

Statistics and Data Analysis

Unit 06 – Lecture 05 Notes

Tofik Ali

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Topic

Stationarity concept; why it matters; fixes like differencing.

Learning Outcomes

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

Detailed Notes

These notes are designed to be read alongside the slides. They expand each slide bullet into plain-language explanations, small worked examples, and common pitfalls. When a formula appears, emphasize (1) what each symbol means, (2) the assumptions needed to use it, and (3) how to interpret the final number in the problem context.

Stationarity

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

Fixes

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

Exercises (with Solutions)

Exercise 1: Trend

Is a strong upward trend likely stationary?

Solution

- No; mean changes over time.

Exercise 2: Variance change

If fluctuations grow over time, is variance constant?

Solution

- No; non-stationary variance.

Exercise 3: Fix choice

Name one fix for non-stationary mean.

Solution

- Differencing.

Exit Question

Why does non-stationarity make forecasting harder?

Demo (Python)

Run from the lecture folder:

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

Output files:

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

References

- Montgomery, D. C., & Runger, G. C. *Applied Statistics and Probability for Engineers*, Wiley.
- Devore, J. L. *Probability and Statistics for Engineering and the Sciences*, Cengage.
- McKinney, W. *Python for Data Analysis*, O'Reilly.