

```
#copy the data from savio and rename it as disney_data
scp esther730@dtn.brc.berkeley.edu://global/scratch/esther730/Dinsney-counts2/part-00000   /mnt/c/Users
```

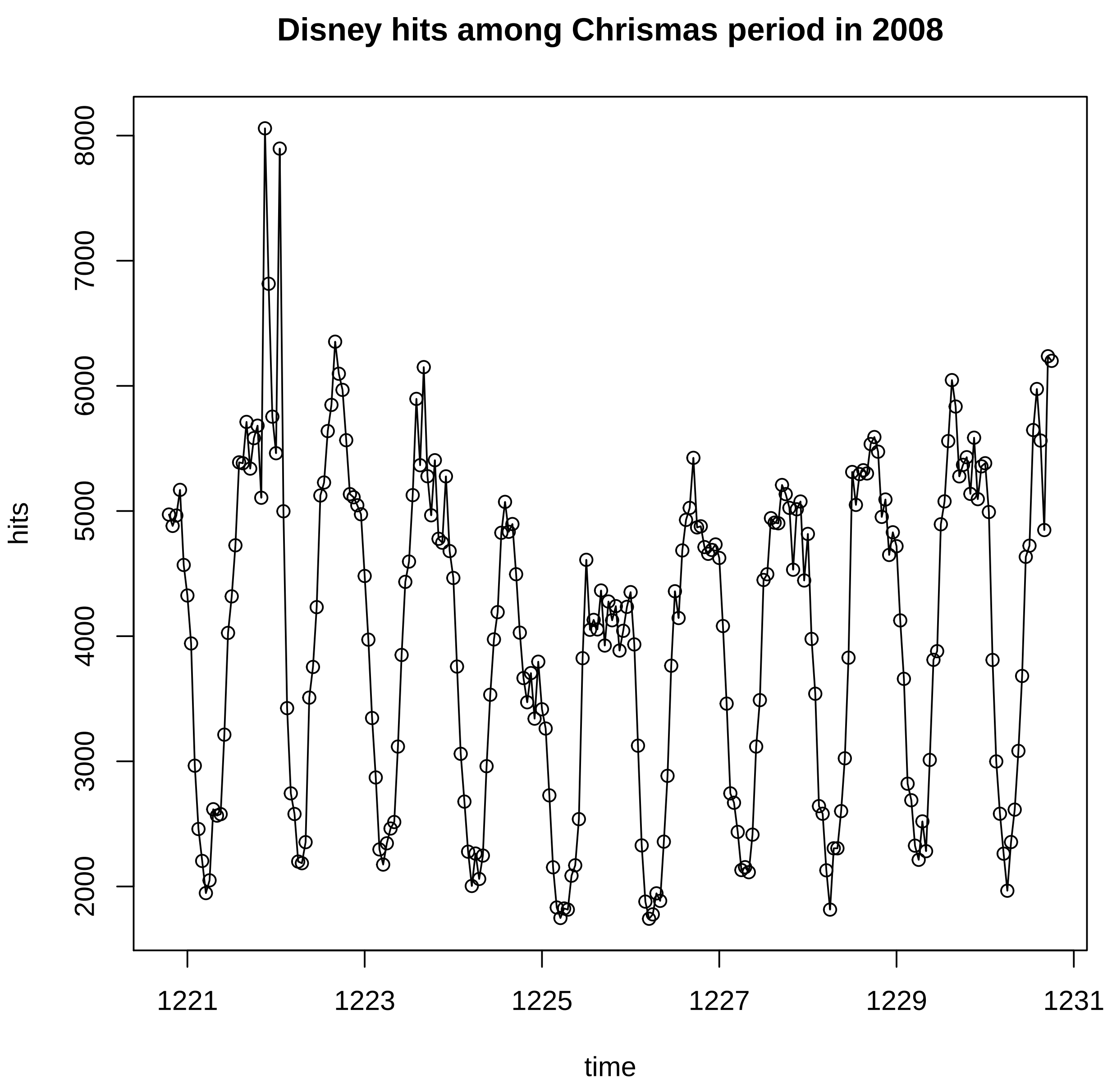
As showing in the plot, the highest hits appears three days before the Chirsmas.

```
# Note: refer from chatper 8 obama_plot.R
library(dplyr)
library(chron)

setwd("C:/Users/Esther/Desktop/stat243-fall-2017-master/section/s07")
dat <- read.table("disney_data", sep = ",")
```

```r
names(dat) <- c("date", "time", "lang", "hits")
dat$date <- as.character(dat$date)
dat$time <- as.character(dat$time)
dat$time[dat$time %in% c("0", "1")] <- "000000"
wh <- which(nchar(dat$time) == 5)
dat$time[wh] <- paste0("0", dat$time[wh])
dat$chron <- chron(dat$date, dat$time, format = c(dates = "ymd", times = "hms"))
dat$chron <- dat$chron - 5/24  # GMT -> EST

dat <- dat %>% filter(dat$lang == "en")
# collect data between Chismas period in 2008. Bedtime Stories release in
# December 25, 2008.
sub <- dat %>% filter(dat$date < 20081231 & dat$date > 20081220)
plot(sub$chron, sub$hits, type = "l", xlab = "time", ylab = "hits", main = "Disney hits among Chrismas
points(sub$chron, sub$hits)
```



```
# dev.off()
```

