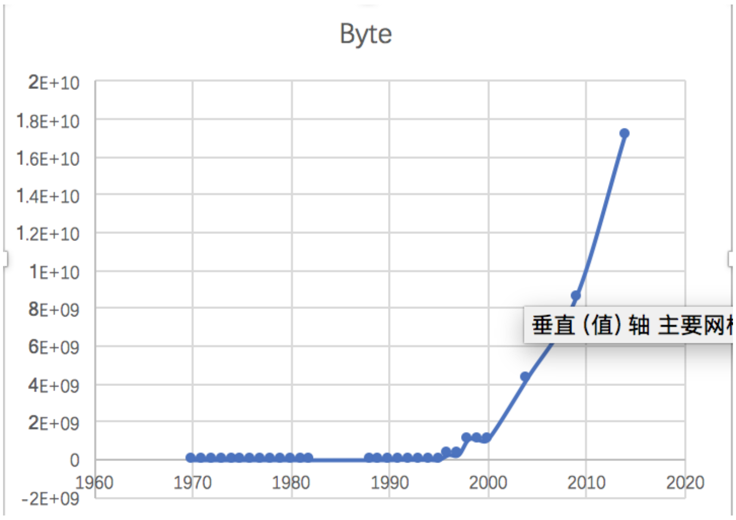
Homework 1

1.

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



2. logistic regression

Logistic regression

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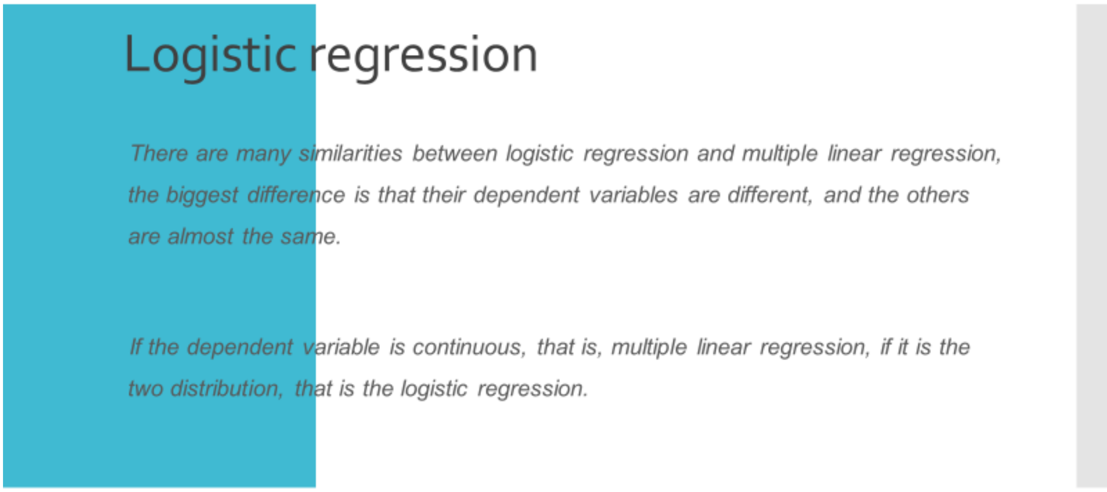
Logistic regression

In statistics, logistic regression, or logit regression, or logit model is a regression model where the dependent variable (DV) is categorical. This article covers the case of a binary dependent variable—that is, where the output can take only two values, "0" and "1", which represent outcomes such as pass/fail, win/lose, alive/dead or healthy/sick. Cases where the dependent variable has more than two outcome categories may be analysed in multinomial logistic regression, or, if the multiple categories are ordered, in ordinal logistic regression.In the terminology of economics, logistic regression is an example of a qualitative response/discrete choice model.

To explore the risk factors of a disease and predict the probability of a disease according to the risk factors. If we have established the logistic regression model, we can predict the probability of a disease or a certain situation under different independent variables according to the model.

