Bayesian Econometrics: Homework 1

Jerin Varghese

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Problem 1

Download and install R and R-Studio from https://cran.r-project.org and https://www.rstudio.com/products/rstudio/download/

Problem 2

Use R to calculate the following:

1. Create a vector called x containing the number 2 5 8 12 16

```
x <- c(2,5,8,12,16)
```

2. Create a vector called y containing the number from 5 to 9

```
y <- c(5:9)
```

3. Calculate z = x-y

```
z <- x-y
```

```
## [1] -3 -1  1  4  7
```

Problem 3

1. Create a vector x of 100 values starting at 2 and increasing by 3 each time

```
x <- seq(from=2,by=3,length.out=100)
```

2. Extract the values at positions 5,10,15 and 20 in the vector of values from x

```
x[seq(5,20,5)]
```

```
## [1] 14 29 44 59
```

3. Extract the values at positions 10 to 20.

```
x[10:20]
```

```
##  [1] 29 32 35 38 41 44 47 50 53 56 59
```

4. Create 25 by 4 matrix x3 from x (first 4 elements go to the first row, next 4 elements go to 2nd row, etc.)

```
x3 <- matrix(data=x, nrow=25, ncol=4)
```

5. Create 25 by 2 matrix from 2nd and 3rd column of matrix x3.

```
matrix(data=x3[,2:3], nrow=25, ncol=2)
```

```
##       [,1] [,2]
##  [1,]   77  152
##  [2,]   80  155
##  [3,]   83  158
##  [4,]   86  161
##  [5,]   89  164
##  [6,]   92  167
##  [7,]   95  170
##  [8,]   98  173
##  [9,]  101  176
## [10,]  104  179
## [11,]  107  182
## [12,]  110  185
## [13,]  113  188
## [14,]  116  191
## [15,]  119  194
## [16,]  122  197
## [17,]  125  200
## [18,]  128  203
## [19,]  131  206
## [20,]  134  209
## [21,]  137  212
## [22,]  140  215
## [23,]  143  218
## [24,]  146  221
## [25,]  149  224
```

Problem 4

1. Save a tap delimited file, called sample file.txt in a directory and set your working directory to where your data is stored. Then read the file into a new structure using read.delim command and check (print) the row 11.

```
working_dir <- "C:/Users/jerin/OneDrive/Documents/JHU/Bayesian Econometrics/Homeworks"
setwd(working_dir)
sample_file <- read.delim('sample_file.txt')
sample_file[11,]
```

```
##    Sample Length Category
## 11   x_11     80        C
```

2. Calculate the mean of the column named Length.

```r
mean(sample_file$Length)
```

```
## [1] 73.325
```

3. Find out how many rows in sample file have a Length which is < 65.

```r
nrow(sample_file[sample_file$Length > 65,])
```

```
## [1] 24
```

4. Print the values of Length less than 65.

```r
sample_file[sample_file$Length > 65,"Length"]
```

```
##  [1]  82  81  96  85  96  80  98  78 100  79  84  68  99  98  83  81  69
## [18]  72  87  84  80  68  95  93
```

Problem 5.

