4.3 REGRESSION CURVE FITTING


Using this feature the user can fit an analytic function to a data.
The program allows four types of functions:

1. Polynomial  : 1st to the 8th order polynom (A+B*X+C*X^2+.....
                 ..+H*X^8). The data should be in the form of two
                 columns, the first column is the dependent variable
                 and the second is the independent variable.
2. Log/power   : Product of powers (8 max) (A*B^X*C^Y*.....*H^U), the
                 data can be in the form of 2 to 8 columns. The first
                 column is the independent variable.
3. Exponent    : A*EXP(X), and the data should be in the form of two
                 columns, the first column is the dependent variable
                 and second is the independent variable.
4. Multi_linear: Linear function of 8 variables maximum,
                 (A+B*Y+C*Y+.......+H*U) the data can be in the form
                 of 2 to 8 columns. The first column is the dependent
                 variable.


Where:

A,B,C...H - Coefficients to be found
X,Y,....U - Independent variables


4.3A <C>urve_fit


Choose the <C>urve_fit menu item to get the next menu:

Import Poly. Log/power Exp. Multi_linear Data_save Graph_save Help


4.3B <I>mport


Choose the <I>mport menu item to get the next prompt:

Input the file name - ISRA6

Type the file name and press ENTER to view the next screen :

---

Import Poly. Log/power Exp. Multi_linear Data_save Graph_save  Help
Import data file (list) of numbers                 [ESC] – Previous menu
          A              B              C              D              E
1 =====================================================================
2         Units          |        Output/Input       |       Memory      |
3 =====================================================================
4   None                 |                   0.00 |                  0.00|
5 =====================================================================
         GA             GB             GC             GD             GE
3      8.154845          1
4      22.16716          2
5      60.25661          3
6      163.7944          4

```
7          445.2394              5
8          1210.286              6
9          3289.899              7
10         8942.873              8
11         24309.25              9
12         66079.39             10
13
14
15
16
```

---

NOTE: The imported data file represents an exponent function.


4.3C <P>olynomial


Press <p> to get the next prompt:

Polynom order (8 max) - 3

The user can choose 1st to 8th order polynom.

In this example we will try to fit a 3rd order polynom to the data.
The program will display the regression curve fitting graphs (the data
and the fitted curve (see POLYNOM3.PIC). If you print this graph using
Lotus PRINTGRAPH you will find that we need to use higher order
polynom.

Type 3 and press ENTER to view the graph.

Press [ESC] to see the next screen:

---

```
Import Poly. Log/power Exp. Multi_linear Data_save Graph_save  Help
Import data file (list) of numbers                  [ESC] - Previous menu
            A               B           C            D              E
 1 ================================================================
 2        Units         |       Output/Input      |        Memory        |
 3 ================================================================
 4    None              |                  0.00 |                    0.00|
 5 ================================================================
       FQ          FR         FS         FT         FU        FV        FW
 3           Regression Output:
 4    Constant                    -15553.4
 5    Std Err of Y Est            4428.812
 6    R Squared                   0.970260
 7    No. of Observations              10
 8    Degrees of Freedom               6
 9
10    X Coefficient(s)
11
12    17328.98 -4880.03 391.9952
13
14    Std Err of Coef.
15
16    6442.657 1328.901 79.68790
```

This is the standard Lotus regression output table.

The fitted curve can be expressed analytically as:

Y = -15553.4 +17328.98*X -4880.03*X^2 + 391.9952*X^3


4.3D <L>og/power


This option enables the use of a product of powers

like:    A * B$^x$ * C$^y$ ... G$^u$

as the fitted function.

Where x,y and u are to be determined and A,B,C and G are known. The
maximum number of products is 8, but the user needs to use only the
number of data columns less 1. For example if the data file includes 7
columns the first column is the dependent function and the rest 6 are
for the independent variables, therefore the user can fit a function
which is a product of 6 powers maximum. In our example we have only
two columns therefore we need to choose 1 power only.

Press <L> to get the next prompt:

Number of powers (Number of columns LESS ONE!, 8 max) - 1

Since in this example we have only two columns type 1 and press ENTER.

