TS Module 9 Non-stationary ARIMA time series

(The attached PDF file has better formatting.)

● ARIMA process
● Constant terms in ARIMA models

Read Section 5.2, "ARIMA models," on pages 92-97. Focus on the concepts. Know how taking first or second differences makes the process stationary. Know how to convert an ARIMA(p,1,q) process into a non-stationary ARMA(p,q) process. The equations seem hard at first; the practice problems show how the equations are applied. Equations 2, 6, 7, 8, and 10 are used for final exam problems on this module.

For actuarial time series, such as loss cost trends, inflation indices, stock prices, and dollar values, first take logarithms and then take first differences. The authors mention this, but it is easy to forget. For an ARI process with $\phi > 1$, taking first differences doesn't make the process stationary. First take logarithms, then take first differences.

Read Section 5.3, "Constant terms in ARIMA models, on pages 97-98. The mean of the underlying ARMA process is the drift of the (integrated) ARIMA process.

Know equations 5.3.16 and 5.3.17 on the bottom on page 97; they are tested frequently on the final exam.

● Only the ϕ_j terms are in the denominator of the expression for μ.
● The θ_j terms do not affect the mean.
● The constant θ_0 term is in the numerator of the expression for μ.

The previous textbook used for this on-line course used δ instead of θ_0. Some practice problems on the discussion forum still have δ. Cryer and Chan use θ instead of θ_1 for an MA(1) process and ϕ instead of ϕ_1 for an AR(1) process. The final exam problems use the notation in the Cryer and Chan textbook, but some practice problems have other notation.

Read Section 5.4, "Other transformations," on page 98-100. Know equation 5.4.3 in the middle of page 99. Many actuarial time series are percentage changes.

Power transformations on pages 101-102 are covered in the regression analysis course. They are not tested in the time series course. But they are needed for proper modeling of actuarial time series. If you have not taken the regression analysis course with the John Fox textbook, read these two pages.

Non-stationary ARIMA processes appear again in the modules on forecasting. The final exam problems test if you understand how ARIMA processes relate to ARMA processes.