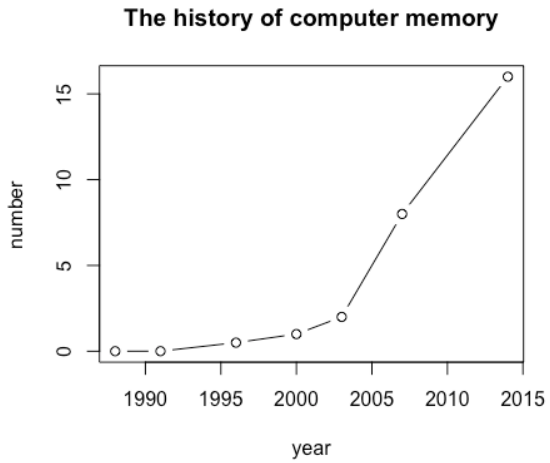
HW1

Memory of PCs over the last 30 years



HW2 Unit

#

```
Library(readxl)
ram <- read_excel("Desktop/ram.xls")
plot(x=ram$Year,y=ram$RAM,xlab="year",ylab="number",type = "b",
        col="black",main = "The history of computer memory")
# B-spline code to solve HW#1
splines.reg.l1 = smooth.spline(x = ram$Year, y = ram$RAM, spar = 1)
lines(splines.reg.l1, col = "red", lwd = 2)
#
 x = 6
 n = 1000
 lambda = 2
 p = lambda / n
 dbinom (x,2*n,p) # binomial probability mass function
 dpois (x, 2*lambda ) # Poisson probability mass function
 dpois (0, 5 )
```

HW3

#

install.packages("digest")

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")

#DSA

#JSON

#

```
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/xiumei/Desktop/big data/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)

# Produces GARCH estimation results using ARIMA model residuals
rm(list = ls(all = TRUE))
graphics.off()
```

```
# install and load packages
libraries = c("FinTS", "tseries", "forecast", "fGarch")
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/xiumei/Desktop/big data/crix.RData")
ret = diff(log(crix1))

# vol cluster
fit202 = arima(ret, order = c(2, 0, 2))
par(mfrow = c(1, 1))
res = fit202$residuals
res2 = fit202$residuals^2

# different garch model
fg11 = garchFit(data = res, data ~ garch(1, 1))
summary(fg11)
fg12 = garchFit(data = res, data ~ garch(1, 2))
summary(fg12)
fg21 = garchFit(data = res, data ~ garch(2, 1))
summary(fg21)
fg22 = garchFit(data = res, data ~ garch(2, 2))
summary(fg22)

# residual plot
reszo = zoo(fg11@residuals, order.by = index(crix1))
plot(reszo, ylab = NA, lwd = 2)

par(mfrow = c(1, 2))
```

```
fg11res2 = fg11@residuals
acfres2    = acf(fg11res2, lag.max = 20, ylab = "Sample Autocorrelation",
                       main = NA, lwd = 2)
pacfres2 = pacf(fg11res2, lag.max = 20, ylab = "Sample Partial Autocorrelation",
                         main = NA, lwd = 2, ylim = c(-0.5, 0.5))

fg12res2 = fg12@residuals
acfres2    = acf(fg12res2, lag.max = 20, ylab = "Sample Autocorrelation",
                       main = NA, lwd = 2)
pacfres2 = pacf(fg12res2, lag.max = 20, ylab = "Sample Partial Autocorrelation",
                         main = NA, lwd = 2, ylim = c(-0.5, 0.5))
# qq plot
par(mfrow = c(1, 1))
plot(fg11, which = 13)    #9,10,11,13
# kp test
set.seed(100)
x = rnorm(200)
# Do x and y come from the same distribution?
ks.test(x, fg11@residuals)
```

Home Unit4

```
#install.packages( “rjson” )
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)
n<-dim(crix_data_frame)
a<-seq(1,n[2],2)
b<-seq(2,n[2],2)
date<-t(crix_data_frame[1,a])
price<-t(crix_data_frame[1,b])
ts.plot(price)
ret<-diff(log(price))
```

```
plot(ret)
ts.plot(ret)

# histogram of returns
hist(ret, freq=equidist,col = "blue", breaks = 20, main=" The histogram of return" , ylim = c(0, 25), xlab = NA)
lines(density(ret), lwd = 1.8)
mu = mean(ret)
sigma = sd(ret)
x = seq(-4, 4, length = 100)
curve(dnorm(x, mean = mean(ret), sd = sd(ret)), add = TRUE, col = "darkblue", lwd = 2)

# qq-plot
qqnorm(ret)
qqline(ret, col = "black", lwd = 3)

# acf plot
autocorr = acf(ret, lag.max = 20, ylab = "Sample Autocorrelation", main = NA,lwd = 2, ylim = c(-0.3, 1))
# plot of pacf
autopcorr = pacf(ret, lag.max = 20, ylab = "Sample Partial Autocorrelation", main = NA, ylim = c(-0.3, 0.3), lwd = 2)

# 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)

# 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)
```