Engin 103 November 18, 2008 back to e-syllabus	Topics: CW10 CW11 Project 3 Topic Assignment Logbook questions

Engineering 103 –UMass Boston

CW 10

(In-Class-Work 10)

Data Modeling/Curve Fitting with LabVIEW: Arrays, XY Graph, Build Array, and Multiple Plot

Make a VI that finds the best linear fit Y'=a*X+b for the table of data shown below. On a same XY graph (do not use "Express XY Graph") plot both the raw data and the fit curve. It should also output the parameters *a* (slope) and *b* (intercept), and the MSE (Mean Square Error, an equivalent parameter as our "Standard Deviation" that indicates how well our model fits to the data). Use two *Arrays* with a *Digital Control* in each to input raw data X and Y. Use *Linear Fit* under *Analysis-Curve Fitting* to find the best linear fit. Then use two *Bundles* (under *Cluster*) and a *BUILD ARRAY* (under *Array*) to do the multiple plot. The raw data should go in first, then the fit curve, into the *Build Array*, whose output goes into the *XY Graph*. Right click on *Plot 0* on the *XY Graph* to choose *Scattered Plot* under *Common Plots* for the raw data, the fit curve should be a continuous line. Use an Array with a Numeric Indicator to output the coefficients a and b, and a Numeric Indicator for the MSE.

X	Y
2	7.9
3	12.5
4	15.8
5	19.6
7	27.9

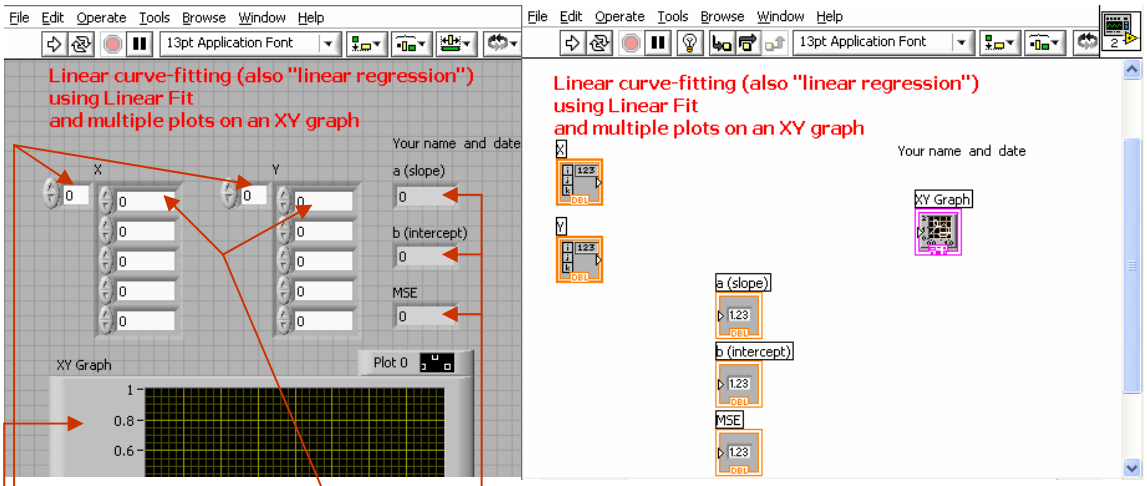
Please insert names and dates within the Front Panels. By alphabetical order of the last names, the first two students in each team will submit LabVIEW LLB file cw10_XX_a.llb, the next two students will submit LabVIEW LLB file cw10_XX_b.llb, to the *files* folder in the server. Each LLB file should contain two VI's corresponding to this CW. These files need to be uploaded to the server today to receive credit.