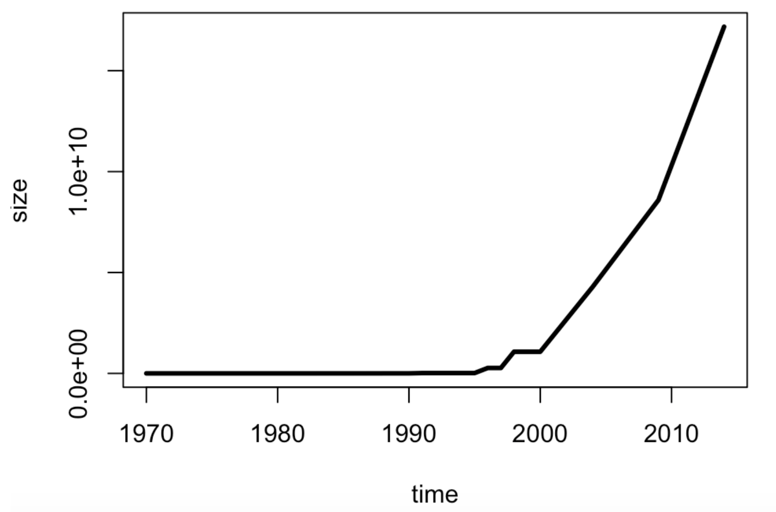


3. **Github Account:** https://github.com/DongyuWang282/Home-Work-for-BDIF

Homework 2

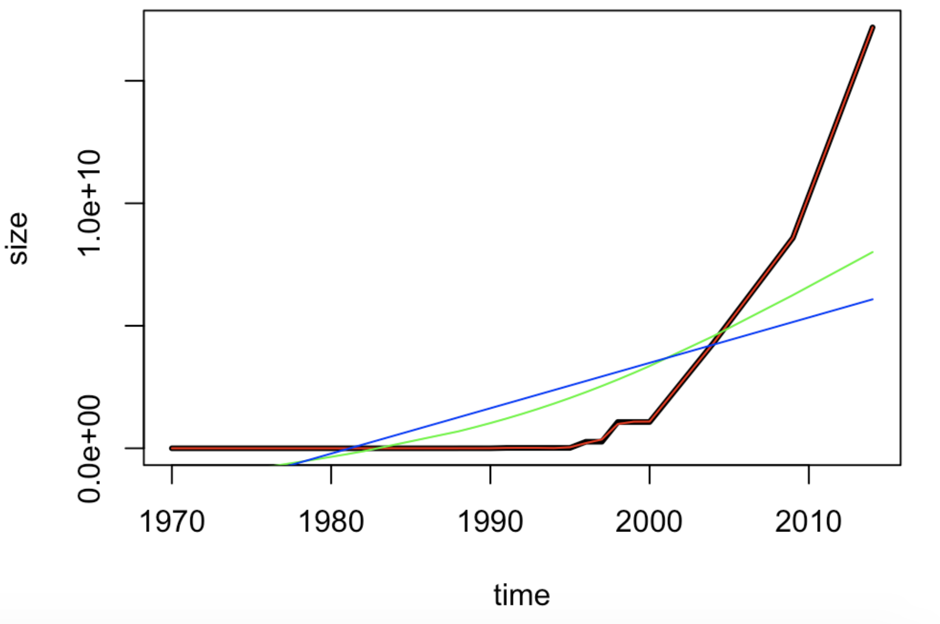
1. **Use R to solve HW #1**

```
library(readr)
RAM_size <- read_csv("~/R data/Home-Work-for-BDIF/RAM_size.csv")
plot(RAM_size,type="l",xlab = "time",ylab = "size",lwd=3)
```



2. **use R with B-spline code to solve HW#1**

splines.reg.l1 = smooth.spline(x = RAM_size$year, y = RAM_size$Byte, spar = 0.2)   # lambda = 0.2
splines.reg.l2 = smooth.spline(x = RAM_size$year, y = RAM_size$Byte, spar = 1)   # lambda = 1
splines.reg.l3 = smooth.spline(x = RAM_size$year, y = RAM_size$Byte, spar = 2)   # lambda = 2
lines(splines.reg.l1, col = "red", lwd = 1)   # regression line with lambda = 0.2
lines(splines.reg.l2, col = "green", lwd = 1)   # regression line with lambda = 1
lines(splines.reg.l3, col = "blue", lwd = 1)   # regression line with lambda = 2



Comments: The larger the spar is, more smooth the line is.

