Final

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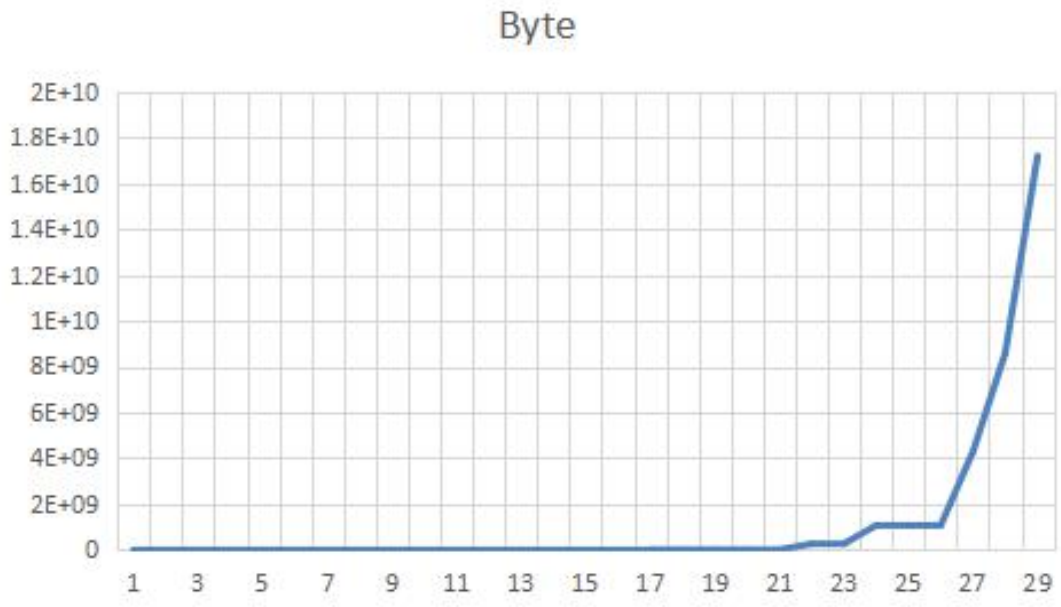
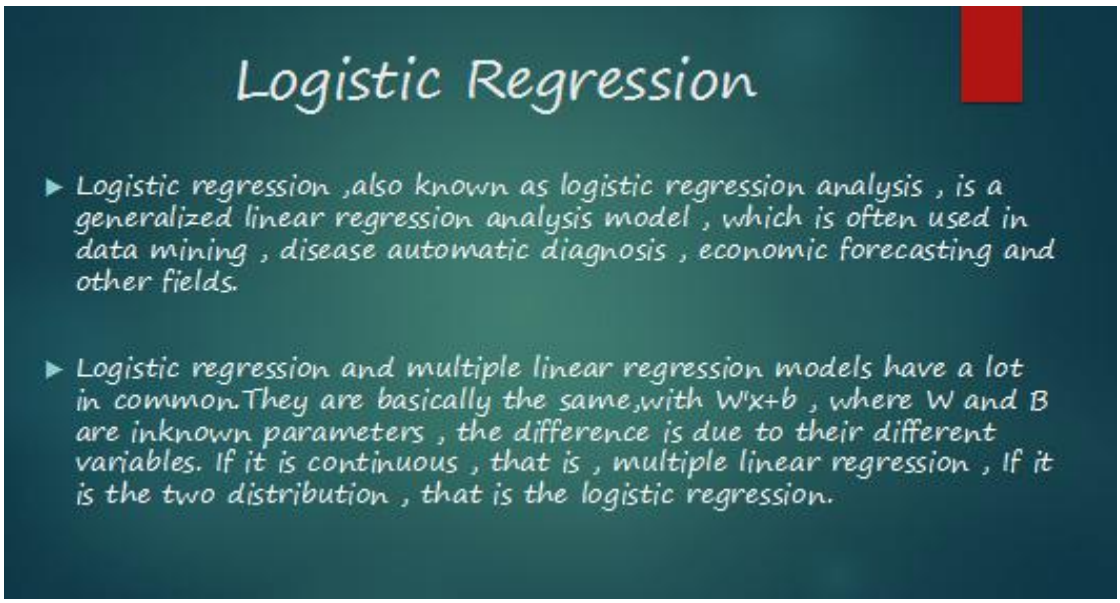
HW Unit 1

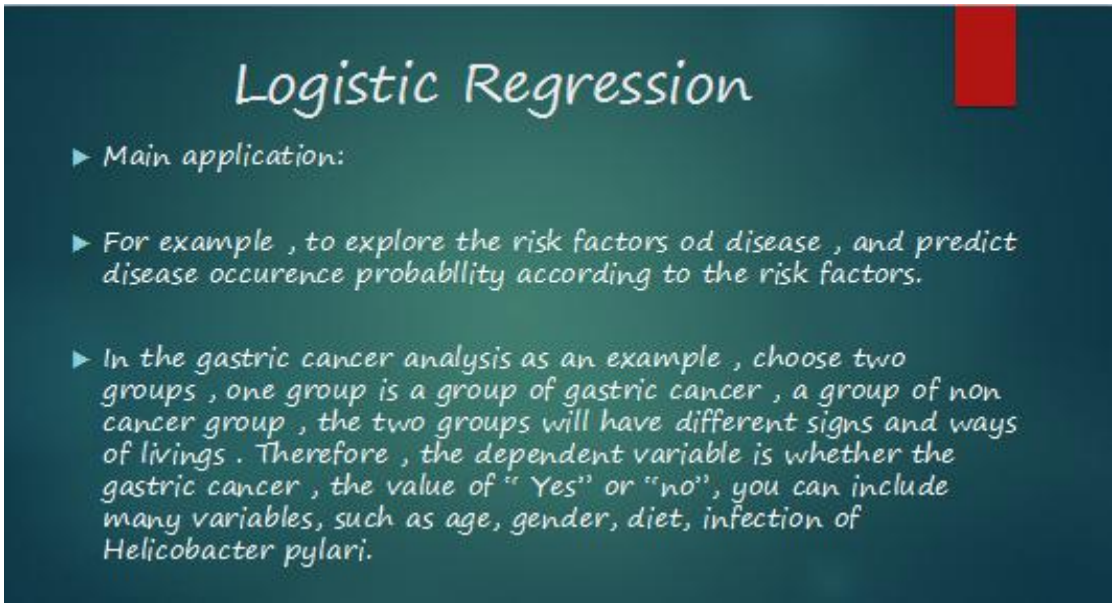
Q1 Calculate the increase of memory of PCs over the last 30 years and check whether the FMRI analysis could have been done 20 years .

