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HW Unit 1:

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

Answer:

Year	RAM /G
1988	0.002
1991	0.004
1996	0.5
2000	1
2003	2
2007	8
2014	16

The FMRI analysis could have been done 20 years ago

1.2 prepare 2-5 slides explaining logistic regression

Answer:

- In statistics, logistic regression, or logit regression, or logit model is a regression model where the dependent variable (DV) is categorical.Cases where the dependent variable has more than two outcome categories may be analysed in multinomial
- In the terminology of economics, logistic regression is an example of a qualitative response/discrete choice model.
- Logistic regression was developed by statistician David Cox in 1958. The binary logistic model is used to estimate the probability of a binary response based on one or more predictor (or independent) variables (features). It allows one to say that the presence of a risk factor increases the odds of a given outcome by a specific factor
- For example, to explore the risk factors for the occurrence of gastric cancer, you can choose two groups of people, one group is gastric cancer group, one group is non-gastric cancer group.
- Here the dependent variable is whether the gastric cancer, that is, "yes" or "no", for the two categories of variables, independent variables can include a lot, such as age, gender, eating habits, Helicobacter pylori infection. The independent

variables can be either continuous or categorical. By logistic regression analysis, you can get a general idea of which factors are risk factors for gastric cancer.

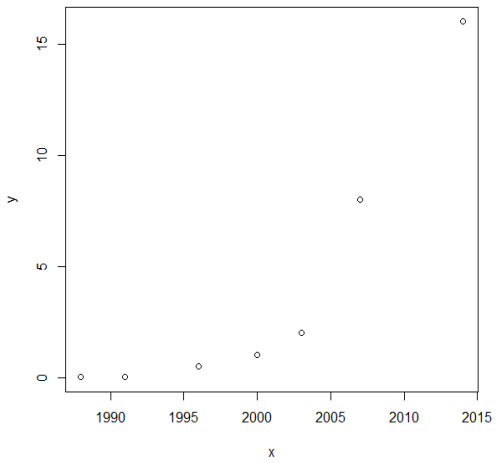
1.3 install R and run simple programs from Quantlet.de, make sure you have a Github(GH) account.

HW Unit 2

2.1 make an R quantlet to solve HW #1 from unit 1 with R and show it on Github (GH). hint: use the CMB Qs for this work

Answer:

```
data<-read.table("file",header=TRUE,sep=",")
x<-data$Year
y<-data$RAM
plot(x,y)
```

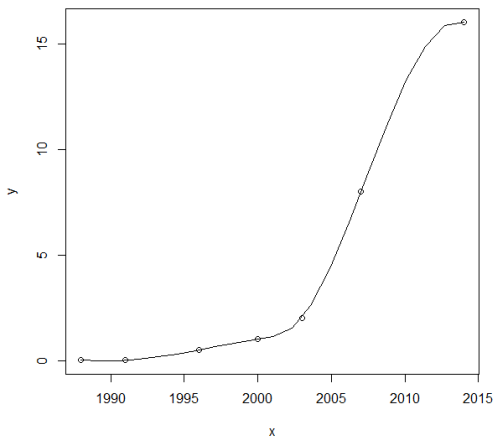


2. 2 use R with B-spline code to solve HW#1, any comments?

Answer:

```
data<-read.table("file",header=TRUE,sep=",")
x<-data$Year
y<-data$RAM
plot(x,y)
lines(spline(x,y))
```

comment: memory of PCs over the last 30 years are increasing, especially in the last 10 years.



2.3 Suppose you observe that in n=1000 mails (in 1 week) you have about 2 scams. Use the LvB /Poisson cdf to calculate that you have 6 scam emails in 2 weeks. In Scammyland you have 5 scams on average, what is the probability to have no scam mail.

Answer:

```
x = 6
n = 1000
lambda = 2
p = lambda / n
dbinom (x,2*n,p) # binomial probability mass function
[1] 0.1042477
dpois (x, 2*lambda ) # Poisson probability mass function
[1] 0.1041956
dpois (0, 5 )
[1] 0.006737947
```

HW Unit 3

3.1 make an R quantlet on GH to produce hash code for the 2 sentences: „I learn a lot from this class when I am proper listening to the professor", „I do not learn a lot from this class when I am absent and playing on my Iphone". Compare the 2 hash sequences

Answer:

```
# call the library doing the hashes
library("digest")
# now do the hash code calculation
digest ("I learn a lot from this class when I am proper listening to the professor")
[1] "a8d3e4701672195e5dcd16ea9b062279"
digest ("I do not learn a lot from this class when I am absent and playing on my
Iphone")
[1] "497edecd95aca5cc9a581e4835c3cccd"
```