XY Graphs:

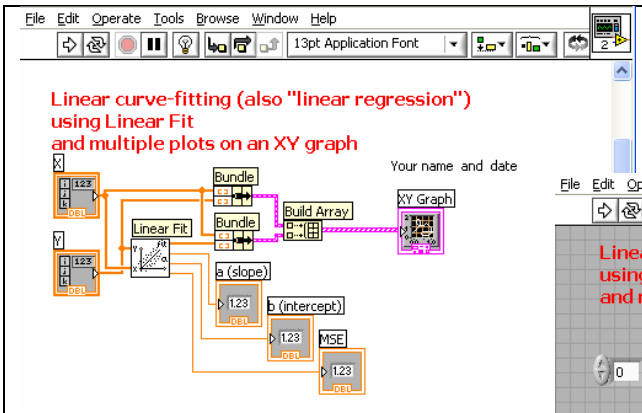
When you have two numeric series or arrays, if you want to plot one against the other you can use the XY Graph (we will use the Express XY Graph). An XY Graph, unlike the Waveform Graph, requires two information: X series and Y series: we will need a 'Bundle' with two inputs.

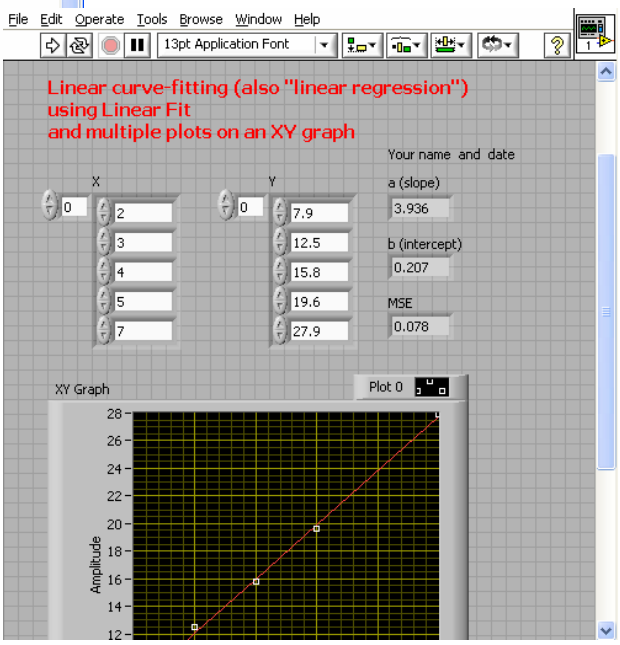
We will also produce two plots in the same Graph using “Build Array’.

In the Block Diagram enter a “Linear Fit”, two “Bundles”, and one “Build Array”



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.

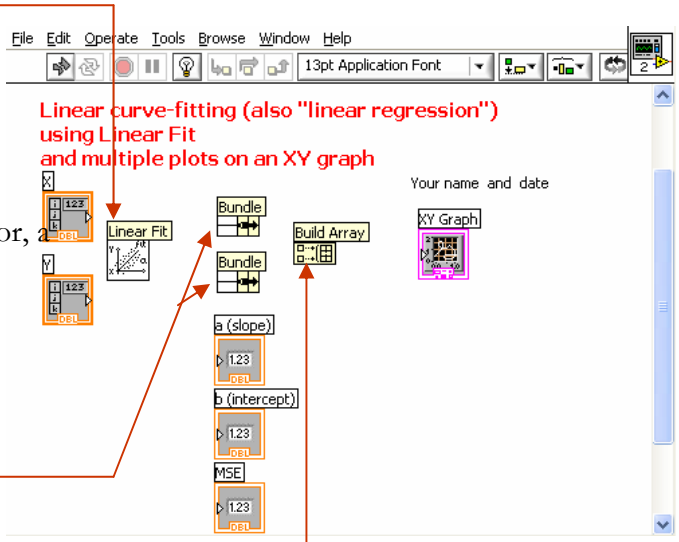




Wiring: rearrange icons for minimum wiring and least wire crossings.