1. Generate a sequence of x variable from 0 to 10 by 0.5 increment.

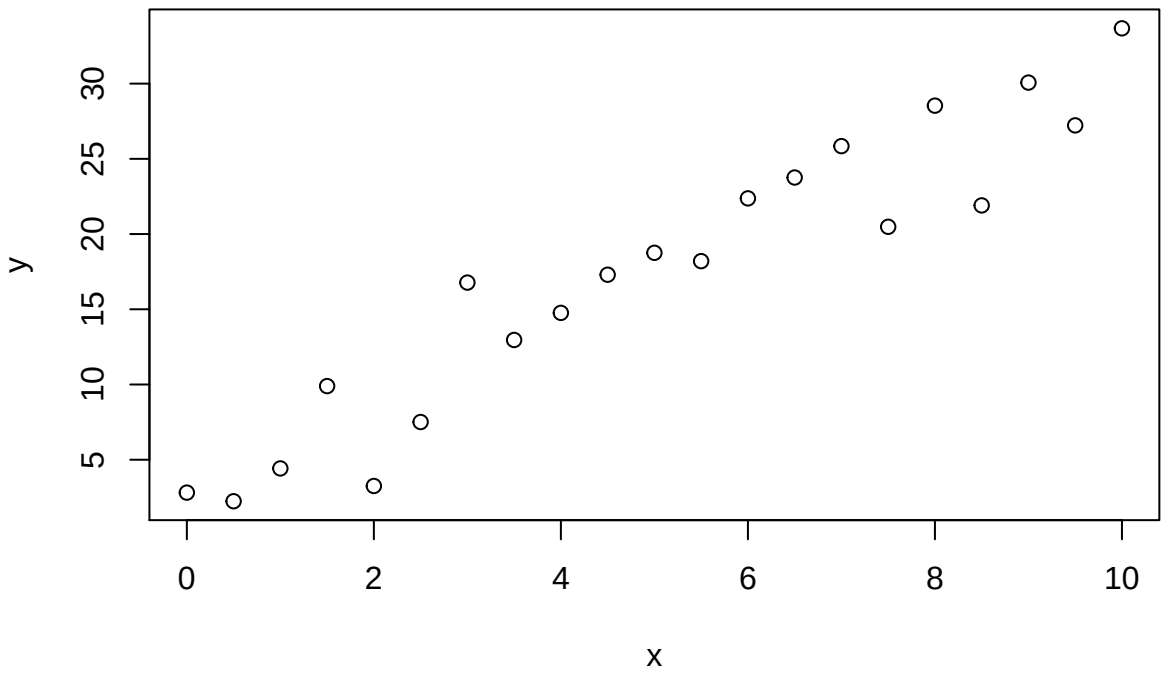
```r
x <- seq(0, 10, 0.5)
```

2. Generate yi = 2 + 3*xi + ei where ei ~ i.i.d.N(0, 3^2).

```r
y <- 2 + 3*x + rnorm(length(x),mean=0,sd=3)
```

3. Plot x and y.

```r
plot(x,y)
```

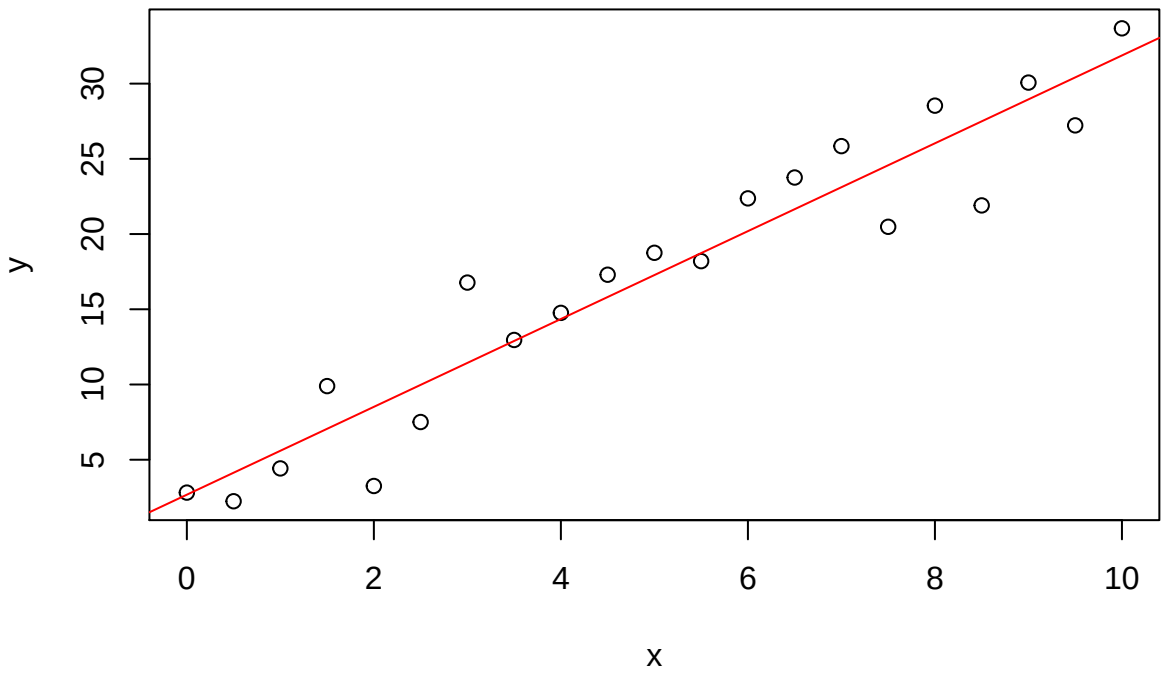


4. Fit a linear regression model for y on x using command lm

```
lm.fit <- lm(y~x)
```

5. Draw the fitted regression line.

```