The program displays the regression curve fitting graphs as Log-Log
graph (the data and the fitted curves, see LOG1.PIC). If you print
this graph using Lotus PRINTGRAPH you will find that the log/power
option doesn't fit so well.

Press [ESC] to get the next screen:

---

```
Import Poly. Log/power Exp. Multi_linear Data_save Graph_save  Help
Import data file (list) of numbers                 [ESC] - Previous menu
            A              B             C            D              E
 1 ======================================================================
 2        Units          |        Output/Input      |      Memory       |
 3 ======================================================================
 4    None                |                   0.00  |             0.00|
 5 ======================================================================
       FQ          FR          FS         FT        FU        FV        FW
 3            Regression Output:
 4    Constant                    0.661512
 5    Std Err of Y Est            0.986340
 6    R Squared                   0.905661
 7    No. of Observations              10
 8    Degrees of Freedom                8
 9
10   X Coefficient(s)
```

```
11
12   3.930705
13
14   Std Err of Coef.
15
16   0.448525
```

In this screen it can be seen that R Squared is far from 1, as the
R Squared gets closer to 1 the better the fit is.

The fitted curve can be expressed as:

$LN(Y) = .661512 + 3.930705 * LN(X)$

and by representing the constant .661512 as LN(EXP(.661512)) we can
write:

$Y = EXP(.661512) * X^{3.930705}$

in case of more powers the function can be expressed as:

$Y = EXP(Constant) * X^{coef1} * Y^{coef2} *.....$

4.3D <E>xponent

The program displays the regression curve fitting graphs as Log(Y) vs.
X (the data and the fitted curves, see EXPONENT.PIC). If you print
this graph using Lotus PRINTGRAPH you will find that it fits well.

Press [ESC] to view the next screen:

```
Import Poly. Log/power Exp. Multi_linear Data_save Graph_save  Help
Import data file (list) of numbers                 [ESC] - Previous menu
              A              B           C            D           E
1  ================================================================
2        Units         |       Output/Input      |        Memory        |
3  ================================================================
4    None              |                  0.00 |                    0.00|
5  ================================================================
        FQ          FR         FS         FT        FU        FV        FW
3           Regression Output:
4    Constant                  1.098612
5    Std Err of Y Est          0.000000
6    R Squared                        1
7    No. of Observations             10
8    Degrees of Freedom               8
9
10   X Coefficient(s)
11
12   1.000000
13
14   Std Err of Coef.
15
16   0.000000
```

In this screen it can be seen that R Squared=1 therefore the curve is
well fitted.

The fitted curve can be expressed as:

LN(Y) = 1.098612 + 1 * X

by representing the constant 1.098612 as LN(EXP(1.098612)) we can
write:

Y = EXP(1.098612) * EXP(X^1)

and in general terms:

Y = EXP(constant) * EXP(X)


4.3E <M>ulti-linear


Press <m> to get the next prompt:

Number of independent variables (Number of columns LESS ONE!,8max) - 1

In this example we will try to fit a 1 variable linear function to the
data (because the imported file has only two columns). To see the
results you can print the file (LINEAR.PIC).

Type 1 and press ENTER to view the graph.

Press [ESC] to get the next screen:

---

```
Import Poly. Log/power Exp. Multi_linear Data_save Graph_save  Help
Import data file (list) of numbers                 [ESC] - Previous menu
           A              B              C              D              E
1 ======================================================================
2         Units        |        Output/Input      |        Memory      |
3 ======================================================================
4    None              |                   0.00 |                   0.00|
5 ======================================================================
       FQ         FR         FS         FT         FU         FV         FW
3           Regression Output:
4    Constant                    -16853.7
5    Std Err of Y Est            15506.45
6    R Squared                   0.513903
7    No. of Observations               10
8    Degrees of Freedom                 8
9
10   X Coefficient(s)
11
12   4964.891
13
14   Std Err of Coef.
15
16   1707.204
```

In this screen it can be seen that R Squared is far from 1 (we tried
to fit a linear function to data which describes an exponent), as R
Squared get closer to 1 the better the fit is.

The fitted curve can be expressed as:

FUNC = Constant + coef1*X1 + coef2*X2 + .....