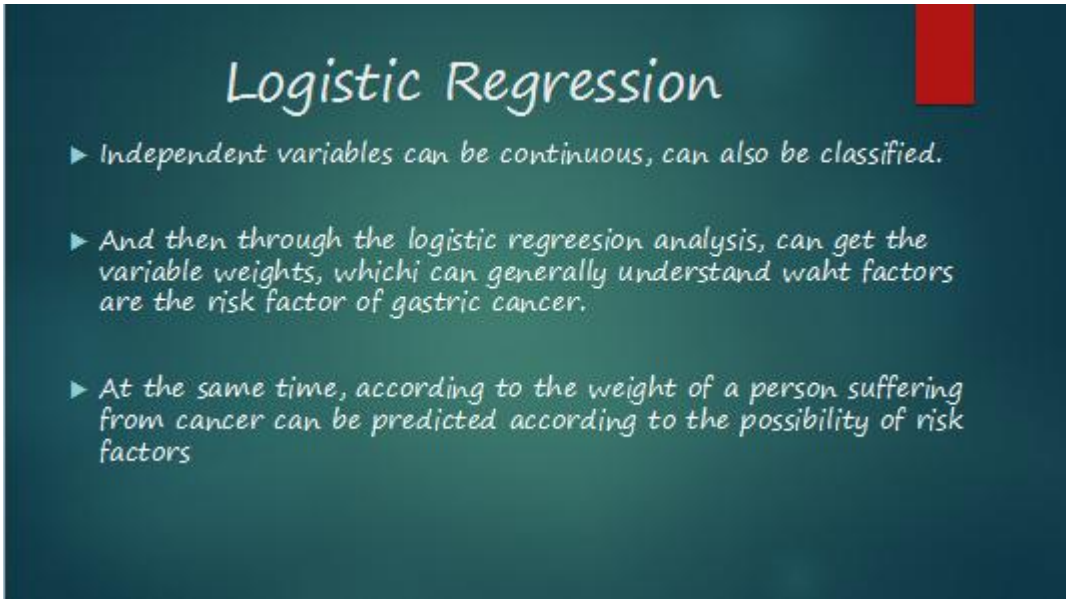
The Trend of Storage					
Year	Byte	Year	Byte	Year	Byte
1970	262144	1980	262144	1995	16777216
1971	262144	1981	262144	1996	268435456
1972	262144	1982	262144	1997	268435456
1973	262144	1988	2097152	1998	1073741824
1974	262144	1989	2097152	1999	1073741825
1975	262144	1990	2097152	2000	1073741826
1976	262144	1991	16777216	2004	4294967296
1977	262144	1992	16777216	2009	8589934592
1978	262144	1993	16777216	2014	17179869184
1979	262144	1994	16777216		



Q2 prepare 2-5 slides explaining logistic regression.







Q3. I have done it and my account is LuYao294.

HW Unit 2

Q1

R code:

```
setwd("C:/Users/Administrator/Desktop")
read.csv("data.csv")
plot(Year,RAM,type ="o",col="red",main = "RAM of computer")
```

Q2

```
splines.reg.l1 = smooth.spline(x,y, spar = 0.2)  # lambda = 0.2
splines.reg.l2 = smooth.spline(x,y, spar = 1)  # lambda = 1
splines.reg.l3 = smooth.spline(x,y, spar = 2)  # lambda = 2

# plot for the regression results
lines(splines.reg.l1, col = "red", lwd = 2)  # regression line with lambda
= 0.2
lines(splines.reg.l2, col = "green", lwd = 2)  # regression line with
lambda = 1
lines(splines.reg.l3, col = "blue", lwd = 2)  # regression line with lambda
= 2
```

Q3

```
> x=3
> lambda=2
> dpois(x,lambda)
[1] 0.180447
> x=0
> lambda=5
> dpois(x,lambda)
[1] 0.006737947
```

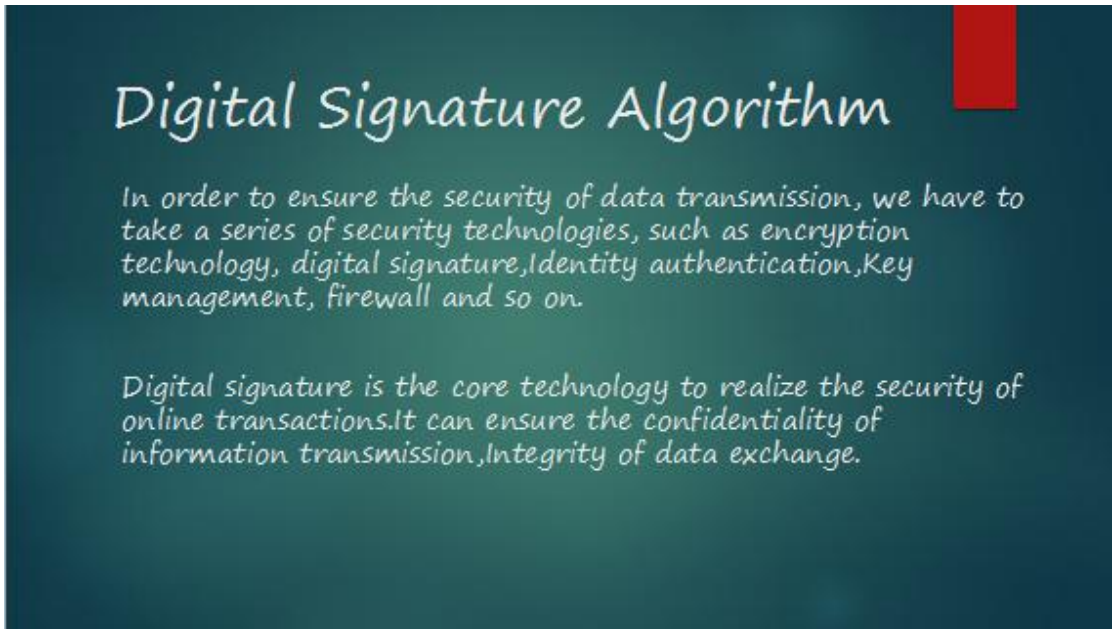
HW Unit 3

Q1

R code:

```
install.packages("digest")
library("digest")
digest("I learn a lot from this class when I am proper listening to the professor", "sha256")
[1]
"c16700de5a5c1961e279135f2be7dcf9c187cb6b21ac8032308c715e1ce9964c"
digest("I do not learn a lot from this class when I am absent and playing on my Iphone", "sha256")
"2533d529768409d1c09d50451d9125fdbaa6e5fd4efdeb45c04e3c68bcb3a63e
```

Q2 Make 3-5 slides (in PPTX) on the DSA (Digital Signature Algorithms)



Digital Signature Algorithm

DSA is another public key algorithm,which is a more advanced way of validation, it can not be used as encryption, only for digital signature .

