TMA4285 Time series models
Excercise 8, Autumn 2019

The task is to analyze monthly mean temperature data from Oslo (1937-2018) using methods from time series analysis as implemented in R.

Minimum demands of the analysis include:

1. Exploring the data with plotting of relevant statistics

2. SARIMA model parameter estimates reported in a table including uncertainty and discussion of relevance of all the parameters. Is the temperature increasing?

3. Use the estimated model to predict the temperature in 2019, including uncertainty, and plot the result together with actual measured data from 2019.

4. The uncertainty of the (p, q) order and the parameters of the stationary ARMA part of the model shall be estimated by simulating (at least) 100 realizations of data from the stationary part of the model estimated from the original data. Use the AICC statistic for model choice in the simulations.

5. Repeat the previous using the AIC statistic in stead of the AICC, and discuss relative performance of the two statistics in this particular case.

6. Translate the SARIMA model into a state-space model with explicit values for the parameters in the state-space model.

7. Diagnostics, including in particular residuals, and model choice discussion.

The analysis should be limited to concepts and methods found in Chapters 1-6 and 9 in the textbook by Brockwell and Davis, *Introduction to Time Series and Forecasting*, Springer 2016. Important concepts and quantities used in the analysis should be defined and identified.

It is required to use the language R in the analysis. Complete copies of the computer code you write for the analysis must be included in an Appendix. Help regarding using R can be found in the book by Shumway and Stoffer: *Time Series Analysis and Its Applications (With R Examples)*, Springer 2017. The data used in the analysis must be included together with the R code in separate electronic attachments.

The result of your analysis should be reported according to the outline: **Title, Abstract, Introduction, Theory, Data analysis, Discussion, Conclusion, Appendix, References**. The report length is limited to at most 10 pages excluding the title page, the Appendix, and the list of References. The title page must contain the title, the list of authors, the abstract, and a table of contents. Figures may be included in the Appendix, but it is recommended to have some figures in the main text.

If parts of the report is judged to be essentially copy-pasted versions of other reports, then this will be taken into account in the grading.