3. **Poisson Distribution**

lambda=4
x=6
dpois(x,lambda)

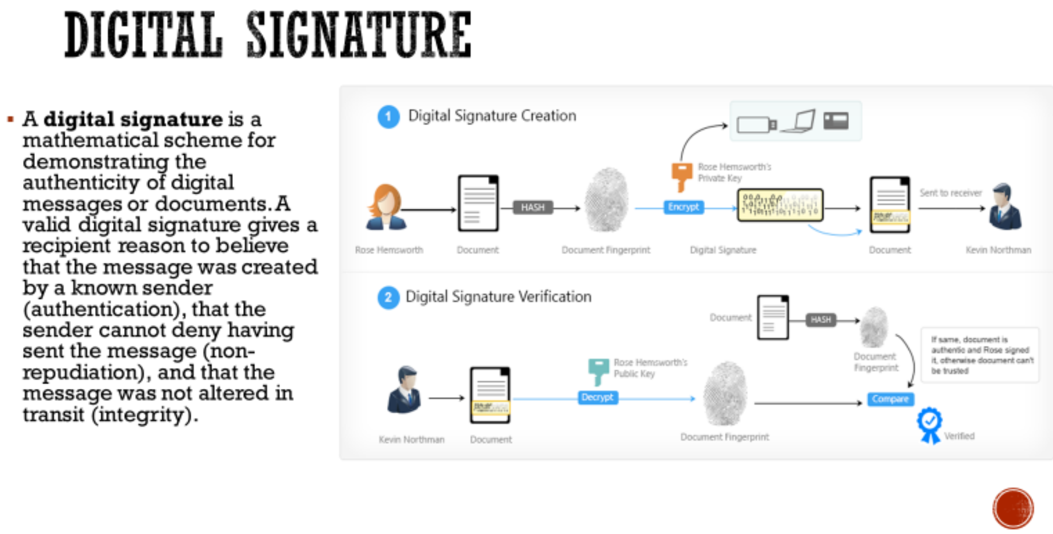
lambda=5
x=0
dpois(x,lambda)

Homework 3

1. **hash code**

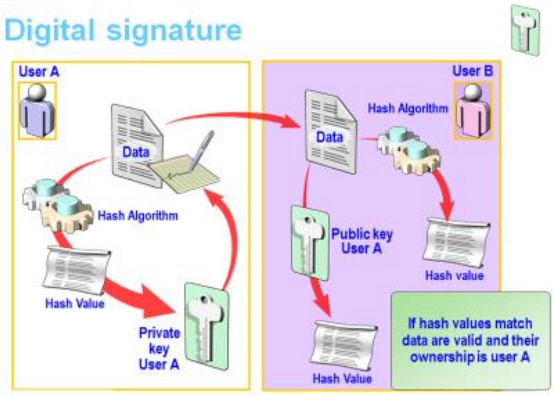
```
#install.packages("digest",repos='http://cran.us.r-projest.org')
library(digest)
digest("I learn a lot from this class when I am proper listening to the professor","sha256")
digest("I do not learn a lot from this class when I am absent and playing on my Iphone","sha256")
```

2. **Digital Signature Algorithms**



DIGITAL SIGNATURE

- Digital signatures are a standard element of most cryptographic protocol suites, and are commonly used for software distribution, financial transactions, contract management software, and in other cases where it is important to detect forgery or tampering.



DSA

- **DSA-Digital Signature Algorithm** is a variant of Schnorr and ElGamal signature algorithms, which is DSS (Digital Signature Standard) by NIST in the United states.
- In a simple way, **DSA** is a more advanced verification method that is used as a digital signature. Not only the public key, the private key, but also the digital signature. Private key encryption generates digital signature, public key authentication data and signature. If the data and signature do not match, the verification failure is considered! The function of digital signature is to check the data and not to be modified in the process of transmission. Digital signature is the upgrade of one-way encryption!

3. Json data

JSON

- Dataframe in R

	year	Byte
1	1970	262144
2	1971	262144
3	1972	262144
4	1973	262144
5	1974	262144
6	1975	262144
7	1976	262144
8	1977	262144
9	1978	262144
10	1979	262144
11	1980	262144
12	1981	262144
13	1982	262144
14	1988	2097152

Json

- library(rjson)
- json_RAM <- toJSON(RAM_size,method = "C")

```
> json_RAM
[1] "{\"year\":[1970,1971,1972,1973,1974,1975,1976,1977,1978,1979,1980,1981,1982,1988,1
989,1990,1991,1992,1993,1994,1995,1996,1997,1998,1999,2000,2004,2009,2014],\"Byte\":[26
2144,262144,262144,262144,262144,262144,262144,262144,262144,262144,262144,262144,26214
4,2097152,2097152,2097152,16777216,16777216,16777216,16777216,16777216,268435456,268435
456,1073741824,1073741824,1073741824,4294967296,8589934592,17179869184]}"
```

