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5 SEM TDC DSE STS (CBCS) 2 (H) (N/O)

2024

(November)

STATISTICS

(Discipline Specific Elective)

(For Honours)

Paper : DSE-2

(Time Series Analysis)

*The figures in the margin indicate full marks
for the questions*

(New Course)

Full Marks : 55

Pass Marks : 22

Time : 3 hours

1. Choose the correct answer from the given alternatives : 1×5=5
- (a) What is the primary characteristic of time series data?
- (i) Measured at random intervals
 - (ii) Measured at successive points in time
 - (iii) Measured across different individuals
 - (iv) Measured over a single variable

(b) Variance in a time series is associated with

- (i) the level of stationarity
- (ii) the magnitude of fluctuations around the mean
- (iii) the trend component
- (iv) the cyclical component

(c) The process of estimating the parameters of ARIMA models is called

- (i) model fitting
- (ii) model identification
- (iii) model selection
- (iv) None of the above

(d) You are given the following seasonal indices for four quarters :

1.2, 0.9, 1.1, 0.8

What is the ratio-to-trend for the first quarter?

- (i) 1.15
- (ii) 1.2
- (iii) 1.1
- (iv) 0.9

(e) In exponential smoothing method, which parameter controls the smoothing level?

- (i) Alpha (α)
- (ii) Beta (β)
- (iii) Gamma (γ)
- (iv) Delta (δ)

2. Answer the following questions in brief :

2×5=10

- (a) Why we need separate analysis for time series data?
- (b) What is the difference between deterministic and stochastic trends?
- (c) Differentiate between seasonal and cyclical fluctuations in time series data with examples.
- (d) What is detrending? Why is it used in time series?
- (e) What is exponential smoothing and when is it used?

3. (a) Apply the method of link relatives to the following data and calculate seasonal indices :

10

Quarter	Quarterly figures				
	1995	1996	1997	1998	1999
I	6.0	5.4	6.8	7.2	6.6
II	6.5	7.9	6.5	5.8	7.3
III	7.8	8.4	9.3	7.5	8.0
IV	8.7	7.3	6.4	8.5	7.1

Or

- (b) What is Box-Jenkins method? Explain its procedure and applications in time series forecasting.

4. (a) Discuss the role of autocorrelation function and correlogram in analysing time series data. How are they useful for forecasting?

10

Or

- (b) What are the various methods used for estimating trend in time series? Discuss their advantages and limitations.

5. (a) Discuss the methods for estimating the seasonal component of a time series using simple averages and the ratio to trend method.

10

Or

- (b) Discuss the harmonic analysis for cyclic components in time series. How is it used to identify cycles in data?

6. Answer any *two* of the following : $5 \times 2 = 10$

(a) What is the random component in a time series? Explain the role of the variate component method.

(b) Define and differentiate between moving average (MA) and autoregressive (AR) processes.

(c) Define stationary time series and distinguish between weak and strong stationarity.

(5)

(Old Course)

Full Marks : 50

Pass Marks : 20

Time : 3 hours

1. Choose the correct answer from the following alternatives : 1×5=5

(a) What does autocorrelation measure in a time series?

- (i) The strength of the trend
- (ii) The correlation between different time series
- (iii) The similarity between a time series and a lagged version of itself
- (iv) The seasonal variation of the data

(b) Which type of time series component represents regular, repeated patterns in data within specific periods, like months or quarters?

- (i) Trend
- (ii) Seasonal
- (iii) Cyclic
- (iv) Random

- (c) The Autoregressive Integrated Moving Average (ARIMA) model is best suited for which of the following?
- (i) Data with a strong seasonal component
 - (ii) Stationary time series data
 - (iii) Non-stationary time series data
 - (iv) Data with no trend
- (d) Which statistical test is commonly used to check for stationarity in a time series?
- (i) *t*-test
 - (ii) *Z*-test
 - (iii) Augmented Dickey-Fuller test
 - (iv) Chi-square test
- (e) In an MA model, the current value is expressed as a function of
- (i) past values of the series
 - (ii) future values of the series
 - (iii) past forecast errors
 - (iv) current trend of the series

2. Answer the following questions in brief (any five) : $2 \times 5 = 10$

- (a) What do you mean by the stationarity of a time series?
- (b) Which component of time series can not be detected and why?
- (c) Define ARIMA (4, 1, 2).
- (d) Why is the term 'exponential' used in the exponential smoothing technique of forecasting?
- (e) What is time series? Define with example.
- (f) What are the components of time series? Define with example for each.

3. (a) Explain each step of ARIMA model. 10

Or

- (b) Write about the double-exponential smoothing or Holt's forecasting method.

4. Write short notes on the following (any three) : $5 \times 3 = 15$

- (a) Autocorrelation and correlogram
- (b) Time series decomposition
- (c) MA process and AR process
- (d) Weak stationary and strong stationary
- (e) Estimation of trend

5. (a) The table below shows the data of sale of nine years :

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales (in Lakh unit)	65	95	115	63	120	100	150	135	172

Fit the trend using free-hand curve method. Also write the merits and demerits of this technique. $6+4=10$

Or

- (b) Describe any two methods for estimating the seasonal component of time series. $5+5=10$
