# First midterm test in Advanced Econometrics

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1. For the following ARMA models, determine the relevant characteristic polynomials and conclude whether the processes are stable. What distinguishes a stable process from a stationary process?

   (a) $X_t = \varepsilon_t$

   (b) $\Delta X_t = \varepsilon_t$

   (c) $X_t = 0.5X_{t-1} + \varepsilon_t + 0.5\varepsilon_{t-1}$

   (d) $X_t = \varepsilon_t + 2\varepsilon_{t-1}$

2. A friend of yours wishes to fit an ARMA model to her data. She tries out all $\text{ARMA}(p, q)$ models for $0 \leq p \leq 4$ and $0 \leq q \leq 4$, and she obtains a minimum AIC at $p = q = 2$ and a minimum BIC at $p = 2, q = 0$, a maximum AIC at $p = 4, q = 3$ and a maximum BIC at $p = q = 4$. Which ARMA model would you suggest to use, or would you recommend running more tests? In the latter case, describe which tests you would suggest.

3. You wish to test for unit roots in trending data using the Dickey-Fuller test, but you only have access to a software that does not explicitly provide that test, just regression analysis. You also have access to tables of significance points.

   (a) In a preliminary lag order search, you choose an AR(3) model as having the best fit to your data. Indicate the regression that you would have to run now, and also indicate where in the typical regression printout you would find the test statistic that you should compare to your table of significance points.

   (b) What distinguishes the DF–$\mu$ from the DF–$\tau$ test?

   (c) Assuming that the DF–test rejects, what is your conclusion concerning the generating process for your data?

4. A (white-noise) process $(Y_t)$ follows the ARCH model

$$\text{var}(Y_t|\mathcal{I}_{t-1}) = \sigma_t^2 = 1 + 0.5Y_{t-1}^2$$

and has been started in the distant past, such that it can be regarded as stationary. Evaluate the unconditional variance $\text{var}Y_t$.