4. CRIX data

#install.packages("rjson", repos="http://cran.us.r-project.org")

library(rjson)

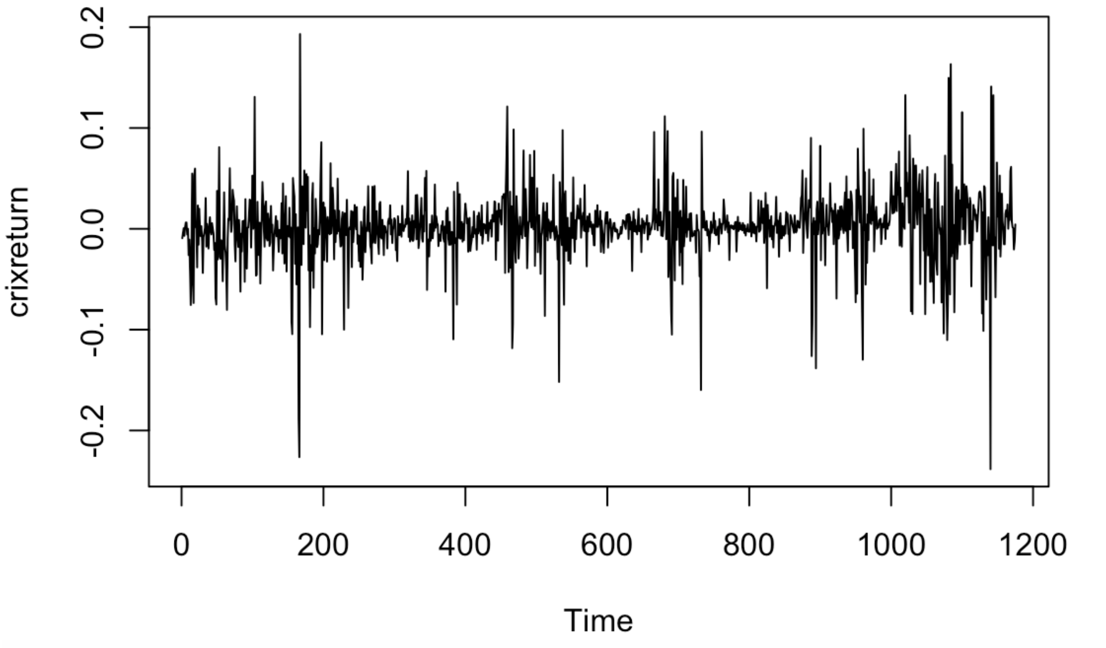
json_file = "http://crix.hu-berlin.de/data/crix.json"

json_data = fromJSON(file=json_file)

```
lst <- lapply(json_data,function(x){
  df<-data.frame(date=x$date,price=x$price)
  return(df)
})
crix_data_frame <- Reduce(rbind,lst)
plot(crix_data_frame$date,crix_data_frame$price)

#install.packages("forecast")
#install.packages("tseries")
library(forecast)
library(tseries)
ts.plot(crix_data_frame$price)
Acf(crix_data_frame$price)

for(i in 1:length(crix_data_frame$price)){
  crixreturn[i] <- log(crix_data_frame$price[i+1]/crix_data_frame$price[i])
}
ts.plot(crixreturn)
Box.test(crixreturn, type = "Ljung-Box", lag = 20)
autocorr = acf(crixreturn, lag.max = 20, ylab = "Sample Autocorrelation", main
= NA, lwd = 2, ylim = c(-0.3, 1))
Acf(crixreturn)
```

Pacf(crixreturn)

arima(crixreturn,order = c(2,0,2))



