**Tutorial No 2**

**Least Squares Straight Line**

For a given set of N data points (X1, y1), (X2, Y2), …… , (XN, YN) assume that the straight line

Y= a0 + a1X= f(X) … (1)

fits to the data in the least squares sense.

Normalized equation are given by

 = 

 = 

known as "**Normal equations**". In such a case Equation (1) represents a least squares straight line.

**Fitting of straight line**

1. Fit a straight line to the following data.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year x : | 1951 | 1961 | 1971 | 1981 | 1997 |
| Production y (000 tons) : | 10 | 12 | 8 | 10 | 15 |

Also estimate the production in 1987. [**Ans**: 12.28.]

1. Find the best fitting straight line y = a + bx to the following data.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| (i) | x | 1 | 2 | 3 | 4 | 5 |  |
|  | y | 4 | 3 | 6 | 7 | 11 | [**Ans.:** y = 5.909x + 0.965] |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| (ii) | x | 5 | 10 | 15 | 20 | 25 |  |
|  | y | 15 | 19 | 23 | 26 | 30 | [**Ans.:** y = 0.74x + 11.5] |

1. Find the best fitting straight line y = a +bx to the following data.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| i) | x | 1 | 2 | 3 | 4 | 5 |  |
|  | y | 14 | 27 | 40 | 55 | 68 | [**Ans.:** y = 13.6x] |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ii) | x | 1 | 2 | 3 | 4 | 5 | 6 |  |
|  | y | 1200 | 900 | 600 | 200 | 110 | 50 | [**Ans.:** y = 1361.97 − 243.42x] |

1. Fit a straight line to the following data and estimate the production in the year 1957

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year:** | 1951 | 1961 | 1971 | 1981 | 1991 |
| **Production in the Thousand tons:** | 10 | 12 | 08 | 10 | 13 |

[**Ans.:** y = −68.24 + 0.04x; Production in 1957 = 10.04 thousand tons]

1. Fit a straight line to the following data and estimate y when x = 12

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| y | 52.5 | 58.7 | 65.0 | 70.2 | 75.4 | 81.1 | 87.2 | 95.5 | 102.2 | 108.4 |

[**Ans.:** Y = 79.62 + 3.08X where X = (x − 5.5)2, when x = 12, y = 119.66