Engin 103
Fall '06
Meeting #24: Nov 28, 2006

Binary representation: CW#7

Similar to a decimal representation that uses powers of 10 and coefficients between 0 and 9:

$188 = \underline{0} \times 10^7 + \underline{0} \times 10^6 + \underline{0} \times 10^5 + \underline{0} \times 10^4 + \underline{0} \times 10^3 + \underline{1} \times 10^2 + \underline{8} \times 10^1 + \underline{8} \times 10^0$

A binary representation uses powers of 2 and coefficients 0 or 1:

$188 = \underline{1} \times 2^7 + \underline{0} \times 2^6 + \underline{1} \times 2^5 + \underline{1} \times 2^4 + \underline{1} \times 2^3 + \underline{1} \times 2^2 + \underline{0} \times 2^1 + \underline{0} \times 2^0$

$= \underline{1}\ \ \underline{0}\ \ \underline{1}\ \ \underline{1}\ \ \underline{1}\ \ \underline{1}\ \ \underline{0}\ \ \underline{0}$

The advantage is that electrically a computer works more efficiently with 0 and 1, the disadvantage is with eight bits of information (8 digits as shown above), the highest integer we can represent in binary is only $2^7+2^6+2^5+2^4+2^3+2^2+2^1+2^0=255$, while with the same number of decimal digits that number is much higher: 99 999 999.

1

To represent 0.5 with eight bits we convene, for example, that the highest number (1111 1111 or 255) corresponds to 1 and the lowest number (0000 0000) to 0, obviously. Then Half of the highest number (127.5) rounded to the next integer will represent 0.5

An alternative method for representing fractional numbers is to use a "binary dot" similar to the decimal dot:

$13.125 = \underline{0} \times 10^3 + \underline{0} \times 10^2 + \underline{1} \times 10^1 + \underline{3} \times 10^0 \ \bullet\ \underline{1} \times 10^{-1} + \underline{2} \times 10^{-2} + \underline{5} \times 10^{-3} + \underline{0} \times 10^{-4}$

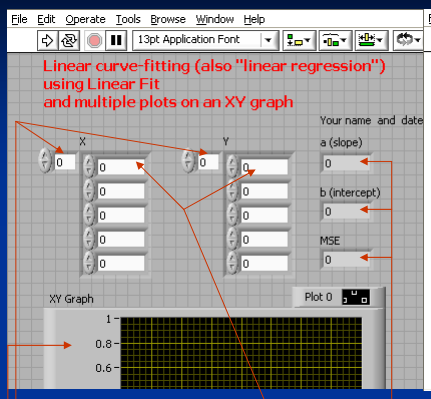
A binary representation would use negative powers of 2 after the dot:

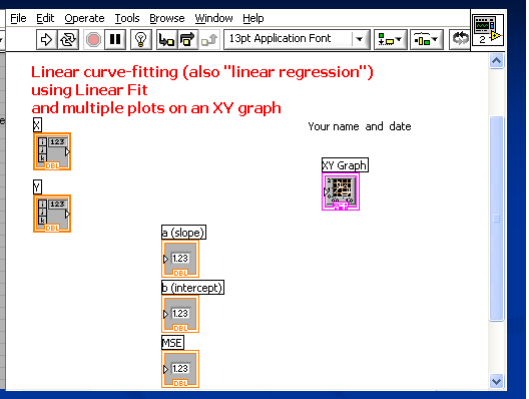
$13.127 = \underline{1} \times 2^3 + \underline{1} \times 2^2 + \underline{0} \times 2^1 + \underline{1} \times 2^0 \ \bullet\ \underline{0} \times 2^{-1} + \underline{0} \times 2^{-2} + \underline{1} \times 2^{-3} + \underline{0} \times 2^{-4}$

$= \underline{1}\ \ \underline{1}\ \ \underline{0}\ \ \underline{1}\ \bullet\ \underline{0}\ \ \underline{0}\ \ \underline{1}\ \ \underline{0}$

2

LabVIEW application to do data modeling (linear model) and to plot two curves in a same graph





