Problem Set 3

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1 Analytical Exercises

1. Derive the likelihood of an $MA(q)$ model.
2. Assume the true model is an $AR(2)$ and instead you estimate an $AR(1)$. What are the effects of that. (Hint: Compare with the results of Problem set 1.)

2 R Exercise

3. Simulate the following models:

1. $y_t = 1.2 + 0.4y_{t-1} + \epsilon_t$,
2. $y_t = 2.5 + 0.3y_{t-1} + \epsilon$,
3. $y_t = 0.8 + 0.5\epsilon_{t-1} + \epsilon_t$
4. $y_t = 2.1 + 0.5y_{t-1} + 0.2\epsilon_{t-1} + \epsilon_t$

where ϵ_t is a gaussian white noise. For each of the process, perform the Box-Jenkins model approach.
4. Simulate an AR(1) $y_t = \beta y_{t-1} + \epsilon_t$ where $\beta = 0.4, 0.95$ and $\epsilon_t \sim G.W.N.(0, 1)$. Estimate by both OLS and Maximum Likelihood(ML). By considering the

OLS estimator, run a Monte Carlo simulation and plot the histogram of the estimated value of the parameter for both βs by superimposing a line to the true parameter value. What do you observe?

2.1 Monte Carlo

1. Generate (using a loop) a large number(usually 1000) of (the same) AR(1) processes given by the above specification.
2. For each of these,estimate the parameter and save it as the i-th element of a vector.
3. The vector will contain the estimates of the parameters over the Monte Carlo simulations.