TS Module 12 Parameter estimation method of moments

(The attached PDF file has better formatting.)

- Method of moments
- Autoregressive, moving average, and mixed models

Read Section 7.1, "Method of moments," on pages 149-154. Know equation 7.1.1 on the bottom of page 149 and equations 7.1.2 and 7.1.3 on the top of page 150. An exam problem may give the sample autocorrelations for the first two lags of an AR(2) process and ask for ϕ_1 and ϕ_2, which you solve using equation 7.1.2.

The final exam does not ask Yule-Walker equations for processes not illustrated in the text. But know how to use the method of moments for your student project.

- Use linear regression for autoregressive processes with Excel's regression add-in.
- If you do not have other statistical software, you must use Yule-Walker equations for moving average and mixed processes.

Moving average models: Know equations 7.1.4 on the bottom of page 150. The final exam gives the sample autocorrelation for an MA(1) process and asks for θ_1.

Know equations 7.1.5 and 7.1.6 in the middle of page 151. The final exam will give ρ_1 and ρ_2 for an ARMA(1,1) process and ask for the estimates of ϕ and θ.

Read "Estimates of the noise variance" on pages 151-152: know equations 7.1.8 and 7.1.9 on the bottom of page 151 and equation 7.1.10 on the top of page 152. Each equation is derived in previous discussions of autoregressive, moving average, and mixed models. The final exam may give the variance of the observed time series values, from which you estimate σ^2_ε. The final exam may give the observed time series values and the type of fitted model, such as AR(2) or ARMA(1,1), from which you derive γ_0, the ϕ and θ parameters, and σ^2_ε.

The procedures in the textbook work two ways. The logic is the same; focus on observed values vs theoretical values.

- From σ^2_ε and the parameters of the ARIMA process, we derive covariances, autocorrelations, and partial autocorrelations.
- From observed values, we derive sample autocorrelations, the type of ARIMA process, the parameters, and σ^2_ε.

The time series processes are stochastic, so we can not know that any model is correct. From the observed values, we get reasonable estimates for the type of model and the parameters. Cryer and Chan explain how to derive the standard errors of the parameters. The final exam problems test these standard errors and the resulting confidence intervals.

Read “Numerical examples” on pages 152-154. These are illustrations; you are not tested on the details in this section. The illustrations help you understand the theory; you are not tested on the figures.