Homework 4

1. Figure3,4,5,6

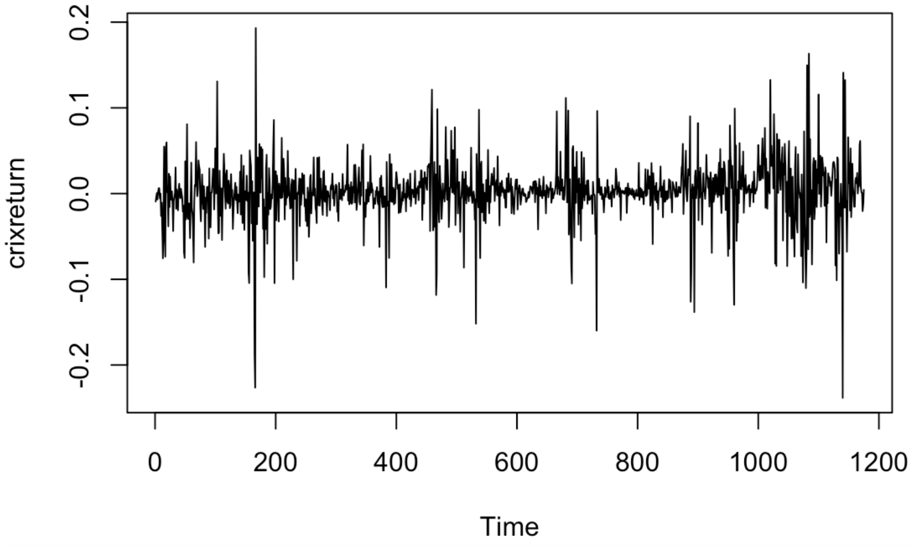
```
#HW4.1

library(rjson)

json_file = "http://crix.hu-berlin.de/data/crix.json"

json_data = fromJSON(file=json_file)

lst <- lapply(json_data,function(x){

  df<-data.frame(date=x$date,price=x$price)

  return(df)

})
```

```
crix_data_frame <- Reduce(rbind,lst)

crix_data_frame <- crix_data_frame[-1,]

load(file = "ecrix.RData")

load(file = "efcrix.RData")

length(ecrix)=length(crix_data_frame$price)

length(efcrix)=length(crix_data_frame$price)

ecrix_data_frame <- as.data.frame(ecrix)

efcrix_data_frame <- as.data.frame(efcrix)

#install.packages("dplyr")

library(dplyr)

sum_crix <- cbind(crix_data_frame,ecrix_data_frame,efcrix_data_frame)

#figure3

ts.plot(sum_crix$price)

lines(sum_crix$price,col="black",lwd=0.5)

lines(sum_crix$ecrix,col="blue",lwd=1)

lines(sum_crix$efcrix,col="red",lwd=1)
```

#figure4

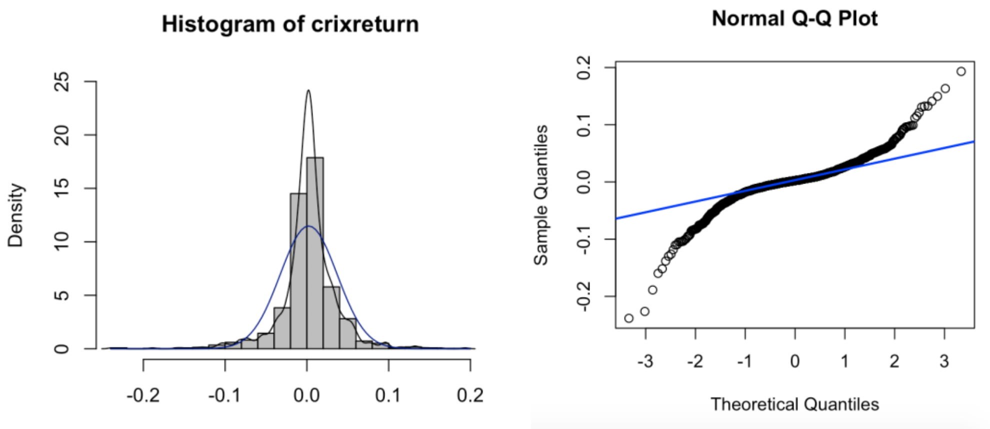
crixreturn <- diff(log(crix_data_frame$price))

ts.plot(crixreturn)



#figure5

```
hist(crixreturn,col = "grey",breaks = 20,freq = FALSE,ylim = c(0,25),xlab = NA)
lines(density(crixreturn),lwd=1)
mu = mean(crixreturn)
sigma = sd(crixreturn)
x = seq(-4, 4, length = 100)
curve(dnorm(x, mean = mean(crixreturn), sd = sd(crixreturn)), add = TRUE, col = "darkblue", lwd = 1)
qqnorm(crixreturn)
qqline(crixreturn, col = "blue", lwd = 2)
```




```
#figure6
Box.test(crixreturn, type = "Ljung-Box", lag = 20)
adf.test(crixreturn, alternative = "stationary")
kpss.test(crixreturn, null = "Trend")
par(mfrow = c(1, 2))
```

