Lab 2 :ARIMA processes

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ARMA process

Example of the Volcanic Dust Veil in the Northern Hemisphere: The file file http://robjhyndman.com/tsdldata/annual/dvi.dat contains data on the volcanic dust veil index in the northern hemisphere, from 1500-1969

1. Read the file, transforme the data into a time series object and plot resulting ts.
2. Describe the time serie: Statiobarity, Trend, seasonality?
3. Plot the ACF and PACF of the diff. time serie
4. deduce the parameters of the ARIMA model
5. use the principle of parsimony to decide which model is best (Ockham's razor)
6. Estimate the ARIMA model with the choosen parameters (use **arima()** function)
7. use the model to forecast the 30 next observation
8. Check the forecast residuals (ACF, PACF, Ljung-Box test)

```
volcanodust <-
scan("http://robjhyndman.com/tsdldata/annual/dvi.dat", skip=1)
volcanodustseries <- ts(volcanodust,start=c(1500))
plot.ts(volcanodustseries)
acf(volcanodustseries, lag.max=20)
pacf(volcanodustseries, lag.max=20)
volcanodustseriesarima <- arima(volcanodustseries, order=c(2,0,0))
volcanodustseriesforecasts <- forecast(volcanodustseriesarima, h=31)
plot(volcanodustseriesforecasts)
acf(volcanodustseriesforecasts$residuals, lag.max=20)
Box.test(volcanodustseriesforecasts$residuals, lag=20, type="Ljung-
Box")
plot.ts(volcanodustseriesforecasts$residuals)
```

ARIMA process

Example of the Ages at Death of the Kings of England

The file http://robjhyndman.com/tsdldata/misc/kings.dat contains data on the age of death of successive kings of England, starting with William the Conqueror (original source: Hipel and Mcleod, 1994).

1. Read the file, transforme the data into a time series object and plot resulting ts.
2. Describe the time serie: Statiobarity, Trend, seasonality?

3. Use **diff()** function to remove the trend
    - is the resulting time series has a trend?
    - Plot the ACF and PACF of the diff. time serie
    - deduce the parameters of the ARIMA model
    - use the principle of parsimony to decide which model is best (Ockham's razor)
    - Estimate the ARIMA model with the choosen parameters (use **arima()** function)
    - use the model to forecast the 5 next observation
    - Check the forecast residuals (ACF, PACF, Ljung-Box test)

```
kings <-
scan("http://robjhyndman.com/tsdldata/misc/kings.dat",skip=3)
kingstimeseries <- ts(kings)
plot.ts(kingstimeseries)
kingtimeseriesdiff1 <- diff(kingstimeseries, differences=1)
plot.ts(kingtimeseriesdiff1)
acf(kingtimeseriesdiff1, lag.max=20)
pacf(kingtimeseriesdiff1, lag.max=20)
kingstimeseriesarima <- arima(kingstimeseries, order=c(0,1,1))
kingstimeseriesforecasts <- forecast(kingstimeseriesarima,
h=5)
plot.forecast(kingstimeseriesforecasts)
acf(kingstimeseriesforecasts$residuals, lag.max=20)
Box.test(kingstimeseriesforecasts$residuals, lag=20,
type="Ljung-Box")
plot.ts(kingstimeseriesforecasts$residuals)
```