ISA 444: Business Forecasting
18 - ARIMA Models (Cont.)

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Outline

Recap of What we Have Covered Last Two Weeks

ARMA Models: Models we considered may have three components, an autoregressive component (AR), and a moving average component (MA).

Main Learning Outcomes from Last 3 Classes

- Describe the behavior of the ACF and PACF of an AR(p) process.
- Describe the behavior of the ACF and PACF of an MA(q) process.
- Describe the behavior of the ACF and PACF of an ARMA (p,q) process.
- Fit an ARMA model to a time series, evaluate the residuals of a fitted ARMA model to assess goodness of fit, use the Ljung-Box test for correlation among the residuals of an ARMA model.

Summary Table for ARMA Models

Model	ACF	PACF
AR(p)	Exponentially decays or damped sinusoidal pattern	Cuts off after lag p
MA(q)	Cuts off after lag q	Exponentially decays or damped sinusoidal pattern
ARMA(p,q)	Exponentially decays or damped sinusoidal pattern	Exponentially decays or damped sinusoidal pattern

Learning Outcomes for Today's Class

Main Learning Outcomes

- Explain how ARIMA models work when compared to ARMA models.
- Fit an ARMA model to a time series, evaluate the residuals of a fitted ARMA model to assess goodness of fit, use the Ljung-Box test for correlation among the residuals of an ARIMA model.

Outline

ARIMA Models for Nonstationary Processes

When the time series is nonstationary, differencing can be used to transform the series. The ADF or KPSS tests can be used to test for stationarity, and the `ndiffs()` function is useful for determining the number of differences necessary to achieve stationarity.

A Live-Example

In class, we will use the GNP Data to highlight how ARIMA models can be fit and used for forecasting.

Non-graded In-Class Activity

You have 15 minutes to examine and model `series10` in 18 - InClass ARIMA Practice.csv, where you should:

- Determine an appropriate model to fit based on examining the output from the `ndiffs()`, examining both the `acf()` and `pacf()` of your data (or differenced data), and the output from the `checkresiduals()`.

- Once you fit an appropriate model, return its accuracy metrics and use it to forecast the values of the time-series for the next 10 time periods

Outline

Summary of Main Points

Main Learning Outcomes

- **Explain how ARIMA models work when compared to ARMA models.**
- **Fit an ARMA model to a time series, evaluate the residuals of a fitted ARMA model to assess goodness of fit, use the Ljung-Box test for correlation among the residuals of an ARIMA model.**

Things to Do to Prepare for Next Class

- Thoroughly read Chapter 6.2 of our textbook.

- Go through the slides, examples and make sure you have a good understanding of what we have covered.

- Go through the posted assignment (see next slide).

Graded Assignment 16: Evaluating your Understanding

Please go to Canvas (click here) and answer the questions. **The assignment is due April 1, 2021 [11:59 PM, Ohio local time].**

What/Why/Prep? The purpose of this assignment is to evaluate your understanding and retention of ARIMA modeling. To reinforce your understanding of the covered material, I also suggest reading Chapter 6.1-6.2 of the book.

General Guidelines:
- Individual assignment.
- This is **NOT** a timed assignment.
- Proctorio is NOT required for this assignment.
- You will need to have R installed (or accessible through the Remote Desktop)

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