The digital signature, can perform these functions: (1) to confirm the information is sent by the signer; (2) to confirm the information from the signature to receive so far, has not been altered; the signer cannot deny that information is sent by myself.

Digital Signature Algorithm

DSA uses a public key to verify the integrity of the data and the identity of the sender for the recipient.

It can also be used by the third party to determine the security of the signature and the authenticity of the data.

Q3

R code:

```
>install.packages("RJSONIO)
>library(rjson)
> bodylength<-c(188,152,201,165)
>bodyfeature<-c("tall","short","very tall","normal" )
> individualfeature<-data.frame(bodylength,bodyfeature)
> data<-as.matrix( individualfeature)
>cat(toJSON(data))
```

Q4

R code:

```
rm(list = ls(all = TRUE))
graphics.off()
# install and load packages #
libraries = c("zoo", "tseries")
lapply(libraries, function(x) if (!(x %in% installed.packages()))
{install.packages(x)})
lapply(libraries, library, quietly = TRUE, character.only = TRUE)

# load dataset #
load(file = "C:Users\Administrator\Desktop/crix.RData")
ret = diff(log(crix))

# d order #
Box.test(ret, type = "Ljung-Box", lag = 20)
# stationary test #
adf.test(ret, alternative = "stationary")
kpss.test(ret, null = "Trend")
par(mfrow = c(1, 2))
# acf plot #
autocorr = acf(ret, lag.max = 20, ylab = "Sample Autocorrelation", main
= NA, lwd = 2, ylim = c(-0.3, 1))

# LB test of linear dependence #
print(cbind(autocorr$lag, autocorr$acf))
Box.test(ret, type = "Ljung-Box", lag = 1, fitdf = 0)
Box.test(autocorr$acf, type = "Ljung-Box")

 # plot of pacf #
autopcorr = pacf(ret, lag.max = 20, ylab = "Sample Partial Autocorrelation",
main = NA, ylim = c(-0.3, 0.3), lwd = 2)
print(cbind(autopcorr$lag, autopcorr$acf))
```

```
# arima model#
par(mfrow = c(1, 1))
auto.arima(ret)
fit1 = arima(ret, order = c(1, 0, 1))
tsdiag(fit1)
Box.test(fit1$residuals, lag = 1)

# aic#
aic = matrix(NA, 6, 6)
for (p in 0:4) {
  for (q in 0:3) {
    a.p.q = arima(ret, order = c(p, 0, q))
    aic.p.q = a.p.q$aic
    aic[p + 1, q + 1] = aic.p.q
  }
}
Aic

# bic
bic = matrix(NA, 6, 6)
for (p in 0:4) {
  for (q in 0:3) {
    b.p.q = arima(ret, order = c(p, 0, q))
    bic.p.q = AIC(b.p.q, k = log(length(ret)))
    bic[p + 1, q + 1] = bic.p.q
  }
}
bic

# select p and q order of ARIMA model
fit4 = arima(ret, order = c(2, 0, 3))
tsdiag(fit4)
Box.test(fit4$residuals, lag = 1)

fitr4 = arima(ret, order = c(2, 1, 3))
tsdiag(fitr4)
Box.test(fitr4$residuals, lag = 1)
# to conclude, 202 is better than 213
fit202 = arima(ret, order = c(2, 0, 2))
tsdiag(fit202)
tsdiag(fit4)
tsdiag(fitr4)
```

```
AIC(fit202, k = log(length(ret)))
AIC(fit4, k = log(length(ret)))
AIC(fitr4, k = log(length(ret)))
fit202$aic
fit4$aic
fitr4$aic

# arima202 predict
fit202 = arima(ret, order = c(2, 0, 2))
crpre = predict(fit202, n.ahead = 30)

dates = seq(as.Date("02/08/2014", format = "%d/%m/%Y"), by = "days",
length = length(ret))

plot(ret, type = "l", xlim = c(0, 644), ylab = "log return", xlab = "days",
    lwd = 1.5)
lines(crpre$pred, col = "red", lwd = 3)
lines(crpre$pred + 2 * crpre$se, col = "red", lty = 3, lwd = 3)
lines(crpre$pred - 2 * crpre$se, col = "red", lty = 3, lwd = 3)
```

HW Unit 4

Q1

```
library(rjson)
json_file = "http://crix.hu-berlin.de/data/crix.json"
json_data = fromJSON(file=json_file)
crix_data_frame <- as.data.frame(json_data)
w=crix_data_frame
dim(w)
n=dim(w)
a=seq(1,n[2],2)
b=seq(2,n[2],2)
data=t(w[1,a])
price=t(w[1,b])


#figure3
ts.plot(price)

#figure4
ret=diff(log(price))
ts.plot(ret)
```

```
#figure5
hist(ret, col = "grey", breaks = 40, freq = FALSE)
lines(density(ret), lwd = 2)
par(mfrow = c(1, 2))
# histogram of returns
hist(ret, col = "grey", breaks = 20, freq = FALSE, ylim = c(0, 25), xlab
= NA)
lines(density(ret), lwd = 2)
mu = mean(ret)
sigma = sd(ret)
x = seq(-4, 4, length = 100)
curve(dnorm(x, mean = mean(ret), sd = sd(ret)), add = TRUE, col = "red",
     lwd = 2)
# qq-plot
qqnorm(ret)
qqline(ret, col = "blue", lwd = 3)

#figure6
library(forecast)
library(tseries)
Acf(ret)
```

Results output:

