

Curve Fitting:

x	x_1	x_2	...	x_n
y	y_1	y_2	...	y_n

① Fitting st. line by least square:

$$y = a + bx$$

$$\begin{aligned}\Sigma y &= na + b \Sigma x \\ \Sigma xy &= a \Sigma x + b \Sigma x^2\end{aligned}$$

② Fitting second degree parabola:

$$y = a + bx + cx^2$$

$$\begin{aligned}\Sigma y &= na + b \Sigma x + c \Sigma x^2 \\ \Sigma xy &= a \Sigma x + b \Sigma x^2 + c \Sigma x^3 \\ \Sigma x^2 y &= a \Sigma x^2 + b \Sigma x^3 + c \Sigma x^4\end{aligned}$$

Q1) Fit the st. line curve $y = a + bx$ for the foll. data using least sq. method

x	1	2	3	4	5	6	7	8
y	2.4	3	3.6	4	5	6	7	8

x	1	2	3	4	6	8
y	2.4	3	3.6	4	5	6

Soln:

x	y	xy	x^2
1	2.4	2.4	1
2	3	6	4
3	3.6	10.8	9
4	4	16	16
6	5	30	36
8	6	48	64
24	24	113.2	130

Here $n = 6$

$$y = a + bx$$

$$\sum y = na + b \sum x$$

$$24 = 6a + b(24) \quad \text{--- (1)}$$

$$\sum xy = a \sum x + b \sum x^2$$

$$113.2 = 24a + 130b \quad \text{--- (2)}$$

Solving, $a = 1.9765$

$b = 0.5059$

$$y = 1.9765 a + 0.5059 Bx$$

q. Fit a curve of the form $y = a + bx + cx^2$ for foll. data using least sq. method

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

Soln:

x	y	xy	x^2y	x^2	x^3	x^4
0	1	0	0	0	0	0
1	1.8	1.8	1.8	1	1	1
2	1.3	1.3	5.2	4	8	16
3	2.5	2.5	22.5	9	27	81
4	6.3	6.3	100.8	16	64	256
10	12.4	37.1	130.3	30	100	354

$$y = a + bx + cx^2$$

Egns:

$$5a + 10b + 30c = 12.9$$

$$10a + 30b + 100c = 37.1$$

$$30a + 100b + 354c = 130.3$$

On solving, $a = 1.42$ $b = -1.07$
 $b = -1.0$ $b = -1.09$

$$c = 0.55$$

$$y = 1.42 - 1.07x + 0.55x^2$$

Exp. curve

$$y = ab^x$$

Taking \log_{10} , ~~on~~

~~logs~~

$$\log_{10} y = \log_{10} a + x \log_{10} b$$

\downarrow \downarrow \downarrow
 Y A B

$$Y = A + Bx$$

$$Y = A + Bx$$

Normal eqⁿ:

$$\sum Y = nA + B \sum x$$

$$\sum xY = A \sum x + B \sum x^2$$

Q Fit the curve $y = ab^x$ by using least sq. method to the foll. data & find y at $x=8$

x	1	2	3	4	5	6	7
y	87	97	113	129	202	195	193

$$y = ab^x$$

$$\log y = \log a + x \log b$$

$$Y = A + Bx$$

$$n = 7$$

$$\Sigma Y =$$

$x=x$	y	$Y = \log y$	xy	x^2
1	87	4.4659	4.4659	1
2	97	4.5747	9.1444	4
3	113	4.7279	14.1822	9
4	129	4.8598	14.4392	16
5	202	5.3083	26.5913	25
6	195	5.2730	31.6380	36
7	193	5.2627	36.5388	49
28		34.9718	142.2549	142

Putting in Eqn

$$7A + 26B = 34.9718$$

$$\cancel{28A + 142.2549B}$$

$$\cancel{2A} \quad 28A + 142B = 142.2549$$

$$A = 4.3$$

$$B = 0.15598$$

$$A = \log_e a$$

$$a = e^{4.3}$$

$$a = 73.6999$$

$$b = e^B = e^{0.15599}$$

$$b = 1.1688$$

$$y = ab^x$$

$$y = (73.6998$$

$$y = 73.6998 (1.1688)^x$$

Multiple Regression

$$z = a + bx + cy$$

$$\sum z = na + b \sum x + c \sum y$$

$$\sum xz = a \sum x + b \sum x^2 + c \sum xy$$

$$\sum yz = a \sum y + b \sum xy + c \sum y^2$$