plot(x,y) + abline(lm.fit, col="red")
```




```
## integer(0)
```

Problem 6.

1. Draw a sample of 100 observations from gamma distribution with shape parameter =1 and rate parameter=4.

```
set.seed(42)
gsample <- rgamma(100, shape=1, rate=4)
```

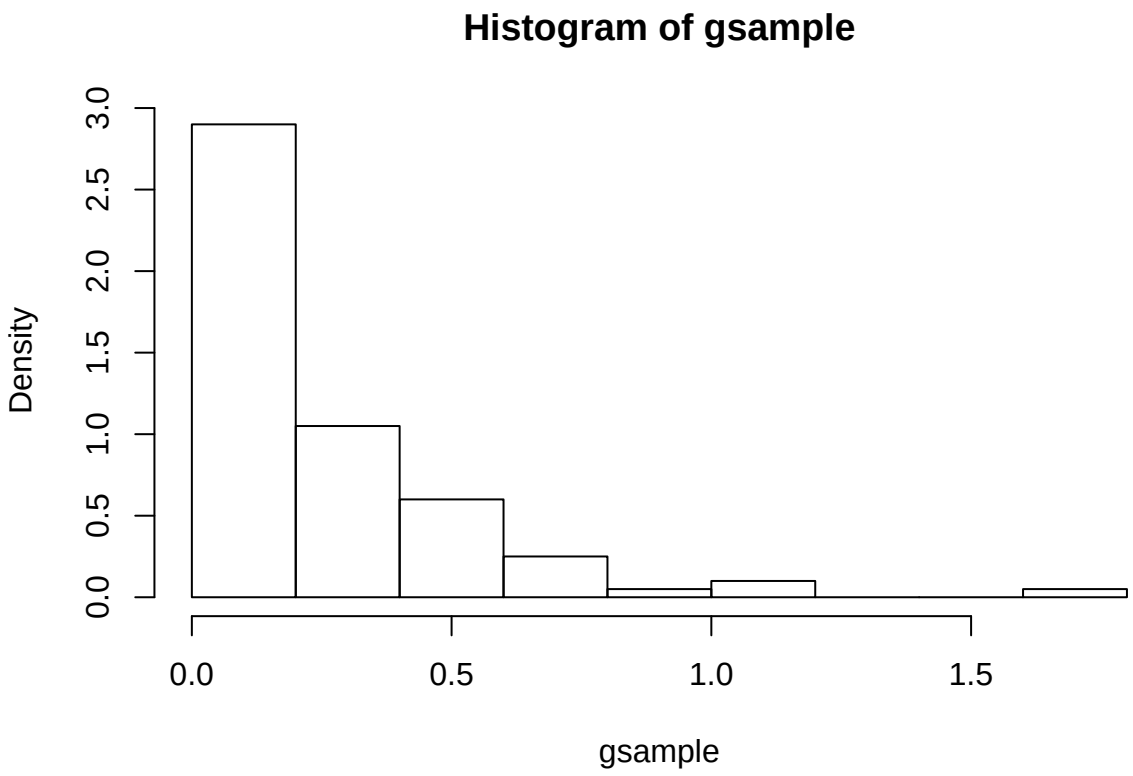
2. calculate the mean and compare with the theoretical mean.

```
# sample mean is .246, which is very close to theoretical mean of 1/4
mean(gsample)
```

```
## [1] 0.2460118
```