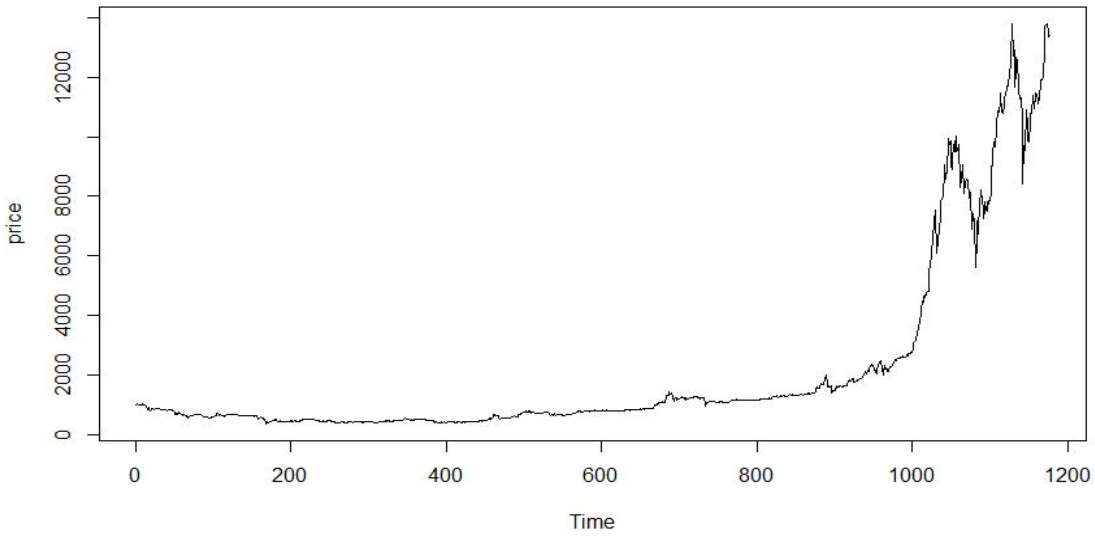


Figure 3

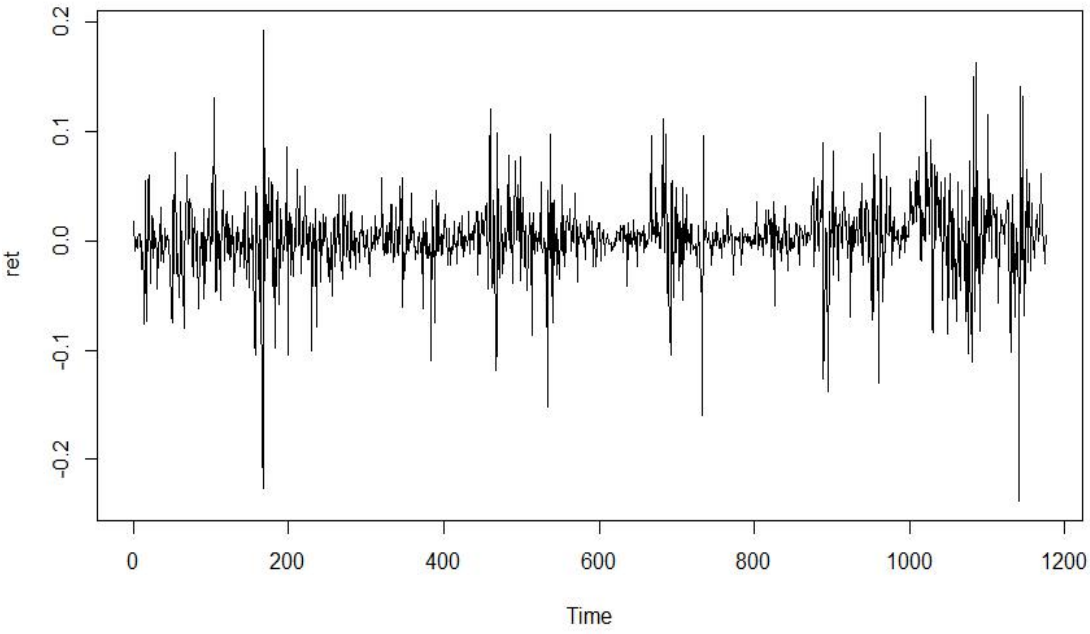
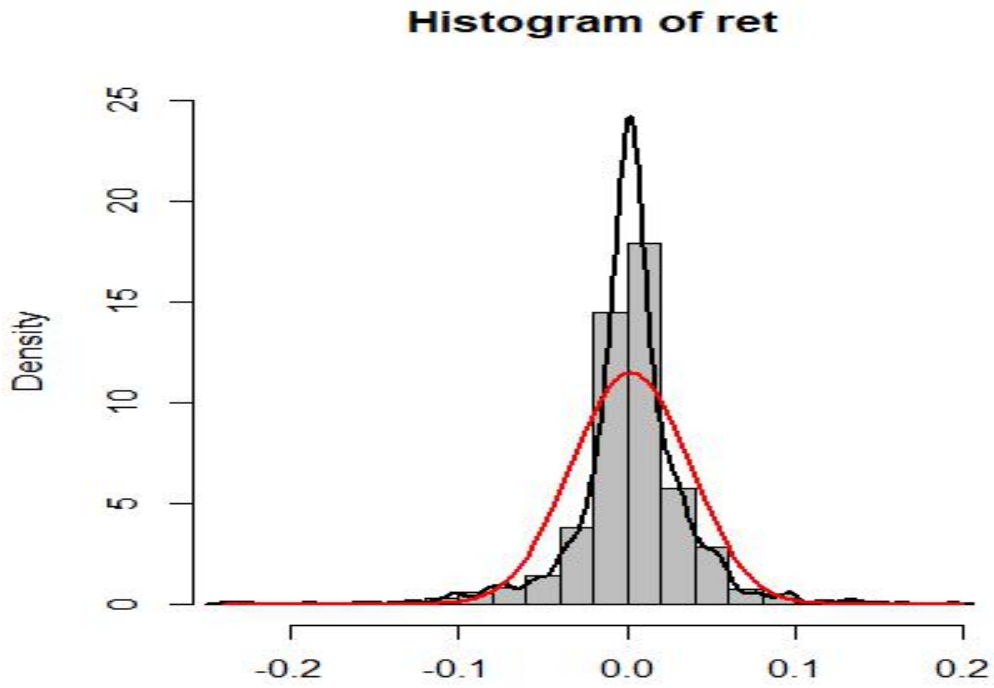

