**Problem 3**

Do the problem and answer all the questions.

Hint for question: Compare the errors on the basis of the Mean Absolute Deviation (MAD)?

Copy and paste the following data set in Excel to save the typing effort and possible mistakes in data entry.

|  |  |
| --- | --- |
| Year | Shipments |
| 1985 | 14,705 |
| 1986 | 15,064 |
| 1987 | 16,676 |
| 1988 | 18,061 |
| 1989 | 21,327 |
| 1990 | 23,738 |
| 1991 | 26,966 |
| 1992 | 32,411 |
| 1993 | 38,851 |
| 1994 | 47,894 |
| 1995 | 60,171 |
| 1996 | 71,065 |
| 1997 | 82,400 |
| 1998 | 97,321 |

**Solution**

1. Construct a scatter diagram between year (year 1985 is equivalent to x =1) and shipments. Add a linear trend line and a fitted equation to the chart.
2. Use the linear equation obtained from the chart to forecast the shipments from 1985 – 1998.

1985 Y = (6115.6\*1) -5391.90 = 723.70

1986 Y = (6115.6\*2) -5391.90 = 6839.30

1987 Y = (6115.6\*3) -5391.90 = 12954.90

1988 Y = (6115.6\*4) -5391.90 = 19070.50

1989 Y = (6115.6\*5) -5391.90 = 25186.10

1990 Y = (6115.6\*6) -5391.90 = 31301.70

1991 Y = (6115.6\*6) -5391.90 = 37417.30

1992 Y = (6115.6\*6) -5391.90 = 43532.90

1993 Y = (6115.6\*6) -5391.90 = 49648.50

1994 Y = (6115.6\*6) -5391.90 = 55764.10

1995 Y = (6115.6\*6) -5391.90 = 61879.70

1996 Y = (6115.6\*6) -5391.90 = 67995.30

1997 Y = (6115.6\*6) -5391.90 = 7410.90

1998 Y = (6115.6\*6) -5391.90 = 80226.50

1. Construct a scatter diagram between year (year 1985 is equivalent to x =1) and shipments. Add a quadratic trend line and a fitted equation to the chart.

d.) Use the quadratic equation obtained from the chart to forecast the shipments from 1985 – 1998.

1985 =(0.61701\*(1^2))-(3139.5\*13)+19288

1986 =(0.61701\*(2^2))-(3139.5\*2)+19288

1987 =(0.61701\*(3^2))-(3139.5\*3)+19288

e.) Compute the errors for each forecast and compare the errors produced by using the two different fitted equations.

Comparison of the methods based on MAD. 

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Shipments | Forecast Linear | Forecast Quadratic | Abs Deviation Linear | Abs Deviation Quadratic |
| 1 | 14,705 | 723.70 | 13011.47 | 13981 | 1694 |
| 2 | 15,064 | 6839.30 | 9875.05 | 8225 | 5189 |
| 3 | 16,676 | 12954.90 | 6739.87 | 3721 | 9936 |
| 4 | 18,061 | 19070.50 | 3605.93 | -1010 | 14455 |
| 5 | 21,327 | 25186.10 | 473.21 | -3859 | 20854 |
| 6 | 23,738 | 31301.70 | -2658.27 | -7564 | 26396 |
| 7 | 26,966 | 37417.30 | -5788.51 | -10451 | 32755 |
| 8 | 32,411 | 43532.90 | -8917.52 | -11122 | 41329 |
| 9 | 38,851 | 49648.50 | -12045.30 | -10798 | 50896 |
| 10 | 47,894 | 55764.10 | -15171.84 | -7870 | 63066 |
| 11 | 60,171 | 61879.70 | -18297.15 | -1709 | 78468 |
| 12 | 71,065 | 67995.30 | -21421.43 | 3070 | 92486 |
| 13 | 82,400 | 74110.90 | -24544.07 | 8239 | 106944 |
| 14 | 97,321 | 80226.50 | 19288.00 | 17095 | 78033 |
|  |  |  | MAD | -0.10 | 44464.33 |