Statistics and Data Analysis

Unit 06 – Lecture 04: Forecasting Fundamentals and ARIMA

Tofik Ali

School of Computer Science, UPES Dehradun

February 14, 2026

https://github.com/tali7c/Statistics-and-Data-Analysis

Quick Links

Overview ARIMA Differencing Exercises Demo Summary

Agenda

Learning Outcomes

- Define ARIMA(p,d,q) at a high level

Learning Outcomes

- Define ARIMA(p,d,q) at a high level
- Explain differencing (d) to remove trend

Learning Outcomes

- Define ARIMA(p,d,q) at a high level
- Explain differencing (d) to remove trend
- Explain p and q meaning (AR and MA orders)

Learning Outcomes

- Define ARIMA(p,d,q) at a high level
- Explain differencing (d) to remove trend
- Explain p and q meaning (AR and MA orders)
- Describe time-based train/test split for forecasting

ARIMA: Key Points

- p: AR order

ARIMA: Key Points

- p: AR order
- d: differencing order

ARIMA: Key Points

- p: AR order
- d: differencing order
- q: MA order

Differencing: Key Points

- First difference: y_t - y_t-1

Differencing: Key Points

- First difference: y_t - y_t-1
- Often stabilizes mean

Differencing: Key Points

- First difference: y_t - y_t-1
- Often stabilizes mean
- Over-differencing adds noise

Exercise 1: Meaning of d

What does d=1 mean?

Solution 1

- First differencing once.

Exercise 2: Chronological split

Why not random split in time series?

Solution 2

- Random split leaks future information.

Exercise 3: Trend fix

Series has strong upward trend. Name one simple step.

Solution 3

- First differencing.

Mini Demo (Python)

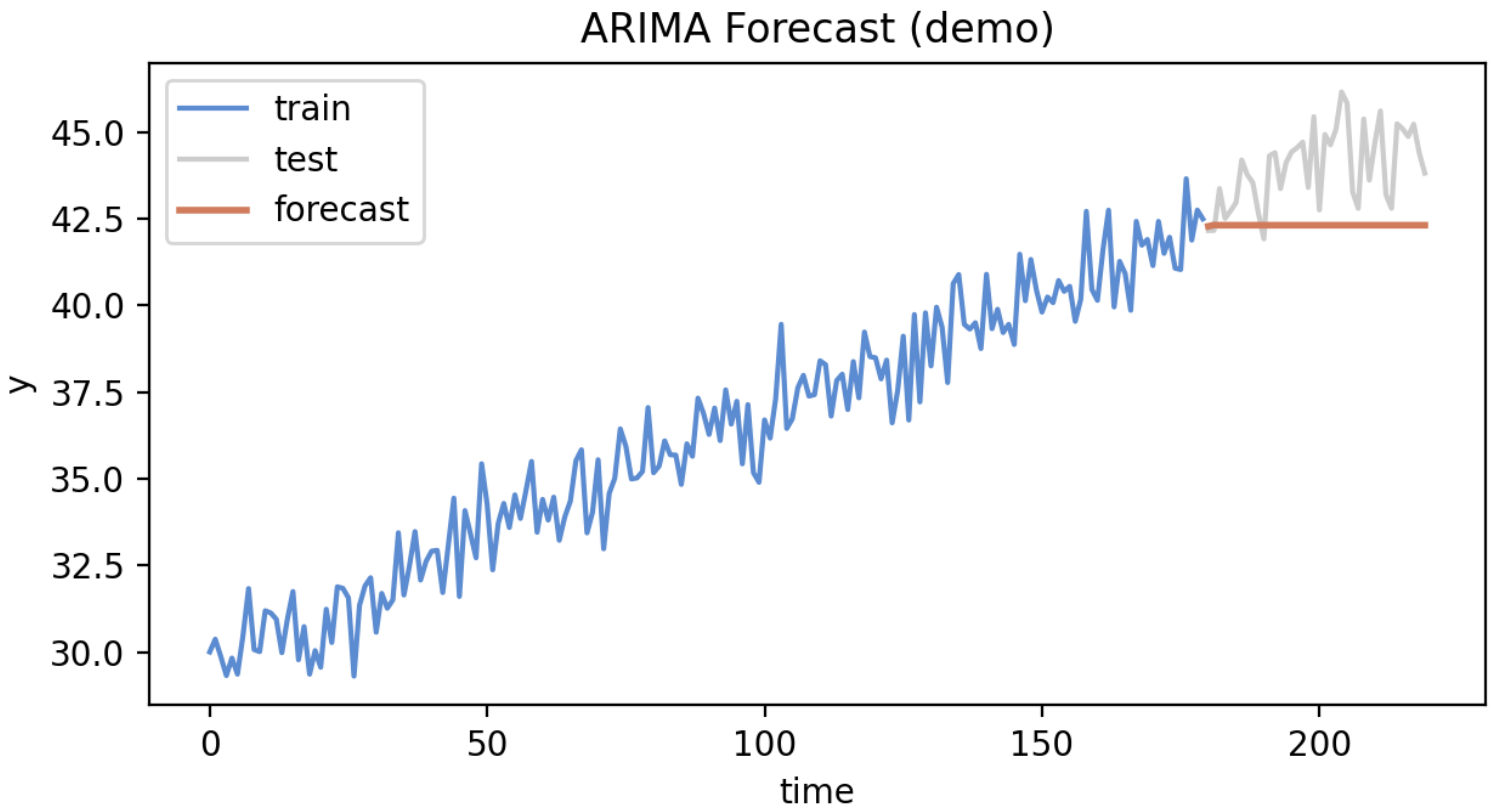
Run from the lecture folder:

```
python demo/demo.py
```

Outputs:

- `images/demo.png`
- `data/results.txt`

Demo Output (Example)



Summary

- Key definitions and the main formula.

Summary

- Key definitions and the main formula.
- How to interpret results in context.

Summary

- Key definitions and the main formula.
- How to interpret results in context.
- How the demo connects to the theory.

Exit Question

Why do we check residuals after fitting an ARIMA model?