ret
0.2
0.1
0.0
-0.1
-0.2
0
200
400
600
800
1000
1200
Time

Figure 4


Histogram of ret
Density
25
20
15
10
5
0
-0.2
-0.1
0.0
0.1
0.2

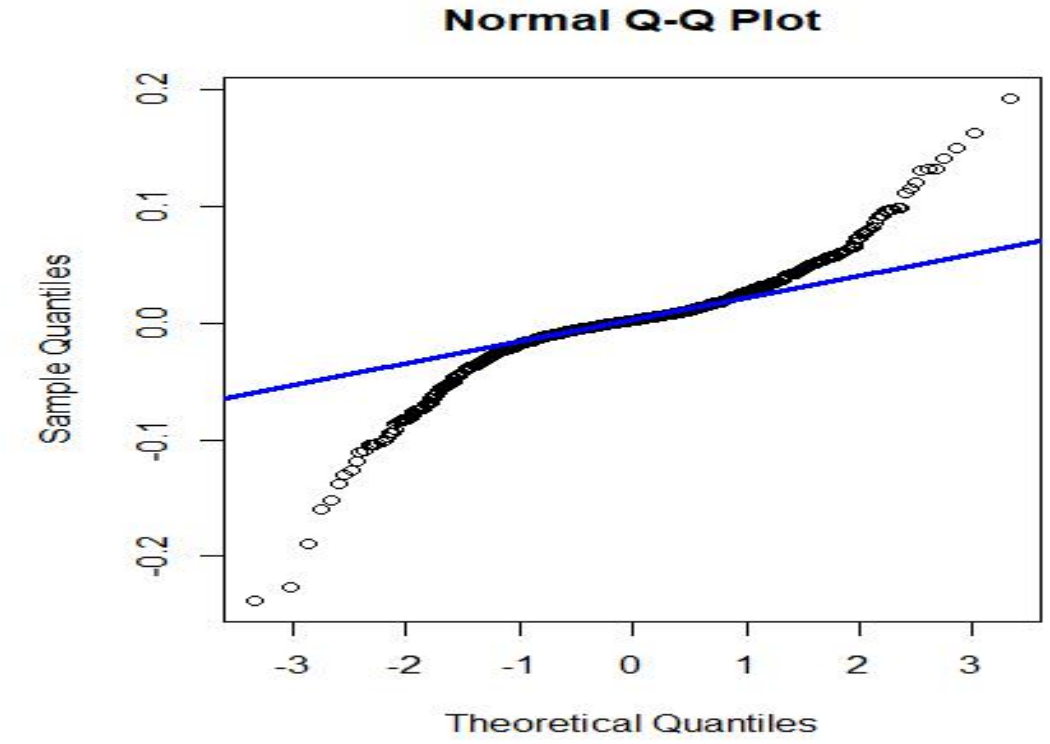


Figure 5

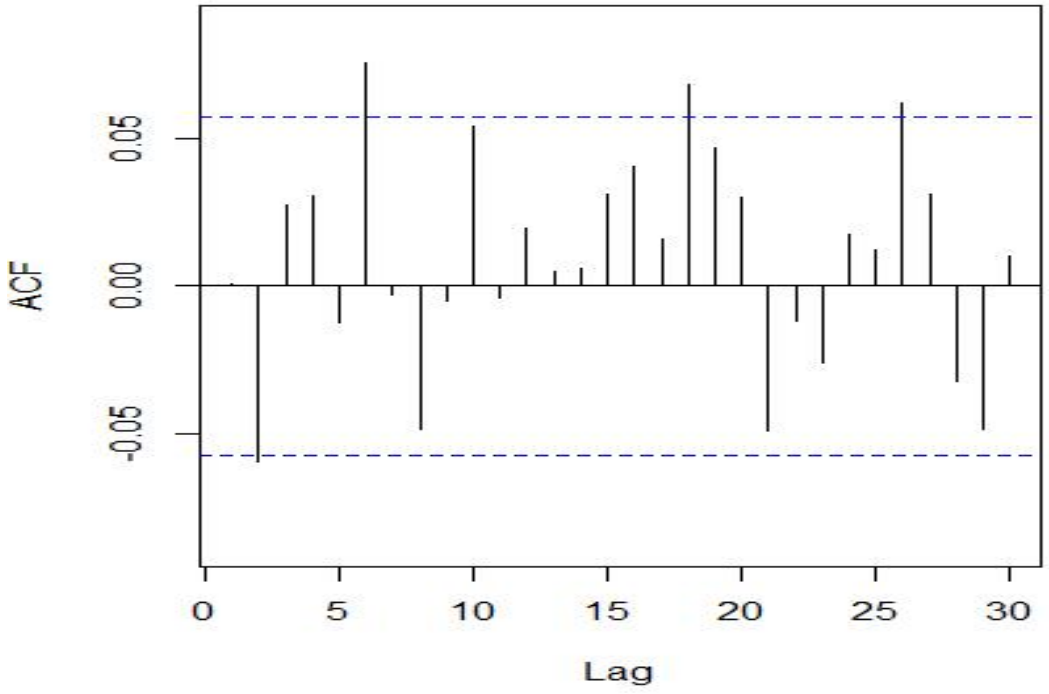


Figure 6

Q2

```
rm(list = ls(all = TRUE))
graphics.off()

# install and load packages
libraries = c("zoo", "tseries")
lapply(libraries, function(x) if (!(x %in% installed.packages())) {
  install.packages(x)
})
lapply(libraries, library, quietly = TRUE, character.only = TRUE)

# d order
Box.test(ret, type = "Ljung-Box", lag = 20)
# stationary test
adf.test(ret, alternative = "stationary")
kpss.test(ret, null = "Trend")
par(mfrow = c(1, 2))
# acf plot
autocorr = acf(ret, lag.max = 20, ylab = "Sample Autocorrelation", main
= NA,
             lwd = 2, ylim = c(-0.3, 1))
# LB test of linear dependence
print(cbind(autocorr$lag, autocorr$acf))
Box.test(ret, type = "Ljung-Box", lag = 1, fitdf = 0)
Box.test(autocorr$acf, type = "Ljung-Box")
# plot of pacf
autopcorr = pacf(ret, lag.max = 20, ylab = "Sample Partial
Autocorrelation",
               main = NA, ylim = c(-0.3, 0.3), lwd = 2)
print(cbind(autopcorr$lag, autopcorr$acf))

# arima model
par(mfrow = c(1, 1))
auto.arima(ret)
fit1 = arima(ret, order = c(1, 0, 1))
tsdiag(fit1)
Box.test(fit1$residuals, lag = 1)

# aic
aic = matrix(NA, 6, 6)
for (p in 0:4) {
  for (q in 0:3) {
```

```
    a.p.q = arima(ret, order = c(p, 0, q))
    aic.p.q = a.p.q$aic
    aic[p + 1, q + 1] = aic.p.q
  }
}
aic

# bic
bic = matrix(NA, 6, 6)
for (p in 0:4) {
  for (q in 0:3) {
