Time Series Analysis - Week 2

Introduction
This is a *voluntary* mini-project that aims to examine how one can simulate AR, MA, and ARMA processes, as well as examine the corresponding ACF and PACF of these processes. You complete it on your own and you *do not* need to hand in anything after completing it; it is just meant to get you started.

Before you begin:

- View the online videos related to stochastic process and identification, as well as read chapters 3 and 4.1-4.2 in the course textbook.
- Download the data file for this assignment from the course webpage.

Task 1
Use Matlab to generate $N = 10.000$ samples of an AR, MA, and ARMA process with the $A(z)$ and $C(z)$ polynomials

$$A(z) = 1 - 1.79z^{-1} + 0.84z^{-2}$$
$$C(z) = 1 - 0.81z^{-1} - 0.11z^{-2}$$

You can do this by first generating a white Gaussian noise using the command `randn` and then use the command `filter` to shape the noise to the different processes. Plot the resulting realisations using the command `plot`. Use the provided `acf` and `pacf` functions and plot the ACF and PACF for each of the processes. Check if the result corresponds to your expectations - are you able to identify the correct models? Try reducing the number of samples to $N = 100$. Can you identify the models correctly?

Task 2
Try changing the $A(z)$ and $C(z)$ polynomials such that one of the polynomials at a time have a root outside the unit circle. The command `roots` can be used to compute the roots of a polynomial. Plot the resulting realisations using the command `plot`. Which polynomial may have a root outside the unit circle without causing instability?

Task 3
Load the provided data set using the command `load week2data` and examine what might be an appropriate model structure for this data set.

Comment:
You can find further details on how to write the required Matlab code in the first computer exercise, which is available on the course webpage. As you will see, by solving these tasks, you will also have solved part of this computer exercise.