Statistics and Data Analysis
Unit 06 – Lecture 07 Notes

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Topic

ACF/PACF interpretation to guide AR/MA orders (rough).

Learning Outcomes

- Define ACF and PACF (intuition)
- Use ACF/PACF patterns to guess AR and MA orders (rough)
- Recognize slow ACF decay as non-stationarity hint
- Explain why validation/diagnostics are still needed

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.

ACF

- Corr(x_t, x_t-k) vs lag k
- Slow decay can suggest non-stationarity
- ACF cutoff after q lags can suggest MA(q) (rough)

PACF

- Partial correlation after removing lower lags
- PACF cutoff after p lags can suggest AR(p) (rough)
- Use with caution and validate

Exercises (with Solutions)

Exercise 1: ACF pattern

If ACF stays significant for many lags, what might it suggest?

Solution

- Non-stationary; try differencing.

Exercise 2: PACF AR hint

PACF cuts off after lag 2: what AR order to try?

Solution

- Try AR(2) as starting point.

Exercise 3: Rules not perfect

Why ACF/PACF rules are not perfect?

Solution

- Finite sample noise, seasonality, mixed ARMA.

Exit Question

How do ACF and PACF help choose ARIMA orders p and q?

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.