    b.p.q = arima(ret, order = c(p, 0, q))
    bic.p.q = AIC(b.p.q, k = log(length(ret)))
    bic[p + 1, q + 1] = bic.p.q
  }
}
bic

# select p and q order of ARIMA model
fit4 = arima(ret, order = c(2, 0, 3))
tsdiag(fit4)
Box.test(fit4$residuals, lag = 1)

fitr4 = arima(ret, order = c(2, 1, 3))
tsdiag(fitr4)
Box.test(fitr4$residuals, lag = 1)

# to conclude, 202 is better than 213
fit202 = arima(ret, order = c(2, 0, 2))
tsdiag(fit202)
tsdiag(fit4)
tsdiag(fitr4)

AIC(fit202, k = log(length(ret)))
AIC(fit4, k = log(length(ret)))
AIC(fitr4, k = log(length(ret)))
fit202$aic
fit4$aic
fitr4$aic

# arima202 predict
fit202 = arima(ret, order = c(2, 0, 2))
crpre = predict(fit202, n.ahead = 30)
```

```
dates = seq(as.Date("02/08/2014", format = "%d/%m/%Y"), by = "days",
length = length(ret))

plot(ret, type = "l", xlim = c(0, 1200), ylab = "log return", xlab = "days",
    lwd = 1.5)
lines(crpre$pred, col = "red", lwd = 3)
lines(crpre$pred + 2 * crpre$se, col = "red", lty = 3, lwd = 3)
lines(crpre$pred - 2 * crpre$se, col = "red", lty = 3, lwd = 3)
```

Results output:

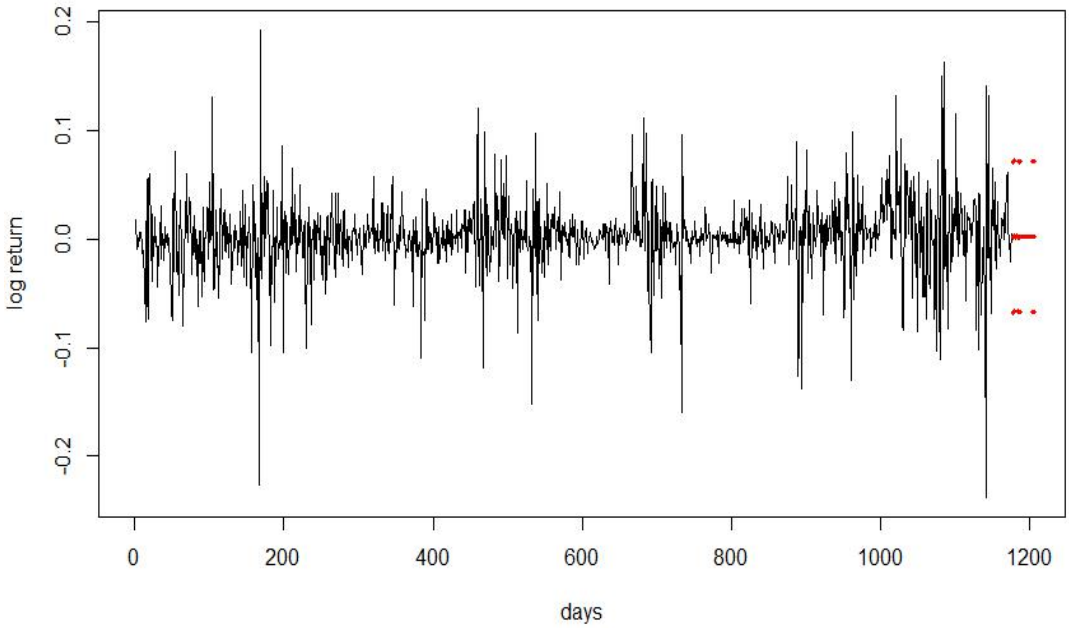


Figure 7

HW Unit 5

Q1.do a word cloud for Shakesspeare’ s dramas. Romeo and Julia, Julius Caesar, Hamlet.

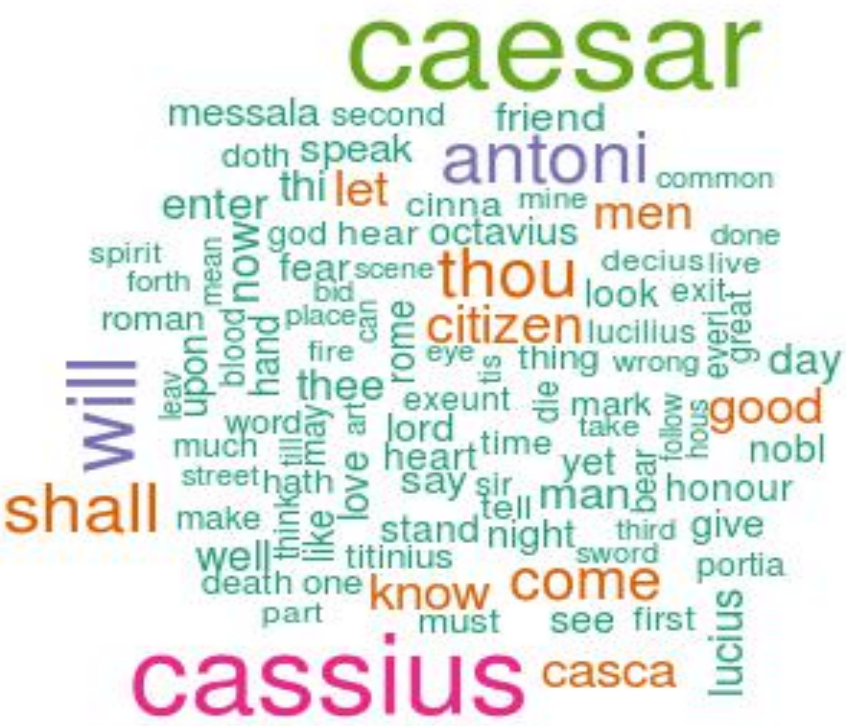
R Code:

```
install.packages("RCurl")
install.packages("XML")
library(RCurl)
library(XML)
url1     = "http://shakespeare.mit.edu/romeo_juliet/full.html"
url2     = "http://shakespeare.mit.edu/julius_caesar/full.html"
url3     = "http://shakespeare.mit.edu/hamlet/full.html"
```

