2021

STATISTICS — HONOURS

Paper : CC-10

(Index Numbers and Time Series Analysis)

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer ***any five*** questions from ***question nos.* 1-8**. 2×5

1. How is the base period of an index number chosen?

2. Discuss a way of circumventing the homogeneity error.

3. How will you choose the weights for a Wholesale price index number ?

4. How can you use *differencing* to remove trend and seasonality ?

5. In an additive model on quarterly data with Q1, 2018 as t = 1, the (quarterly) seasonalities are 85, 105, 120, 90, respectively, while the intercept and slope of the fitted linear trend are 1000 and 5 respectively. Find the predicted value for Q3, 2021.

6. Give one example each of a deterministic and an indeterministic process.

7. Sketch the *autocorrelation function* of a MA(2) process.

8. If X_t and Y_t are independent stationary processes, show that the process $Z_t = X_t + Y_t$ is also stationary.

Answer ***any two*** questions from ***question nos.* 9-11**. 5×2

9. What is a Value Index? How is it related to the Laspeyre's and Paasche's indices? — Justify.

10. Describe in detail the technique of exponential smoothing.

11. Check whether the series $X_t = 0.83X_{t-1} + 0.25X_{t-2} + \varepsilon_t$, where $\varepsilon_t \sim N(0, \sigma^2)$, is stationary.

Answer ***any three*** questions from ***question nos.* 12-16**. 10×3

12. (a) While computing the weighted average of price relatives, why is the choice of weights for the Laspeyre's index more plausible than that of the Paasche's index?

(b) If either of the two is used in a chain base index, will it satisfy the time reversal test ?

(c) If all prices have exactly doubled in the current period (as compared to the base), thus inducing the current demand quantity of all commodities to fall to ¾ of the base period quantities, find a

relation between the Laspeyre's and Paasche's indices. 3+4+3

13. Three years daily data on $PM_{2.5}$, an air pollutant, is available from a road-side monitor. It is observed that the pollution level has been steadily increasing. It is also observed that owing to low traffic, the pollution levels over the weekends are considerably lower than for the rest of the week. Discuss in detail how you will analyse the data. 10

14. Show that Trend-value obtained by applying moving-Average method is actually a use of fitting a polynomial equation to time-series data. Use equations involving degree one and two of the time component. 10

15. (a) Define weak stationarity.

(b) Check whether the process $X_t = u_1 \text{ Cos } \lambda t + u_2 \text{ Sin } \lambda t$, $t = 1, 2, \ldots$,

where λ is a constant and u_1 and u_2 are independently distributed with means 0 and variances σ^2, is stationary or not. 2+8

16. (a) Derive the condition under which an AR(2) process is stationary.

(b) Derive the Yule-Walker equations for a stationary AR(2) process and discuss how you will estimate the parameters from them. 4+6