Midterm 2:

Review & Exercises

Week IX: Video 27

STAT 485/685, Fall 2020, SFU

Sonja Isberg

What We've Learned

Ch. 4: Models for Stationary Time Series (Videos 14-18)

- General linear process: Definition, and relationship to MA & AR models
- MA process: definition, important properties, invertibility
- AR process: definition, important properties, stationarity
- ARMA process: definition, properties, etc.

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Ch. 5: Models for Non-Stationary Time Series (Videos 19-22)

- ARIMA process: relationship between a non-stationary process $\{Y_t\}$ and its stationary differences series $\{W_t\}$
- Transformations: log, difference of logs, power transformation
- Constant mean terms: effect on an ARMA model, and effect on an ARIMA model

What We've Learned (cont'd)

Ch. 6: Model Specification (Videos 23-25)

- Sample ACF: important properties, usefulness for model specification
- Sample PACF: important properties, usefulness for model specification
- Sample EACF: important properties, usefulness for model specification
- Using all three methods together

Exercises

Let's go over an example from each chapter.

We will give two complete examples (from Chapters 4 & 5), and one incomplete example (from Chapter 6) which will be "left to the reader as an exercise".

Ch. 4 Exercise

Consider the following model:

$$Y_t = 0.2Y_{t-1} + 0.4Y_{t-2} + e_t - 0.7e_{t-1}$$

Identify the model, and give all values of its parameters. Then determine whether or not this model is stationary.

Ch. 5 Exercise

Prove that the random walk process is an ARIMA(0,1,0) process.

Ch. 6 Exercise

Left to the reader as an exercise:

Practice your model specification skills!

1. Obtain a dataset, using one of the below methods:
   - Choose a dataset from the `TSA` package
   - Find a dataset online somewhere and copy-paste it into R (or read it in from an Excel/CSV file if you know how)
   - Generate it yourself from a known ARMA model, using code similar to what we've done in the Ch. 6 videos

   Note: If you use one of the latter two methods, you will then have to define it as a "time series" object using the `ts()` function.

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2. Create a sample ACF plot, sample PACF plot and sample EACF table.

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2. Create a sample ACF plot, sample PACF plot and sample EACF table.
3. Interpret each one of the plots/tables individually. Then, use these interpretations together to make some overall conclusion about a plausible model (or several plausible models) for this dataset.

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4. Repeat as many times as you wish!

Final Comments

That's all for now!

Good luck on the midterm!

Next Week in STAT 485/685: Some more topics on model specification, and the start of the next step in the Model Building Process: *parameter estimation*.

Thank you!

References:

[1] Cryer, J. D., & Chan, K. S. (2008). *Time series analysis: with applications in R.* Springer Science and Business Media.

[2] Chan, K. S., & Ripley, B. (2020). TSA: Time Series Analysis. R package version 1.2.1.