3. Draw histogram and density of the sample

```
hist(gsample, prob=TRUE)
```



Problem 7

Generate 1000 observations of an AR process and draw graphs:

1. generate a standard normal random variable for the initial value x1.

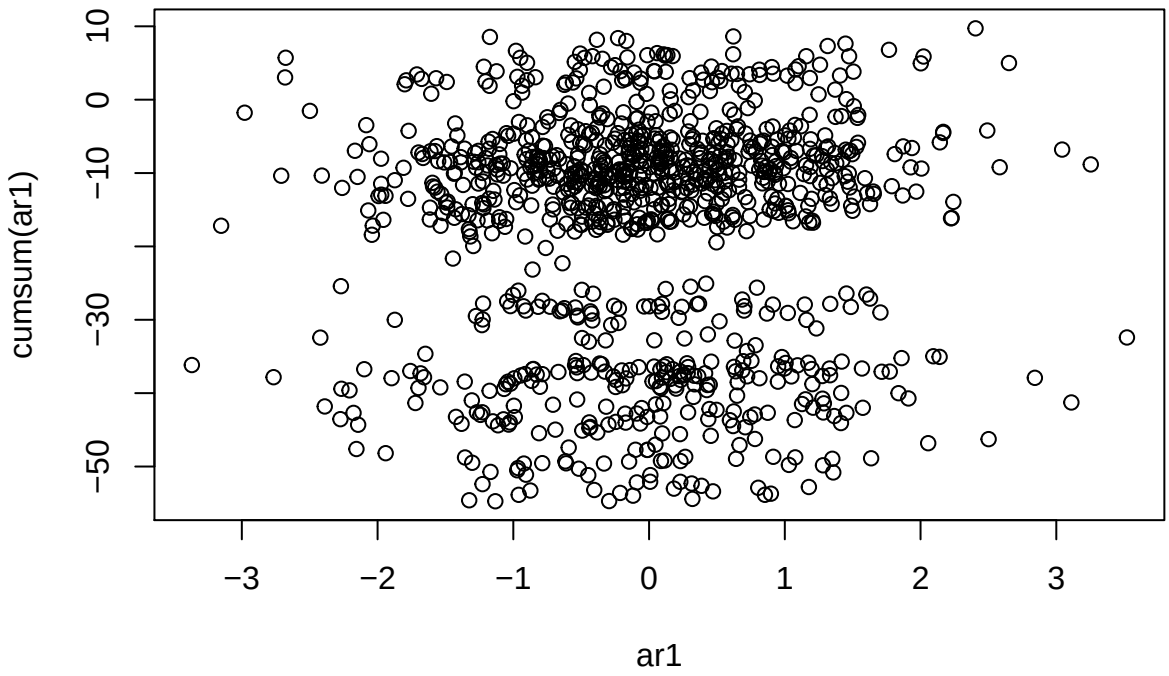
```
set.seed(42)
n <- 1000
white_noise <- rnorm(n)
# initialize first value
ar1 <- c(white_noise[1])
```

2. for xi from i=2 to 1000, xi = .09*x[i-1] + ei where ei ~ i.i.d.N(0, 1)

```
for (i in 2:n){
  ar1[i] <- .09*ar1[i-1] + white_noise[i]
}
```

3. plot x and cumulative sum of x (use command cusum) over i

```
plot(ar1, cumsum(ar1))
```


cumsum(ar1)
10
0
−10
−30
−50
−3
−2
−1
0
1
2
3
ar1