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

- The Digital Signature Algorithm (DSA) is a Federal Information Processing Standard for digital signatures.
- A digital signature algorithm is a subset of the digital signature standard that represents a specific public key algorithm that is used only as a digital signature.
- The key runs on the message hash generated by SHA-1: To verify a signature, recalculate the message's hash, use the public key to decrypt the signature and then compare the results.
- The implementation of a digital signature is usually done by the sender of the message through a one-way function to process the message to be transmitted to produce a string of digits that can not be forged by another person to authenticate the source of the message and to detect whether the message has been modified.
- The message receiver decrypts the received message encrypted with the sender's private key with the sender's public key, and determines the source and integrity of the message, and the sender can not deny the signature.

3. 3 Make slides with R code where you create a JSON data set that you save and read again.

Answer:

- **Creat json data:**

```
{
    "ID":["1","2","3","4","5"],
    "Name":["Alice","Bob","Dan","Pat","Hua"],
    "Grades":["88","89","98","94","90"]
}
```

- **Save data** :

  C:/Users/王陈圆/Desktop/hw3jsondata.json

- **Read Data:**

```
# Load the package required to read JSON files.
 ibrary("rjson")
# Give the input file name to the function.
 result <- fromJSON(file = "C:/Users/王陈圆/Desktop/hw3jsondata.json")
# Print the result.
 print(result)
```

- **Result**

```
$ID
[1] "1" "2" "3" "4" "5"
$Name
[1] "Alice" "Bob"   "Dan"   "Pat"   "Hua"
$Grades
[1] "88" "89" "98" "94" "90"
```

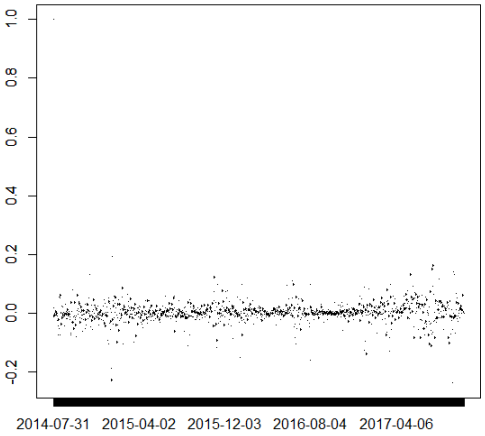
3.4 Download the CRIX data and make a plot of the time series, analyse its properties, i.e. fit ARMA, ARIMA etc. Is there a GARCH effect?

Answer:

```
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)
a<-seq(1,2348,2)
b<-seq(2,2348,2)
date<-t(crix_data_frame[1,a])
price<-t(crix_data_frame[1,b])
return<-1:1174
for(i in 1:1174)
{return[i+1]<-log(price[i+1]/price[i])}
new<-data.frame(date,price,return[1:1174])
names(new)<-c("date","price","return")
plot(new$date,new$return)
```

```
arima(new$return, order = c(2,0,1))
#These results suggest that the CRIX return series can be modeled by some ARIMA
  process, for example ARIMA(2, 0, 2).
```

```
Call:
arima(x = new$return, order = c(2, 0, 2))
Coefficients:
          ar1      ar2      ma1     ma2  intercept
      -0.7564  -0.8752   0.7584  0.8281     0.0031
s.e.   0.0757   0.2050   0.0881  0.2261     0.0013
sigma^2 estimated as 0.002041:  log likelihood = 1970.32,  aic = -3928.65
```



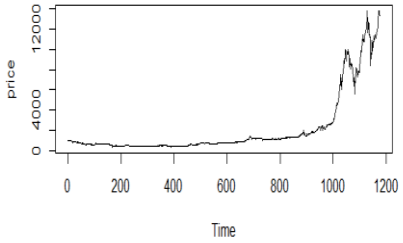
HW Unit 4

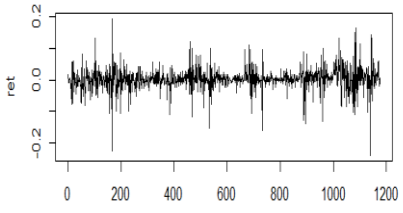
(all this to be done on perfect PPTX slides)

4.1. improve the R quantlets on GH (from CRIX directory on quantlet.de) and make excellent graphics that follow Fig 3,4,5,6 of the „Econometrics of CRIX“ paper.
Answer :

