DPP-7 Maths-IV Unit-3

Topic - Curve Fitting

Q-1: Using method of least square, fit second degree parabola $y = a+bx+cx^2$ for following data.

x:	2	3	4	5	6
y:	14	17	20	24	29

Sol- Equation of parabola

$$y = a+bx+cx^2 \quad \text{—} (1)$$

Normal equations-

$$\Sigma y = na+b\Sigma x+c\Sigma x^2 \quad \text{—} (2)$$

$$\Sigma xy = a\Sigma x+b\Sigma x^2+c\Sigma x^3 \quad \text{—} (3)$$

$$\Sigma x^2y = a\Sigma x^2+b\Sigma x^3+c\Sigma x^4 \quad \text{—} (4)$$

$n = 5$

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x	y	xy	x^2	x^3	x^4	x^2y
2	14	28	4	8	16	56
3	17	51	9	27	81	153
4	20	80	16	64	256	320
5	24	120	25	125	625	600
6	29	174	36	216	1296	1044
$\Sigma x = 20$	$\Sigma y = 104$	$\Sigma xy = 453$	$\Sigma x^2 = 90$	$\Sigma x^3 = 440$	$\Sigma x^4 = 2274$	$\Sigma x^2y = 2173$

Put values in normal equations

$$104 = 5a + 20b + 90c$$

$$453 = 20a + 90b + 440c$$

$$2173 = 90a + 440b + 2274c$$

On solving these equations we get,

$$a = 11, \quad b = 0.842, \quad c = 0.357$$

Hence required equation

$$\boxed{y = 11 + 0.842x + 0.357x^2}$$

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Q-2:- Using the method of least square, if a parabolic curve of second degree to the following data -

x	0	1	2	3	4
y	1	1·8	1·3	2·5	6·3

Sol:- Equation of parabola -

$$y = a + bx + cx^2 \quad -(1)$$

Normal equations :- $\Sigma y = na + b\Sigma x + c\Sigma x^2 \quad -(2)$

$$\Sigma xy = a\Sigma x + b\Sigma x^2 + c\Sigma x^3 \quad -(3)$$

$$\Sigma x^2 y = a\Sigma x^2 + b\Sigma x^3 + c\Sigma x^4 \quad -(4)$$

x	y	xy	x^2	x^3	x^4	x^2y
0	1	0	0	0	0	0
1	1·8	1·8	1	1	1	1·8
2	1·3	2·6	4	8	16	5·2
3	2·5	7·5	9	27	81	22·5
4	6·3	25·2	16	64	256	100·8
$\Sigma x = 10$	$\Sigma y = 12·9$	$\Sigma xy = 37·1$	$\Sigma x^2 = 30$	$\Sigma x^3 = 100$	$\Sigma x^4 = 354$	$\Sigma x^2 y = 130·3$

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Put all values in normal equations -

$$12 \cdot 9 = 5a + 10b + 30c$$

$$37 \cdot 1 = 10a + 30b + 100c$$

$$130 \cdot 3 = 30a + 100b + 354c$$

On solving these equations

$$a = 1 \cdot 42$$
$$b = -1 \cdot 07$$
$$c = 0 \cdot 55$$

Hence required equation

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

$$\boxed{y = 1 \cdot 42 - 1 \cdot 07x + 0 \cdot 55x^2}$$

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