

Miscellaneous

TESTING OF HYPOTHESIS

[May, 2011 examinations onwards this topic has been excluded from the existing syllabus]

Question 1

A factory manager contends that the mean operating life of light bulbs of his factory is 4,200 hours. A customer disagrees and says it is less.

The mean operating life for a random sample of 9 bulbs is 4,000 hours, with a sample standard deviation of 201 hours.

Test the hypothesis of the factory manager, given that the critical value of the test statistic as per the table is (-) 2.896. (6 Marks)(June, 2009)

Answer

Manager's Hypothesis $H_0 \quad \mu_0 = 4,200$

$H_1 \quad \mu < 4,200$ (Left Tail test)

$$t = \frac{\bar{x} - \mu_0}{\sigma}$$

$$\text{where } \sigma = \frac{s}{\sqrt{n}} = \frac{201}{\sqrt{9}} = \frac{201}{3} = 67$$

$$t = \frac{4,000 - 4,200}{67} = \frac{-200}{67} = -2.985$$

Calculated $t = 2.985$, < table value of $t_{.01}$ (sdf) which is -2.896

Hence reject the null hypothesis H_0 . i.e. Accept H_1

The customer's claim is correct.

Question 2

In the past, a machine has produced pipes of diameter 50 mm. To determine whether the machine is in proper working order, a sample of 10 pipes is chosen, for which mean diameter is 53 mm and the standard deviation is 3 mm. Test the hypothesis that the machine is in proper working order, given that the critical value of the test statistic from the table is 2.26.

(4 Marks)(Nov., 2009)

Answer

Null Hypothesis $H_0 : \mu = 50$ mm i.e. the M/c works properly.

$H_1 : \mu \neq 50$ mm. i.e. the M/c does not work properly

Sample Size = 10, small.

use 't' statistic

$$t = \frac{\bar{x} - \mu}{S / \sqrt{n-1}}$$

$$\bar{x} = 53$$

$$\mu = 50$$

$$n = 10; \sqrt{n-1} = \sqrt{9} = 3$$

$$S = \text{std dev} = 3$$

$$T = \frac{53-50}{3/3} = \frac{3}{1} = 3$$

Table Value = 2.26

Calculated t > table value

Reject H_0

i.e. The M/c is not working properly.

Question 3

A potato chips manufacturing company decided that the mean net weight per pack of its product must be 90 grams. A random sample of 16 packets yields a mean weight of 80 grams with standard deviation of 17.10 grams. Test the hypothesis that the mean of the whole universe is less than 90, use level of significance of (a) 0.05 (b) 0.01. (5 Marks)(Nov., 2010)

Answer

Test of Hypothesis

$$H_0 : \mu_0 = 90$$

$$H_1 : \mu_0 < 90 \text{ (Left tail test)}$$

As n is small, <30, we use the t Statistic

$$t = (\bar{X} - \mu_0) / \sigma$$

$$\sigma = S / \sqrt{n} = 17.10 / \sqrt{16} = 4.275$$

$$t = (80 - 90) / 4.275 = -2.339 \approx -2.4$$

Calculated t = -2.339, < table value of $t_{.05}(15 \text{ degrees of freedom})$ which is -1.753 Hence, reject the null hypothesis at 5% level of significance

Calculated $t = -2.339$, $>$ table value of $t_{.01}$ (15 dof) which is -2.602 . Hence, accept the null hypothesis at 1% level of significance.

TIME SERIES ANALYSIS & FORECASTING

[May, 2011 examinations onwards this topic has been excluded from the existing syllabus]

Question 4

Point out the errors in the network given below, going by the usual conventions while drawing a network to use CPM
(6 Marks)(May, 2011)

Answer

Flows

2 – 3 : There are 2 activities which are duplicate. In case they are two different activities, one may pass through a dummy

2 – 5: is a dangling activity; No complete path exists.
Can be joined to (9) with a dummy

4 – 6 & 6 – 4 : looping exists; This is not proper sequencing

Question 5

What is trend? What are the various methods of fitting a straight line to a time series?

(3 Marks) (Nov., 2008)

Answer

Trend is the long term movement of a time series. Any increase or decrease in the values of a variable occurring over a period of several years gives a trend.

The various methods of fitting a straight line to a time series are:

- (i) Free hand method.
- (ii) The method of semi-averages.
- (iii) The method of moving averages.
- (iv) The method of least squares.

Question 6

Name the various methods of fitting a straight line to a time series and briefly explain any two of them.
(5 Marks)(June, 2009)

Answer

The various methods of fitting a straight line are:

- (i) Free hand method

- (ii) Semi-average
- (iii) Moving average
- (iv) Least square

Freehand method: First the time series figures are plotted on a graph. The points are joined by straight lines. We get fluctuating straight lines, through which an average straight line is drawn. This method is however, inaccurate, since different persons may fit different trend lines for the same set of data.

Method of Semi Averages: The given time series is divided into two parts, preferably with the same number of years. The average of each part is calculated and then a trend line through these averages is fitted.

Moving Average Method: A regular periodic cycle is identified in the time series. The moving average of n years is got by dividing the moving total by n . The method is also used for seasonal and cyclical variation.

Method of Least Squares: The equation of a straight line is $Y = a + bX$, where X is the time period, say year and Y is the value of the item measured against time, a is the Y intercept and b , the co-efficient of X , indicating the slope of the line. To find a and b , the following 'normal' equations are solved.

$$\sum Y = an + b \sum X$$

$$\sum XY = a \sum X + b \sum X^2$$

Where n is the no. of observation in the series or $n =$ no. of data items.

Question 7

Identify the characteristics movement such as regular, irregular, cyclical, seasonal, long-term trend, short-term etc. of time series in the following situations:

- (i) *A factory delaying its production due to demolition of factory shed in earthquake.*
- (ii) *An era of depression in business.*
- (iii) *The country needs more and more food grains due to constant growth of population.*
- (iv) *Decline in death rate due to availability of proper health care facilities.*
- (v) *A continuous increase in demand of small cars.*
- (vi) *A demand of gold products is increasing during the festival time. (3 Marks) (May, 2010)*

Answer

- (i) Irregular
- (ii) Cyclical
- (iii) Long Term Trend

- (iv) Long term Trend
- (v) Long Term Trend

Question 8

Discuss various forecasting methods using time series.

(5 Marks)(Nov., 2010)

Answer

Forecasting methods using Time series.

- (i) Mean forecast: In this method we calculate mean of the series for the time period t and take this value as representative of the future time series. $Y_t = Y$
- (ii) Naïve forecast:-This method is based on the assumption that the future will exactly resemble the past. We forecast the value, for the time period t , to be equal to the actual value observed in the previous period t that is, time period $(t-1)$ $Y_t = Y_{t-1}$
- (iii) Linear trend forecast: A linear relationship is established between the time and the variable under study, which may be represented by $Y_t = a + bX$

Where X will be found from the value of t and a and b are constants.

- (iv) Non –linear trend forecast: In this method, a non-linear relationship between the time and the response value has been found again by least squares method. Then the value, for the time period t , will be calculated from the non-linear equation;

$$Y_t = a + bX + cX^2$$

- (v) Forecasting by exponential smoothing: In this method, the forecast value for the time period t is found using exponential smoothing of time series

$$Y_t = Y_{t-1} + a (Y_t - Y_{t-1}) \text{ where } Y_{t-1} = \text{the forecasted value for time period } t$$

$Y_t =$ the observed value for time period t .