- **The daily value of indices in the CRIX and The log returns of CRIX index**

```
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)
```

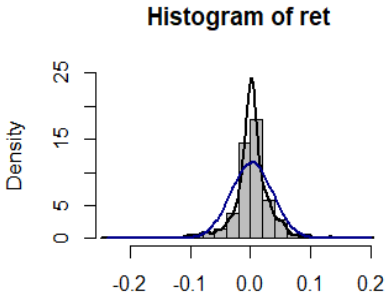


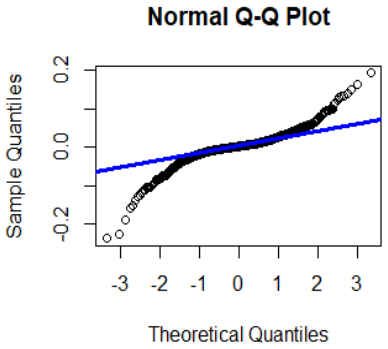


```
ret<-diff(log(price))
par(mfrow=c(2,1))
ts.plot(ret)
```

- **Histogram and QQ plot of CRIX returns**

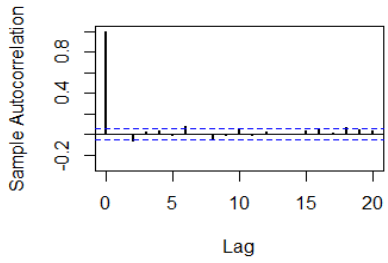
```
# histogram of returns
par(mfrow=c(2,1))
hist(ret, col = "grey", breaks = 20, freq = FALSE,
  ylim = c(0, 25), xlab = NA)
lines(density(ret), lwd = 2)
mu = mean(ret)
sigma = sd(ret)
x = seq(-4, 4, length = 100)
curve(dnorm(x, mean = mean(ret), sd = sd(ret)),
    add = TRUE, col = "darkblue", lwd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

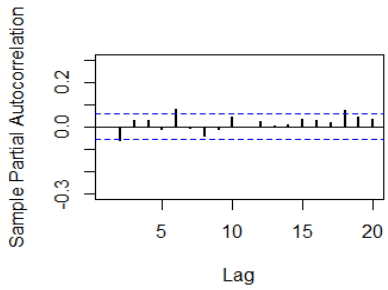




- **The sample ACF and PACF of CRIX returns**

```
# 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)
```

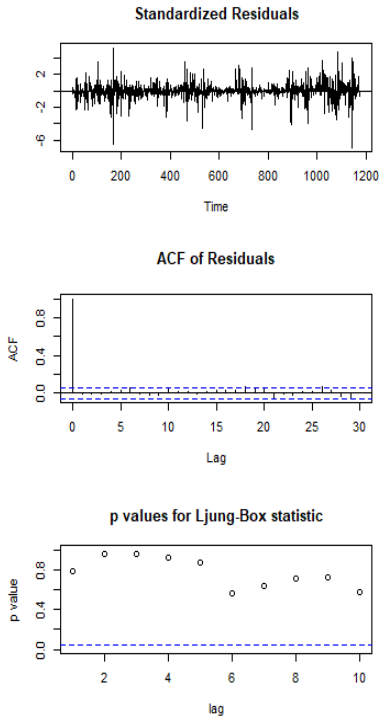




- **Diagnostic Checking**

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

  tsdiag(fit202)

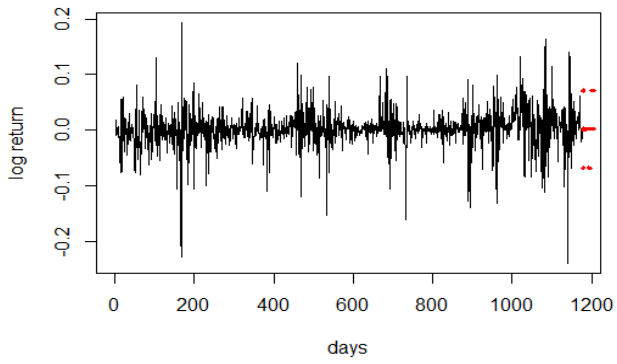


4.2. make your R code perfect as in the R examples on quantlet.de i.e. make sure that the code is „time independent" by using actual dimensions of the data that you are collecting from crix.hu-berlin.de RecreateFig 7 from „Econometrics of CRIX".

Answer:

CRIX returns and predicted values

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



4.3. redo as many figures as you can.