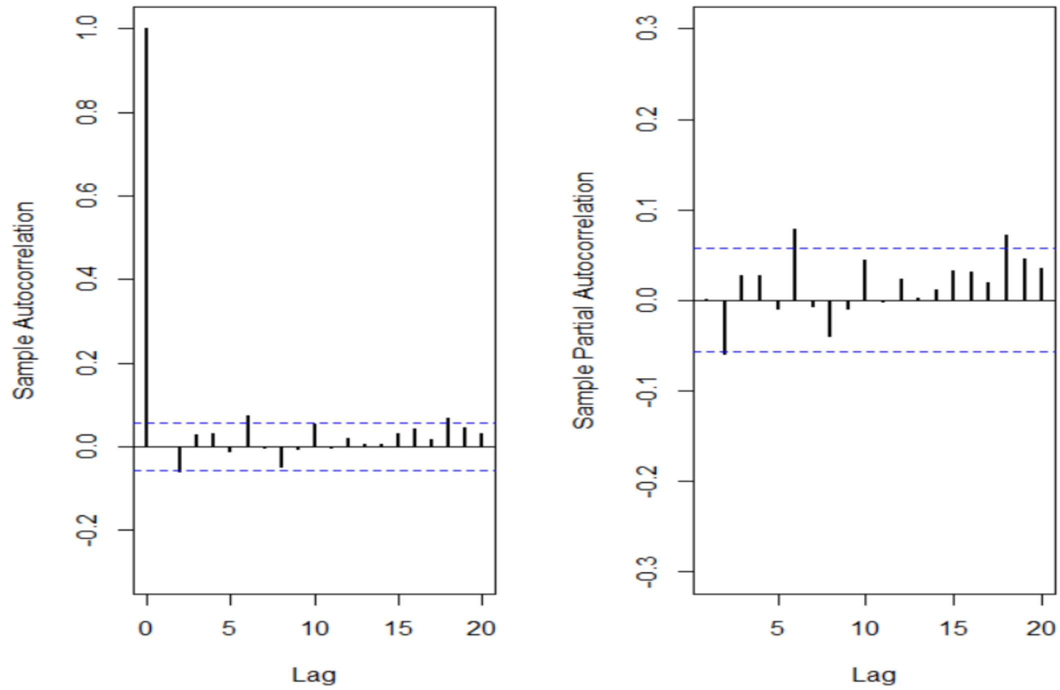
autocorr = acf(crixreturn, lag.max = 20, ylab = "Sample Autocorrelation", main = NA, lwd = 2, ylim = c(-0.3, 1))

print(cbind(autocorr$lag, autocorr$acf))

Box.test(crixreturn, type = "Ljung-Box", lag = 1, fitdf = 0)

Box.test(autocorr$acf, type = "Ljung-Box")

autopcorr = pacf(crixreturn, lag.max = 20, ylab = "Sample Partial Autocorrelation",main = NA, ylim = c(-0.3, 0.3), lwd = 2)



2. Figure 7

par(mfrow = c(1, 1))

auto.arima(crixreturn)

fit1 = arima(crixreturn, order = c(1, 0, 1))

tsdiag(fit1)

```r
Box.test(fit1$residuals, lag = 1)


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


bic = matrix(NA, 6, 6)
for (p in 0:4) {
   for (q in 0:3) {
      b.p.q = arima(crixreturn, order = c(p, 0, q))
      bic.p.q = AIC(b.p.q, k = log(length(crixreturn)))
      bic[p + 1, q + 1] = bic.p.q
   }
}
bic
fit4 = arima(crixreturn, order = c(2, 0, 3))
```

```
tsdiag(fit4)

Box.test(fit4$residuals, lag = 1)

fitr4 = arima(crixreturn, order = c(2, 1, 3))

tsdiag(fitr4)

Box.test(fitr4$residuals, lag = 1)

fit202 = arima(crixreturn, order = c(2, 0, 2))

tsdiag(fit202)

tsdiag(fit4)

tsdiag(fitr4)

AIC(fit202, k = log(length(crixreturn)))

AIC(fit4, k = log(length(crixreturn)))

AIC(fitr4, k = log(length(crixreturn)))

fit202$aic

fit4$aic

fitr4$aic

fit202 = arima(crixreturn, 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(crixreturn))

plot(crixreturn, type = "l", xlim = c(0, 1200), ylab = "log return", xlab =
"days", lwd = 1)

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)
```