

Statistics and Data Analysis

Unit 06 – Lecture 05: Stationarity and Non-stationarity

Tofik Ali

School of Computer Science, UPES Dehradun

February 14, 2026

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

Overview
o

Stationarity
o

Fixes
o

Exercises
oooooo

Demo
oo

Summary
oo

Quick Links

Overview

Stationarity

Fixes

Exercises

Demo

Summary

Agenda

1 Overview

2 Stationarity

3 Fixes

4 Exercises

5 Demo

6 Summary

Learning Outcomes

- Define stationarity (intuition)

Learning Outcomes

- Define stationarity (intuition)
- Recognize non-stationary patterns (trend/seasonality)

Learning Outcomes

- Define stationarity (intuition)
- Recognize non-stationary patterns (trend/seasonality)
- Explain why stationarity matters for ARIMA-type models

Learning Outcomes

- Define stationarity (intuition)
- Recognize non-stationary patterns (trend/seasonality)
- Explain why stationarity matters for ARIMA-type models
- List basic fixes (differencing, transforms)

Stationarity: Key Points

- Mean/variance roughly constant

Stationarity: Key Points

- Mean/variance roughly constant
- Autocorrelation depends on lag only

Stationarity: Key Points

- Mean/variance roughly constant
- Autocorrelation depends on lag only
- Trend/seasonality often implies non-stationarity

Fixes: Key Points

- Differencing removes trend

Fixes: Key Points

- Differencing removes trend
- Seasonal differencing removes seasonality

Fixes: Key Points

- Differencing removes trend
- Seasonal differencing removes seasonality
- Log transform can stabilize variance

Exercise 1: Trend

Is a strong upward trend likely stationary?

Solution 1

- No; mean changes over time.

Exercise 2: Variance change

If fluctuations grow over time, is variance constant?

Solution 2

- No; non-stationary variance.

Exercise 3: Fix choice

Name one fix for non-stationary mean.

Solution 3

- Differencing.

Mini Demo (Python)

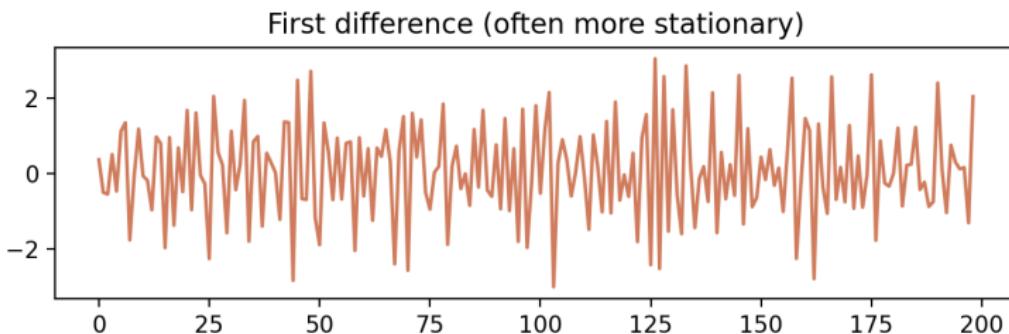
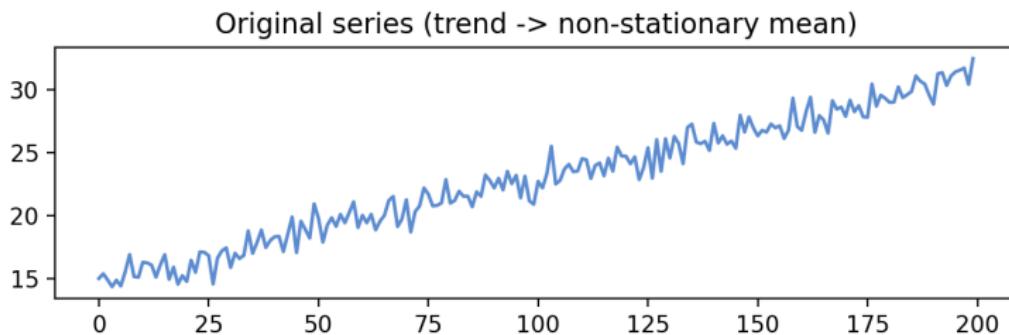
Run from the lecture folder:

```
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 does non-stationarity make forecasting harder?