Lab 6

Simulations AR, MA, ARMA models

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AutoRegressive (AR) and Moving Average (MA)

You can simulate the following models (run them several times, you should increase the number of points $n = 10000$ or more, and also change the coefficients):

1. AR(1)
   
   > tsdisplay(arima.sim(n=100, list(ar = c(0.8897)), sd = sqrt(0.1796)))

2. AR(2)
   
   > tsdisplay(arima.sim(n=100, list(ar = c(0.8897, -0.4858)), sd = sqrt(0.1796)))

3. MA(1)
   
   > tsdisplay(arima.sim(n=100, list( ma = c(-0.2279)), sd = sqrt(0.1796)))

4. MA(2)
   
   > tsdisplay(arima.sim(n=100, list( ma = c(-0.2279, 0.2488)), sd = sqrt(0.1796)))

Try to understand every argument used. Indicate which of MA(1), MA(q=2), AR(1), AR(p=2) has a ACF that has:

- an exponential decay
- an exponential decay or damped sine wave.
• Spike at lag 1, then 0.
• Spikes at lags 1 to q=2, then zero.

and a PACF that has:
• Spike at lag 1, then 0.
• Spikes at lags 1 to p=2, then zero.
• Exponential decay.
• Exponential decay or damped sine wave.

Check your results with the lecture notes.

**AutoRegressive Moving Average (ARMA)**

You can also simulate models that combine AR and MA components. These models are called ARMA models. For instance ARMA(2,2):

```
arima.sim(n = 100, list(ar = c(0.8897, -0.4858), ma = c(-0.2279, 0.2488)), sd = sqrt(0.1796))
```

In this case when time series has both an AR and MA components, it is very hard to identify the patterns in the ACF and PACF.