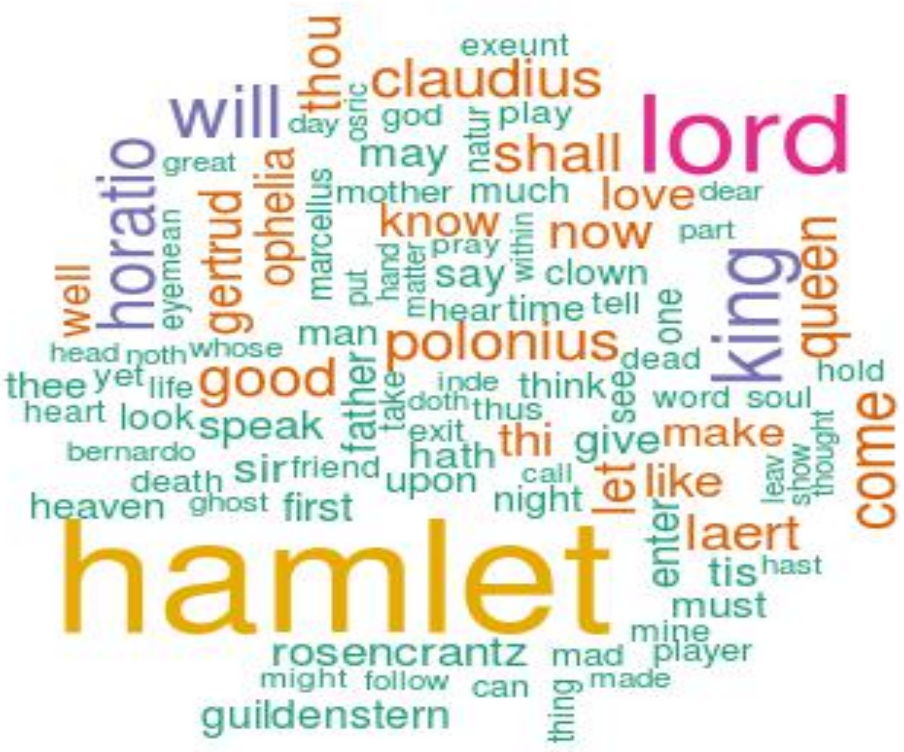
```
html1    = readLines(url1, encoding = "UTF-8")
html2    = readLines(url2, encoding = "UTF-8")
html3    = readLines(url3, encoding = "UTF-8")
html1    = htmlParse(html1, encoding = "UTF-8")
html2    = htmlParse(html2, encoding = "UTF-8")
html3    = htmlParse(html3, encoding = "UTF-8")

install.packages("bitops")
install.packages("stringr")
library(bitops)
library(stringr)
abs1       = lapply(url1, FUN = function(x) htmlParse(x, encoding = "Latin-1"))
abs2       = lapply(url2, FUN = function(x) htmlParse(x, encoding = "Latin-1"))
abs3       = lapply(url3, FUN = function(x) htmlParse(x, encoding = "Latin-1"))
clean_txt = function(x) {
  +    cleantxt = xpathApply(x, "//body//text()
  +                                    [not(ancestor :: script)][ not(ancestor :: style)]
  +                                    [not(ancestor :: noscript)] " ,xmlValue)
  +    cleantxt = paste(cleantxt, collapse="\n")
  +    cleantxt = str_replace_all(cleantxt, "\n", " ")
  +    cleantxt = str_replace_all(cleantxt, "\r", "")
  +    cleantxt = str_replace_all(cleantxt, "\t", "")
  +    cleantxt = str_replace_all(cleantxt, "<br>", "")
  +    return(cleantxt)
  +}
  cleantxt1 = lapply(abs1,clean_txt)
  cleantxt2 = lapply(abs2,clean_txt)
  cleantxt3 = lapply(abs3,clean_txt)
  vec_abs1 = unlist(cleantxt1)
  vec_abs2 = unlist(cleantxt2)
  vec_abs3 = unlist(cleantxt3)

install.packages("tm")
install.packages("SnowballC")
library(tm)
library(SnowballC)
abs1          = Corpus(VectorSource(vec_abs1))
abs2          = Corpus(VectorSource(vec_abs2))
abs3          = Corpus(VectorSource(vec_abs3))
abs_dtm1    = DocumentTermMatrix(abs1, control = list(stemming = TRUE, stopwords
= TRUE, minWordLength = 3,removeNumbers = TRUE, removePunctuation = TRUE))
abs_dtm2    = DocumentTermMatrix(abs2, control = list(stemming = TRUE, stopwords
= TRUE, minWordLength = 3,removeNumbers = TRUE, removePunctuation = TRUE))
abs_dtm3    = DocumentTermMatrix(abs3, control = list(stemming = TRUE, stopwords
```

```
= TRUE, minWordLength = 3,removeNumbers = TRUE, removePunctuation = TRUE))

install.packages("ggplot2")
install.packages("wordcloud")
library(ggplot2)
library(wordcloud)
freq1 = colSums(as.matrix(abs_dtm1))
freq2 = colSums(as.matrix(abs_dtm2))
freq3 = colSums(as.matrix(abs_dtm3))
wf1      = data.frame(word=names(freq1), freq=freq1)
wf2      = data.frame(word=names(freq2), freq=freq2)
wf3      = data.frame(word=names(freq3), freq=freq3)

plot1 = ggplot(subset(wf1, freq>15), aes(word, freq1))
plot1 = plot1 + geom_bar(stat="identity")
plot1 = plot1 + theme(axis.text.x=element_text(angle=45, hjust=1))
plot1
freq1    = colSums(as.matrix(abs_dtm1))
dark2_1 = brewer.pal(6, "Dark2")
wordcloud(names(freq1), freq1, max.words=100, rot.per=0.2, colors=dark2_1)
```

```
plot2 = ggplot(subset(wf2, freq>15), aes(word, freq2))
plot2 = plot2 + geom_bar(stat="identity")
plot2 = plot2 + theme(axis.text.x=element_text(angle=45, hjust=1))
plot2
freq2    = colSums(as.matrix(abs_dtm2))
dark2_2 = brewer.pal(6, "Dark2")
wordcloud(names(freq2), freq2, max.words=100, rot.per=0.2, colors=dark2_2)
```

