

This assignment has two parts. The first part is of the usual form, and the second part is our first “lab”.

Part I

1. Specify the exact likelihood of a Gaussian AR(2) process.
2. Specify the innovations coefficients $\theta_{t,j}$ and variance v_t for an ARMA(2,1) process. To simplify the notation, you may choose to express things also in terms of $\gamma_0, \gamma_1, \gamma_2$, etc. instead of exclusively in terms of ϕ_1, ϕ_2, θ_1 , and σ_a^2 .
3. For an ARMA(2,1) process, specify equations one may solve to obtain $\tilde{\gamma}_0, \tilde{\gamma}_1, \tilde{\gamma}_2$ in terms of ϕ_1, ϕ_2, θ , where $\tilde{\gamma}_k = \gamma_k / \sigma_a^2$.

Part II

The annual immigration into the U.S. from 1820 to 1962 are given in the series `us.immig`. The objective is to find an ARI($p,d,0$) model that “best” fits the data, and an IMA($0,d,q$) or ARIMA(p,d,q) model that “best” fits the data. You may need to transform the data.

A good fit should have residuals (estimates of a_t 's) that behave like a white noise series and have a smaller variance. A good fit should also have fewer parameters, and the parameters should be statistically significant.

You may use `fit<-arma(...)` to fit models, and extract the residuals from the fit via `fit$res`. Feel free to use all the tools known to you for the analysis.

Your report should have the following parts.

Summary This part should contain the basic information of the series (name, length, etc.), the final model(s) with all parameter estimates, and basic exhibits such as the plots of the series and the residuals and the ACFs and PACFs thereof. Label the exhibits.

Analysis *Briefly* describe the steps you followed to reach the final model(s) and justify your decisions. You do not need to report all the “side-tracks” you walked into, but do report ones that are worth reporting.

The material evidences for your analysis, mainly computer outputs I assume, should either be included where it is needed, or be placed in the appendix clearly labelled and be referenced by the labels.

Appendix Include all the computer outouts and plots, labelled, that you find necessary to include, which are not already in the summary. Do not use labels that were used in summary.

Make the report short and to the point.