Continuous Assessment Homework 1 - 2023

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Answer the following questions using all your knowledge and the software R. Send me the answer in a pdf file no later than the 28th May.

1 Introductory Models

1. Load the file *ldeaths* in the folder datasets of R. Make the graphical representation. Identify and estimate the trend, the seasonal component and the residual component. Are the residuals a sample of an IID noise?

2. Simulate a Gaussian white noise of $n = 10.000$ data. Verify by testing that it is an IID noise and a Gaussian white noise. Simulate a Gaussian Random Walk. Simulate IID noises of 10.000 data that are not a Gaussian white noise: a Poisson noise and an exponential noise. Test their properties.

3. Simulate an AR(p) model with 10000 data, for p=1 and p=2. Fit the best model to the data in both cases. Validate the model by showing the residuals are an IID noise.

4. Simulate an ARMA (2,1). Compute the autocorrelation and the partial autocorrelation. Find the parameters that best fit the ARMA model. Validate it. Characterize the forecasting with the proper graphs.

5. Load the file *Nile* in dataset. Prepare the graphical representation. Make the first differences. Fit the best ARMA model to the process of first differences. Validate it. Make the graphical representation of the forecasting.

2 Long-Memory and Volatile Time Series Models

1. Simulate a FARIMA time series. Fit it the best model and test that the residuals of the fitted model are a white noise

2. Fit a FARIMA model to Nile data in datasets. Check that the fitted model is a good model.

3. Simulate a GARCH(1,1) time series. Fit the best model to this series. Check that the fitted model it is a good model.

4. Fit a GARCH model to the logarithmic transformation of series in EuStockMarkets of datasets. Check the stylised facts (un-correlation, correlation of the squares, heavy tails, volatility clustering). Check that the fitted model is a good model.

5. Simulate a VAR(2) time series. Fit the best model and check that it is a good one.

6. Simulate two co-integrated random walks and check that they are integrated processes and co-integrated.

7. Check if some of the four series in EuStockMarkets are co-integrated.