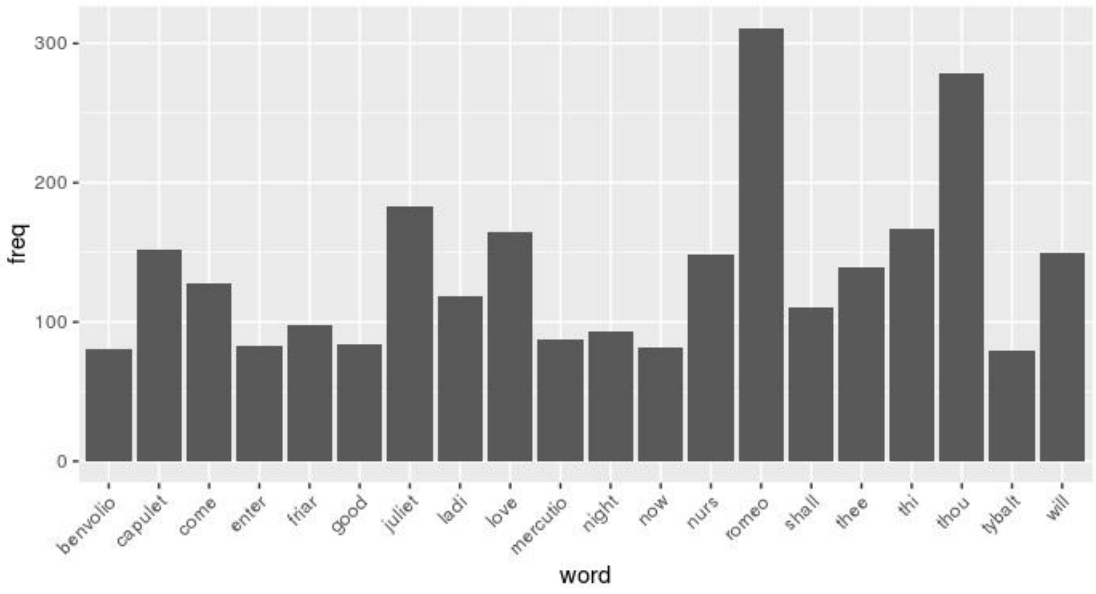


```
plot3 = ggplot(subset(wf3, freq>15), aes(word, freq3))
plot3 = plot3 + geom_bar(stat="identity")
plot3 = plot3 + theme(axis.text.x=element_text(angle=45, hjust=1))
plot3
freq3    = colSums(as.matrix(abs_dtm3))
dark2_3 = brewer.pal(6, "Dark2")
wordcloud(names(freq3), freq3, max.words=100, rot.per=0.2, colors=dark2_3)
```



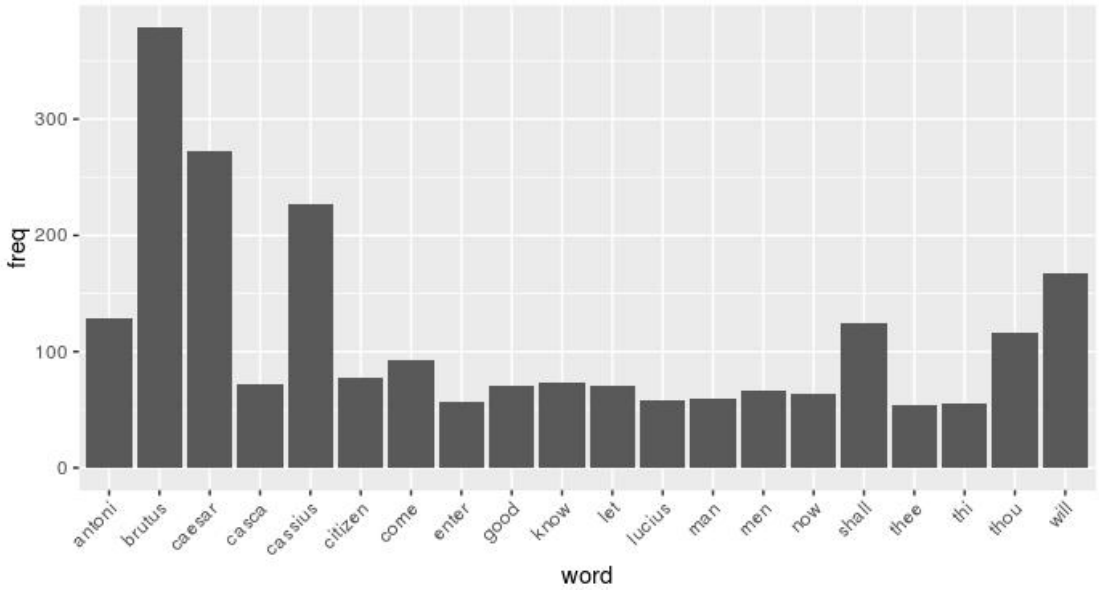
Q2.calculate the histogram of words

```
#Romeo and Juliet
wf1 <- wf1[order(-wf1$freq),]
wf1 <- wf1[c(1:20),]
p1 = ggplot(subset(wf1, freq > 15), aes(word, freq))
p1 = p1 + geom_bar(stat = "identity")
p1 = p1 + theme(axis.text.x = element_text(angle = 45, hjust = 1))
p1
```



#Julius Caeser

```
wf2 <- wf2[order(-wf2$freq),]
wf2 <- wf2[c(1:20),]
p2 = ggplot(subset(wf2, freq > 15), aes(word, freq))
p2 = p2 + geom_bar(stat = "identity")
p2 = p2 + theme(axis.text.x = element_text(angle = 45, hjust = 1))
p2
```



```
#Hamlet
wf3 <- wf3[order(-wf3$freq),]
wf3 <- wf3[c(1:20),]
p3 = ggplot(subset(wf3, freq > 15), aes(word, freq))
p3 = p3 + geom_bar(stat = "identity")
p3 = p3 + theme(axis.text.x = element_text(angle = 45, hjust = 1))
p3
```