Time Series project requirements, 2024-2025, 3rd year students in **Economic Informatics**, English language

The **Term Project** is to be presented in the last seminar of the 2nd semester.

- The project will be realized in teams of 2 to 4 students.
- As your starting point, consider a real-world problem, for example: modeling and forecasting univariate time series such as, but not limited to, the exchange rate RON/EUR or the inflation rate or stock exchange prices etc; modeling multivariate time series to determine correlations between monetary policy and the behavior of the financial or banking market etc. These are just suggestions; you can select a particular topic of interest or a topic that is relevant to our current times. Briefly present at least three papers (studies) on the topics you choose.
- The time series you are analyzing must have at least 60 observations, for yearly, quarterly data; at least 100 observations for monthly data; at least 250 data for daily data.
- The project will consist of the following three applications:
  - **Application 1 - ARMA/ARIMA models**. Use the Box-Jenkins methodology for a time series.
    - Unit root tests for the initial time series; if needed, transform the time series until you obtain a stationary time series;
    - The identification of the best model that adjusts the stationary time series (Box-Jenkins methodology);
    - The analysis of the identified model's validity;
    - The point forecasts and confidence interval forecasts based on the valid model which has been identified, for a range of a few periods, for both the stationary series, and the initial time series; the analysis of the forecast's quality.
  - **Application 2 – SARIMA models (seasonal ARIMA).** Identify a time series influenced by seasonality and identify the appropriate model for it using the SARIMA models, follow the same requirements presented for Application 1.
  - **Application 3 – Multivariate time series.** Investigate the nature of the relationship between two or three time series, applying the methodology related to the following concepts:
    - Non-stationary analysis,
    - Cointegration analysis,
    - Granger causality analysis,
    - VAR/VECM models,
    - Impulse Response Function.
- For all the time series used in the project, you must mention what represents (the definition), the measurement unit, the source of the data (including the link and the code for the variable), such as data retrieved from Eurostat or National Institute of Statistics – Tempo online,
- For each of the three applications, it is mandatory to include a short introduction in which, based on a few bibliographical references, you are supposed to explain and contextualize why you have chosen those time series.
- At the end of the project, bibliography section must exist, you will mention the source of the data, references etc.
- You may use databases from the following sources as well (but not only those, the list is not exhaustive):
  - World Bank: http://www.worldbank.org
  - EUROSTAT: http://ec.europa.eu/eurostat/data/database
  - OECD: http://www.oecd.org/sdd/
  - IMF: http://www.imf.org/en/Data
  - The National Institute of Statistics: www.insse.ro, Tempo ONLINE
  - UNDP: http://hdr.undp.org/en/data
  - The National Bank of Romania, BNR: www.bnr.ro
  - Quandl: Financial, Economic and Alternative Data: https://www.quandl.com/
  - Federal Reserve Bank of St. Louis https://fred.stlouisfed.org/
  - Statistics regarding the Euro zone: https://www.euro-area-statistics.org/?lg=ro
  - Kaggle: Your Machine Learning and Data Science Community, https://www.kaggle.com/ or https://www.kaggle.com/datasets
  - Center for Machine Learning and Intelligent Systems http://archive.ics.uci.edu/ml/index.php
  - Yahoo Finance https://finance.yahoo.com/
  - https://www.investing.com/
- Should you have questions, please, contact me at mihaela.covrig@csie.ase.ro
- **Presentation of the project**: see the next page

- **Presentation of the project**:
  - The project will be uploaded on the online.ase.ro platform, at the seminar section, with at least 3 days before the presentation, as an archive named **LAST NAME AND FIRST NAME STUDENTS 24-25**, which must contain:
    - the project in a format which allows editing (such as, WORD) and
    - the file/files with the raw or initial data (for example, xls, xlsx, csv or wf1),
    - the file/files specific to the used software (EVIEWS, R, Python, Excel),
    - the files of the references (the papers in the reference section).
  - The grade for the project will be given only after its presentation, all students in each team must present and, of course, must be present at the moment of the presentation. Also, each member of the team must have a significant contribution in the project's elaboration.
  - At the presentation, students will bring the hard copy of the project, printed two-sided (not necessarily a color print), and in a simple plastic colored folder (not necessarily spiral bound).