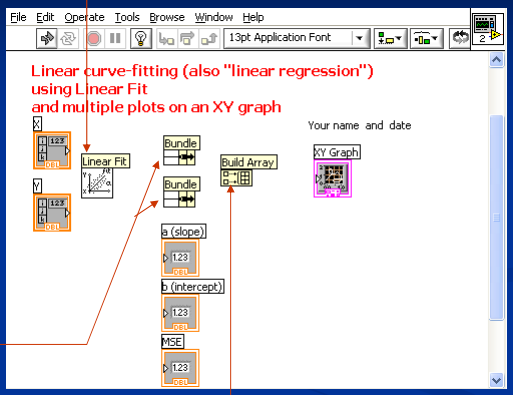
Arrays (All Ctrls) and Numeric Ctrls:
Use resize to show 5 boxes for 5 pairs of data;
Numeric Indicators for a, b, MSE;
XY Graph (All Ctrls/Graph;
not XY Graph Express): takes as inputs
Pairs of series: (X_1,Y_1), (X_2,Y_2), etc.

How to insert a numeric array, what is it for?

1

How to get "Linear Fit"; what are its inputs and outputs? What is "Build Array" for? How to add an extra input? What are the two inputs and output of "Build Array" ?

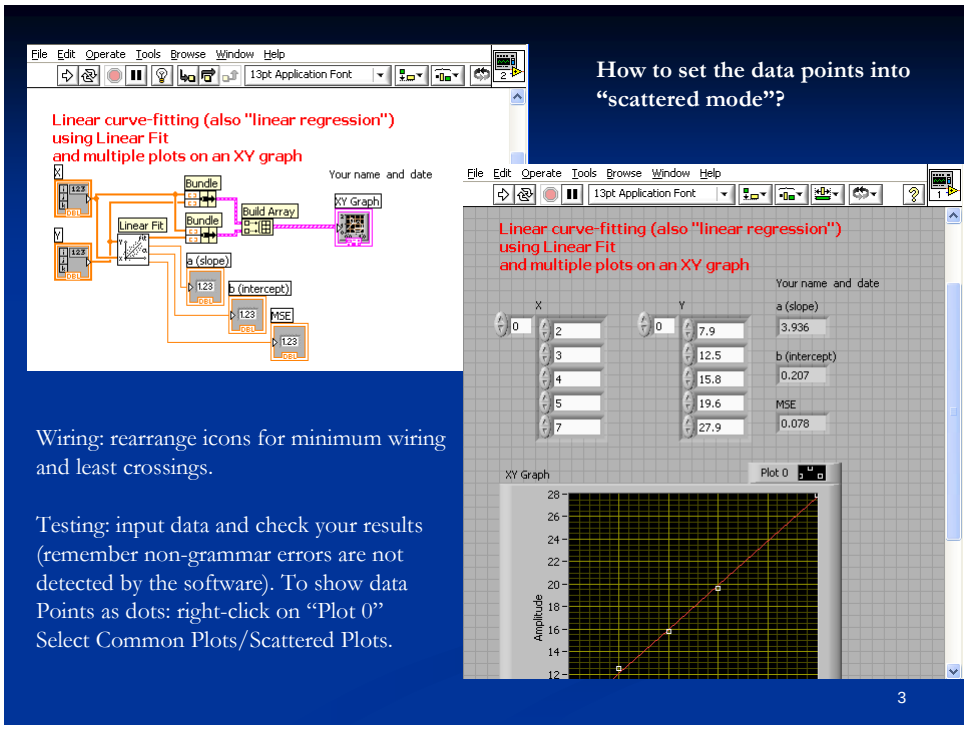
Linear Fit: All Functions/Analyze/
Mathematics/Curve Fitting/
Inputs are data series X and Y;
Outputs are best fit series Y'=aX+b;
Coeff. a (slope); coeff. b (intercept);
and MSE (Mean Square Error, a parameter which is equivalent to our "standard deviation" in doing curve fitting with Excel.



Bundle: All Functions/Cluster/
Bundle 1 takes X and Y; bundle 2
Takes X and Y'

Build Array: All Functions/Array/
Right-click on its left side to "Add Input"
Upper input: XY (bundle 1); lower input: XY' (bundle 2)

2



Suggested items to write in the Engin 103 logbook:

1) Explain if any fractional number can be represented in a binary system with infinite precision, why?

2) How to superimpose two curves in a same XY graph in LabVIEW? Explain in details

3) How to set the data points into "Scattered mode" to distinguish with the fit curve?