Project: Time Series Analysis Using the Box–Jenkins Methodology

Date of delivery: January 8th 2026; groups of two people.

Send via Atenea:

File with the report (.doc, .html o .pdf) + R Script (.r or Rmd) with the code

Project Description

The objective of this project is to apply the Box–Jenkins ARIMA methodology to the analysis and forecasting of a selected **real-world time series**. Students must choose one of the proposed datasets (or suggest another time series, subject to approval) to develop the complete analysis. You are required to submit a **formal report** (with index, introduction, conclusions, etc.). A simple commented R Markdown file is **not sufficient**.

Project Requirements

1. Identification

a) Stationarity and Transformations

- Determine the transformations required to make the series stationary.
- Justify all transformations using both graphical methods and numerical tests.

b) ACF and PACF Analysis

- Analyze the correlograms of the stationary series.
- Identify at least two plausible ARIMA models.
- Clearly explain which features of the ACF and PACF guided your choices.

2. Estimation

a) Model Estimation in R

- Use R to estimate the parameters of the models identified in Step 1.

3. Validation

a) Residual Analysis

- Conduct a complete residual diagnostic analysis.
- Justify all assumptions made, using formal tests and graphical tools.

b) AR and MA Infinite Representations

- Analyze the infinite AR and MA expressions.
- Discuss causality and invertibility.
- Report model adequacy measures.

c) Stability and Predictive Capability

- Assess the stability of each model.
- Evaluate forecast performance by reserving the **last 12 observations**.

d) Model Selection

- Select the model that performs best according to your criteria.

4. Prediction

a) Forecasting

- Produce long-term forecasts for the **12 periods** following the last available observation.
- Provide the corresponding confidence intervals.

Submission

Submit a complete report that documents **all steps**, **results**, and **justified decisions**. The report must follow a traditional academic structure (index, introduction, methodology, results, conclusions, references, etc.).