INSTITUTE OF INFORMATION TECHNOLOGY

JAHANGIRNAGAR UNIVERSITY

Number of Assignment : 02

Submission Date : 07/09/2020

Course Tittle : Numerical Analysis

Course Code : ICT - 2105

Submitted To	**Submitted By**
Dr M Shamim Kaiser	MD. Shakil Hossain
Professor	Roll – 2023
IIT – JU	2^{nd} year 1^{st} Semester
	IIT – JU

Roll — 2023

Curve Fitting Method.

Let $Y = a_0 + a_1 x$ be the straight line to be Points be (x_i, y_i) when $i = 1, 2 \dots n$. and the curve given by $y = f(x)$. At $x = x_i$ the exponential value of the ordinate is y_i and corresponding value of fitting curve is $f(x_i)$. It is the error of approximate at $x = x_i$, then we have

$$e_i = y_i - f(x_i)$$

if we write

$$S = [y_1 - f(x_1)]^2 + [y_2 - f(x_2)]^2 + \dots + [y_n - f(x_n)]^2$$

from $Y = a_0 + a_1 x$ we can write

$$S = [y_1 - (a_0 + a_1 x_1)]^2 + [y_2 - (a_0 + a_1 x_2)]^2 + \dots + [y_m - (a_0 + a_1 x_m)]^2$$

for s to be minimum we have $\frac{\delta s}{\delta a_0} = 0.$

$$\therefore \frac{\delta s}{\delta a_0} = \frac{\delta}{\delta a_0}\left[y_1^2 + (a_0+a_1x_1)^2 - 2y_1(a_0+a_1x_1) + y_2^2 + (a_0+a_1x_2)^2 - 2y_2(a_0+a_1x_2) + \cdots\right.$$

$$\Rightarrow 0 = 2(a_0+a_1x_1) - 2y_1 + 2(a_0+a_1x_2) - 2y_2 + \cdots$$

$$\Rightarrow 0 = -2\left[y_1 - (a_0+a_1x_1)\right] - 2\left[y_2 - (a_0+a_1x_2)\right] - \cdots$$

$$\Rightarrow 0 = -2y_1 + 2a_0 + 2a_1x_1 - 2y_2 + 2a_0 + 2a_1x_2 - \cdots$$

$$\therefore ma_0 + a_1(x_1+x_2+\cdots+x_m) = y_1+y_2+\cdots+y_m \quad \text{---} (1)$$

For s to be minimum $\frac{\delta s}{\delta a_1} = 0$

$$\therefore \frac{\delta s}{\delta a_1} = \frac{\delta}{\delta a_1}\left[y_1^2 + (a_0+a_1x_1)^2 - 2y_1(a_0+a_1x_1) + y_2^2 + (a_0+a_1x_2)^2 - 2y_2(a_0+a_1x_2) + \cdots\right.$$

$$\Rightarrow 0 = 2(a_0+a_1x_1)\cdot x_1 - 2x_1y_1 + 2(a_0+a_1x_2) - 2x_2y_2 + \cdots$$

$$\Rightarrow 0 = -2x_1\left[y_3 - (a_0+a_1x_1)\right] - 2x_2\left[y_2 - (a_0+a_1x_2)\right] \cdots$$

$$\therefore a_0(x_1+x_2+x_3+\cdots+x_m)+a_1(x_1^2+x_2^2+\cdots)=x_1y_1 + x_2y_2+\cdots\cdots+x_my_m \quad \text{——} (2)$$

more Compactly to

$$ma_0+a_1\sum_{i=1}^{m}x_i=\sum_{i=1}^{m}y_i$$

and $$a_0\sum_{i=1}^{m}x_i+a_1\sum_{i=1}^{m}x_i^2=\sum_{i=1}^{m}x_iy_i$$

Since the x_i and y_i are known quantities equation can be solved for the two unknown a_0 and a_1.

Exercise 4.2

For finding the Value of a_0 and a_1 we can use least square curve fitting equation.

$$m a_0 + a_1 \sum_{i=1}^{m} x_i = \sum_{i=1}^{m} y_i \quad \text{--- (1)}$$

$$a_0 \sum_{i=1}^{m} x_i + a_1 \sum_{i=1}^{m} x_i^2 = \sum_{i=1}^{m} x_i y_i \quad \text{--- (2)}$$

x_i	y_i	x_i^2	$x_i y_i$
0	1.0	0	0
1	2.9	1	2.9
2	4.8	4	9.6
3	6.7	9	20.1
4	8.6	16	34.4
$\sum x_i = 10$	$\sum y_i = 24$	$\sum x_i^2 = 30$	$\sum x_i y_i = 67$

From equation (1) and (2)

$$5a_0 + 10a_1 = 24$$
$$10a_0 + 30a_1 = 67$$

$\therefore$ $a_0 = 1$ [By Using Calculator]

$a_1 = 1.9$

Exercise 4.3

Given $y = a_0 + a_1 x$ —— ①

we know that

$$m a_0 + a_1 \sum_{i=1}^{m} x_i = \sum_{i=1}^{m} y_i \quad \text{—— ②}$$

Comparing equation ① and ②

$$m = 1$$

$$y = \sum_{i=1}^{m} y_i$$

$$x = \sum_{i=1}^{m} x_i$$

$$L.H.S = \begin{vmatrix} x & y & 1 \\ \Sigma x_i & \Sigma y_i & m \\ \Sigma x_i^2 & \Sigma y_i^2 & \Sigma x_i \end{vmatrix}$$

$$= \begin{vmatrix} x & y & 1 \\ x & y & 1 \\ \Sigma x_i^2 & \Sigma y_i^2 & \Sigma x_i \end{vmatrix}$$

$$= 0 \quad = R.H.S$$

$\therefore$ L.H.S = R.H.S [showed]