4 Q4

4.1 (a)

```
library(foreach)
require(parallel)
require(doParallel)
nCores <- as.integer(Sys.getenv("SLURM_CPUS_ON_NODE"))
registerDoParallel(nCores)
library(stringr)
library(readr)

#Note: The single function and usuage of str_pad are refer from my classmate, Ming Qiu.
#write a function to detect the strings that contains "Barack_Obama"
single <- function(filename){
  data <- readLines(filename)
  library(stringr)
  out <- data[str_detect(data,'Barack_Obama')]
  return(out) }


n <- 960
#nsub <- 10
result <- foreach(
  i = 1:n,
  .packages = c("stringr"),
  .combine = c,
  .verbose = TRUE) %dopar% {
    filename <- paste("/global/scratch/paciorek/wikistats_full/dated_for_R/part-", str_pad(i-1, width=5
     #filename <- paste("C:/Users/Esther/Desktop/stat243-fall-2017-master/part-",str_pad(i-1, width=5,
    outputs <- single(filename)
    #outputs
  }

#Transfer result into dataframe
results <- data.frame (matrix(sapply(list(result),function(x) unlist(strsplit(x,split=" ") ) ), ncol=6,

#results <- data.frame ( t(sapply(result,function(x) unlist(strsplit(x,split=" ")) ) ))
colnames(results) <- c("date", "time", "language", "webpage", "number of hits", "page size")
head(results)
class(results)
print(dim(results))
proc.time()
```

Part of output file is following:

```
dic <- "C:/Users/Esther/Desktop/stat243-fall-2017-master/section/s07/ps6q4no.out"
output <- readLines(dic)
tail(output, 25)

##  [1] "      date   time  language                                            webpage"
##  [2] "1 20081231 100000 commons.m                          File:Barack_Obama_signature.svg"
##  [3] "2 20081202 150000        en Image:Michelle,_Oprah_Winfrey_and_Barack_Obama.jpg"
##  [4] "3 20081229 200001        en        Europe_and_Ireland_not_MYOB_or_Barack_Obama"
##  [5] "4 20081123 100000        it                          Discussione:Barack_Obama"
##  [6] "5 20081101 010000        pt                           Imagem:Barack_Obama.jpg"
##  [7] "6 20081231 120000        en                        Washington_Or_Barack_Obama"
##  [8] "  number of hits page size"
##  [9] "1              4     26796"
## [10] "2              2     19158"
## [11] "3              1      6047"
## [12] "4              1     40260"
## [13] "5              3     24840"
## [14] "6              1      6007"
## [15] "> class(results)"
## [16] "[1] \"data.frame\""
## [17] "> print(dim(results))"
## [18] "[1] 325263      6"
## [19] "> proc.time()"
## [20] "     user    system   elapsed "
## [21] "34664.559  2247.375  2715.079 "
## [22] "> "
## [23] "> proc.time()"
## [24] "     user    system   elapsed "
## [25] "34664.560  2247.375  2715.093 "
```

4.2 (b)

As the time is 2715 seconds(46 minutes) for one node, which vert close to 12 minutes if divide it my 4. Hence, using R for each has almost similar times or even faster.

4.3 (c)

```
#statistic allicate
library(foreach)
require(parallel)
require(doParallel)
nCores <- as.integer(Sys.getenv("SLURM_CPUS_ON_NODE"))
registerDoParallel(nCores)
library(stringr)

#Note: The single function and usuage of str_pad are refer from my classmate, Ming Qiu.
single <- function(filename){
  data <- readLines(filename)
  library(stringr)
  out <- data[str_detect(data,'Barack_Obama')]
  return(out) }

n <- 960
#n <- 2
path <- "/global/scratch/paciorek/wikistats_full/dated_for_R/part-"
#path <- "C:/Users/Esther/Desktop/stat243-fall-2017-master/part-"
#obtains all the files' directories
i=1:n
filename <- mclapply(n,  mc.preschedule=TRUE, function(x) paste(path,str_pad(i-1, width=5, side="left",
output <- mclapply(filename[[1]], single,  mc.preschedule=TRUE)
```

```
#transfer the data type
results <- data.frame( matrix(sapply( unlist( output ), function(x) unlist(strsplit(x,split=" ") )), nc

colnames(results) <- c("date", "time", "language", "webpage", "number of hits", "page size")
head(results)
class(results)
print(dim(results))
proc.time()
write.table(results, file='/global/scratch/esther730/results_ob.csv',sep = ",",row.names = FALSE)
```

