**Time series project**

**Submission date:** May 19, 2019 by email to your TD representative.

General instruction: This project must be performed under Stata, SAS, R or Python. The rating will take into account the rigour in the implementation of econometric tools, the conciseness and clarity of the presentation of results. The report (maximum 6 pages of content outside the annex) will include the programmes in the annex. This tutoring must be done in pairs of the same group of TDs.

The scale (for information only) is as follows: Part 1: 20%; Part 2: 40%; Part 3: 40%. Good work!

We are interested in modelling and forecasting the industrial production index observed in France. You are not asked to know the process of building the indicator. You only work on the observed data. From the INSEE time series directory, www.insee.fr/fr/statistiques?debut=0&categorie=10, you must choose a raw, monthly aggregate series, corresponding to any sector of activity (at your convenience) containing at least 25 years and containing the month of January 2019.

**Part 1: The Data**

1) What does the chosen series represent? (sector, perimeter, possible treatments, logarithmic transformation,...)

2) Transform the series if necessary to make it stationary (deseasonalization, differentiation, suppression of the deterministic trend,...). Carefully justify your choices.

3) Graphically represent the selected series before and after transformation.

**Part 2: ARMA Models**

4) Choose, and justify, an ARMA model (p,q) (with possibly a seasonal component) for your corrected Xt series. Estimate the model parameters and check its validity.

**Part 3: Forecasting**

Note T is the length of the series. It is assumed that the residues of the series are Gaussian.

5) Write the equation verified by the α level confidence region on the future values (XT+1,XT+2).

6) Specify the assumptions used to obtain this region.

7) Graphically determine this region for α=95%. Comment.

8) Open-ended question: either Yt a stationary series available from t=1 to T. It is assumed that YT+1 is available faster than XT+1. Under what conditions does this information improve the forecast of XT+1?