

ST. LAWRENCE HIGH SCHOOL A JESUIT CHRISTIAN MINORITY INSTITUTION



STUDY MATERIAL-16

SUBJECT – STATISTICS

Pre-test

Chapter: TIME SERIES ANALYSIS

Class: XII

Topic: COMPONENTS IN TIME SERIES

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TIME SERIES ANALYSIS

PART 1

INTRODUCTION:

If we observe or record numerical features of an individual or a population for different pointy of intervals of time, the set of observation forms a time series. The population of a country over a number of years temperature of a place noted on different days of a week, the weight of an animal recorded on different months, an yearly production of wheat are some common example of time series data. In fact, the familiar time series data, such as economic and demographic series, are usually available at equal intervals of time like days, years etc and hence throughout our discussions we shall consider only series of values given at equispaced intervals of time.

If Y be the value of time series at a time t, then mathematically it may be expressed as a function of t. in case of period data t is to be considered as mid point of the tth period.

It should be noted that past time series data are analysed to detect the nature of variations in the data and subsequently to enable one to plan the future judiciously. Such analysis is also important fdor business forecasting.

Adjustment of time series data :

Some preliminary adjustment of the time series data are sometimes necessary to make them aminable for statistical analysis. The raw data may not be comparable for several reasons. It is known as the number of days in calendar month, as well as the number of working days in various months are not same. It is therefore essential to convert monthly data into a standard period by necessary adjustment. For instance, to make the monthly data on industrial production comparable, the figure of each month is to be divided by number of working days in the considered month. Thus the figures are obtained per working day basis.

The data related to population or geographical regions should be transformed to per capita or per unit basis

Again with changes in the price level, the purchasing power of money changes. Hence monetary data are also not comparable over time. In order to bring the figures to a comparable basis, the effect of pricechanges are eliminated dividing the current period figured by a suitable price index number of the current period with the selected base period. This technique is called deflation.

Components of a time series:

When time series are graphically exhibited the variations can be readily observed. Apparently, the graph represents an overall picture of haphazard movement, but in reality it is not so the main factors present in the curve are -i) secular trend or trend (T)

- ii) Seasonal variation (S)
- iii) Cyclical variation (C)
- iv) Irregular fluctuation (I)

Mathematical models in time series:

Additive or sum model: $y_t = T + S + C + I$ Multiplicative or product model $y_t = T * S * C * I$

Description of components in time series:

Secular Trend or trend:

It shows a long term smooth monotonic pattern which shows the basic nature of data. Generally the time period should be taken at least 20 to 25 years. Example: population growth in India in last six decades.

Seasonal Variation:

It gives an oscillatory curve with period of oscillation not more than one year. During every period the curve attains the crest and trough at the same point of time but may differ in magnitude. Example during every winter of a year the sell of woolen garments in Kolkata increases and in summer decreases but the quantity of those sales may differ.

Cyclical variation

It gives an oscillatory curve with period of oscillation more than one year. During every period the curve attains the crest and trough at the same point of time but may differ in magnitude. Example recession in economy. Approximately after every six to ten years we face this recession.

Irregular fluctuation:

It has no specific pattern. It may happen due to catastrophical disorder like flood, earthquake, tsunami, COVD-19 pandemic and war. Example during flood the price of the salt rises abruptly.

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