The following output reveal the processing time of static allocate, which is 17198 that nearly 289 minutes, when running at 4 cores, it will cost nearly 71 minutes.

```
dic <- "C:/Users/Esther/Desktop/stat243-fall-2017-master/section/s07/ps6q4st.out"
output <- readLines(dic)
tail(output, 25)

##  [1] "1
##  [2] "2 Special:AllPages/I_ran_Project_Vote_voter_registration_drive_in_Illinois,_ACORN_was_smack_da
##  [3] "3
##  [4] "4
##  [5] "5
##  [6] "6
##  [7] "  number of hits page size"
##  [8] "1             86   2032215"
##  [9] "2              2     25520"
## [10] "3              1      7825"
## [11] "4             16    760462"
## [12] "5              4     55875"
## [13] "6              1     20922"
## [14] "> class(results)"
## [15] "[1] \"data.frame\""
## [16] "> print(dim(results))"
## [17] "[1] 433895      6"
## [18] "> proc.time()"
## [19] "    user   system  elapsed "
## [20] "16643.04   343.28 17197.31 "
## [21] "> write.table(results, file='/global/scratch/esther730/results_ob.csv',sep = \",\",row.names =
## [22] "> "
## [23] "> proc.time()"
## [24] "     user    system   elapsed "
## [25] "16643.653   343.314 17197.955 "
```

```
#dynamic allocate
library(foreach)
require(parallel)
require(doParallel)
nCores <- as.integer(Sys.getenv("SLURM_CPUS_ON_NODE"))
registerDoParallel(nCores)
library(stringr)


single <- function(filename){
  data <- readLines(filename)
  library(stringr)
  out <- data[str_detect(data,'Barack_Obama')]
  return(out) }


n <- 960
#nsub <- 10
result <- foreach(
  i = 1:n,
  .packages = c("stringr"),
  .combine = c,
  .verbose = TRUE) %dopar% {
    filename <- paste("/global/scratch/paciorek/wikistats_full/dated_for_R/part-", str_pad(i-1, width=5
    outputs <- mclapply(filename,single, mc.preschedule=FALSE) #false for dynamic
    #outputs
  }
#transfer result into dataframe
results <- data.frame (matrix(sapply(list(result),function(x) unlist(strsplit(x,split=" ") ) ), ncol=6,
#results <- data.frame ( t(sapply(result,function(x) unlist(strsplit(x,split=" ")) ) ))
colnames(results) <- c("date", "time", "language", "webpage", "number of hits", "page size")
head(results)
class(results)
print(dim(results))
proc.time()
```

The dynamic allocate used 22585 seconds(377minutes) to grep the strings among 960 files. When running on four nodes, it will cost about 94 minutes to obtain the results.

```
dic <- "C:/Users/Esther/Desktop/stat243-fall-2017-master/section/s07/ps6q4dy.out"
output <- readLines(dic)
tail(output, 25)

##  [1] "1
##  [2] "2 Special:AllPages/I_ran_Project_Vote_voter_registration_drive_in_Illinois,_ACORN_was_smack_da
##  [3] "3
##  [4] "4
##  [5] "5
##  [6] "6
##  [7] "  number of hits page size"
##  [8] "1             86   2032215"
##  [9] "2              2     25520"
## [10] "3              1      7825"
## [11] "4             16    760462"
## [12] "5              4     55875"
## [13] "6              1     20922"
## [14] "> class(results)"
## [15] "[1] \"data.frame\""
## [16] "> print(dim(results))"
## [17] "[1] 433895      6"
## [18] "> proc.time()"
## [19] "    user   system  elapsed "
## [20] "43138.56  1849.43 22584.29 "
## [21] "> #write.table(results, file='/global/scratch/esther730/results_ob.csv',sep = \",\",row.names
## [22] "> "
## [23] "> proc.time()"
## [24] "    user   system  elapsed "
## [25] "43138.56  1849.43 22584.30 "
```

Dynamic allocation is better when iterations may take very different amounts of time. However, in this case, the data size for each file in quite similar, so it would better to use static allocation which evenly divide loop iteration space into n chunks. Hence, generally, static allocation is better method than dynamic way in this case.

5 Q5

5.1 (a)

(calculation attach as hand written version)
The cholesky will do $\frac{n^3}{6} + \frac{n^2}{2} - \frac{2n}{3}$ times operations.

5.2 (b)

Yes, we can overwrite the original matrix.
By the formla of cholesky decomposition, first, the a11, which means the first element in the matrix, would onl be used after the square root of it. Hence, it's fine to overwrite it.

Second, the first row will be calcuate dividing each element to u11, which is the first element of cholesky matrix we obtained by square root of a11. Hence. According to the step 3 of the fomula that begin to calucate the diagonal by row, and we found that only the elements after calculation will be used to obtain uii and uij(where i is smaller than j). Therefore, it's safe to overwrite the first row.

From the fomula, we can found that when calcuate uii and uij, what we need is the corresponding elements from original matrix and the transfer elements from the former rows. Hence, we won't used any corresponding elements of the former rows from the original matrix. Hence, we can overwritten the original matrix by row to each elements.