

8. What are the main drawbacks in Graphic Method ?

**Solution :** The main drawbacks of the Graphical Method are :

- (i) This method is very subjective.
- (ii) It does not enable statisticians to measure trend.

9. Explain Semi-average Method with an example.

**Solution :** In this method, the whole data is divided into two parts with respect to time. Let us consider an example, we consider a period of 16 years, from 2001 to 2016. Here, we have taken data for  $y_t$  where  $t$  is assumed from 2001 – 2016. The two equal parts will be the data from 2001 to 2008 and 2009 to 2016. In case of odd number of years, the two parts are obtained by omitting the value of corresponding to the middle year. But, in this case, the value corresponding to middle year, namely, 2008 being omitted. Then, we have to compute the arithmetic mean for each part and we plot these two averages (A.M.) against the middle values of the respective time-periods covered by each part. The line obtained on joining these two points is the required trend line and it may be extended in both directions to estimate intermediate or future values.

10. What are the advantages (merits) of semi-average method ?

**Solution :** The advantages of semi-average method are :

- (i) This method is very simple and relatively objective as a freehand method.
- (ii) In this method, we classify the time series data into two equal parts and then calculate averages for each half. If the data is for even number of years, it is easily divided into two.

11. What are the curves used in the method of Curve Fitting by Principle of Least Squares. **(Important)**

**Solution :** The principle of Least Square method is very comprehensive method and it is widely used method of fitting mathematical functions to a given set of data. The method yields very correct results. Apart from the usual arithmetic scales, in this method semi-logarithmic or doubly-logarithmic scales may be used

for the graphical representation of the data. The various type of curves that may be used to describe the given data in practice are :

Suppose,  $y_t$  is the value of the variable corresponding to time  $t$ .

(i) A straight line :  $y_t = a + bt$

(ii) Second degree parabola :  $y_t = a + bt + ct^2$

(iii) kth- degree polynomial :  $y_t = a_0 + a_1t + a_2t^2 + \dots + a_kt^k$

(iv) Exponential Curves :  $y_t = ab^t$

$$\Rightarrow \log y_t = \log a + t \log b = A + Bt \text{ (say)}$$

(v) Second degree curve fitted to logarithms :  $y_t = ab^t c^{t^2}$

$$\Rightarrow \log y_t = \log a + t \log b + t^2 \log c = A + Bt + Ct^2 \text{ (say)}$$

(vi) Growth curves :

(a)  $y_t = a + bc^t$  (Modified Exponential curve)

(b)  $y_t = ab^{c^t}$  (Gompertz curve)

$$\Rightarrow \log y_t = \log a + c^t \log b = A + Bc^t \text{ (say)}$$

(c)  $y_t = \frac{k}{1 + \exp(a+bt)}$  (Logistic curve)

12. What are the merits (advantages) of Trend Fitting by the Principle of Least Squares ? **(Important)**

**Solution :** The merits of Trend Fitting by the Principle of Least Squares are :

(i) Due to mathematical or analytical character, this method completely eliminates the element of subjective judgement or personal bias on the part of the investigator.

(ii) Unlike the method of moving averages, this method enables us to compute the trend values for all the given time periods in the series.

(iii) The trend equation can be used to estimate or predict the values of the variable for any period  $t$  in future or even in the immediate periods of the given series and the forecast values are also quite reliable.

(iv) The curve fitting by the principle of least squares is the only technique which enables us to obtain the rate of growth per annum, for yearly data, if linear trend is fitted.

13. What are the demerits or drawbacks (disadvantages) of Trend Fitting by the Principle of Least Squares ? **(Important)**

**Solution :** The drawbacks or demerits of Trend Fitting by the Principle of Least Squares are :

(i) The method is quite tedious and time-consuming as compared with other methods.

(ii) It is rather difficult for a non-mathematical person to understand and use.

(iii) The addition of even a single new observation necessitates all calculations to be done a fresh.

(iv) Future predictions or forecasts based on this method are based only on the long term variation.

(v) The most serious limitation of this method is the determination of the type of the trend curve fitted.

(vi) It cannot be used to fit growth curves like Modified Exponential curve, Gompertz curve and Logistic curve to which most of the economic and business time series data conform.