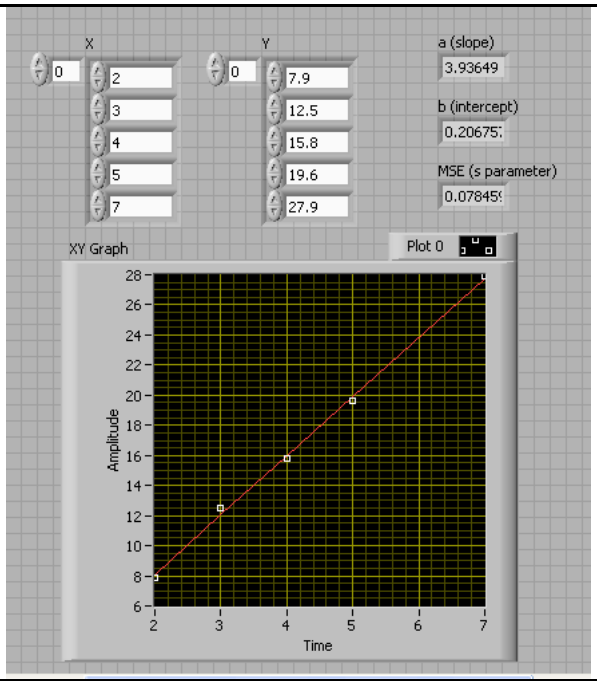
Testing: input data and check your results (remember non-grammar errors are not detected by the software). To show data Points as dots: right-click on "Plot 0" Select Common Plots/Scattered Plots.

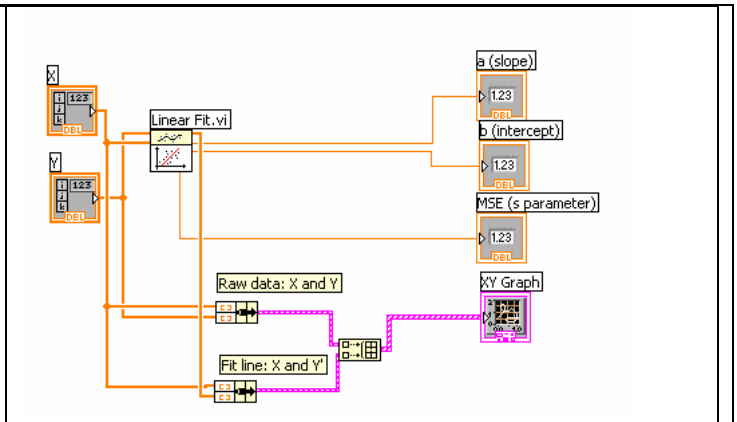
Linear Fit: All Functions/Analyze/ Mathematics/Curve Fitting/ Inputs are data series X and Y; Outputs are best fit series Y'=aX+b; Coeff. a (slope); coeff. b (intercept); and MSE/Residue (Mean Square Error, a parameter which is equivalent to our "s parameter" in doing curve-fitting with Excel.



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)





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Engineering 103 –UMass Boston

CW 11

(In-Class-Work 11)

Digital and Analog representations and conversions

Find in Chapter 4 of DCE (Horenstein) the answers to the following questions (15 min max.)

1.- State the relation between Assembly Code; Programming Language; and Compiler

2.- What is a digital signal? Do an A/D conversion for 2003 with the minimum number of bits, and a D/A conversion for 0101 1010 1101 0010

3.- Do a A/D conversion for 0.5 with 8 bits of information, being 1 the highest number, using no “binary dot” in the binary representation of eight bits; and a second version using a ‘binary dot’ between two groups of four bits, with the second groups using **negative** decreasing powers of 2 from left two right.

By alphabetical order of the last names, the first two students in each team will submit Word file cw11_XX_a.doc, the next two students will submit Word file cw11_XX_b.doc, to the *files* folder in the server. These files need to be uploaded to the server today to receive credit.

What is a digital signal? Computers work with digital signals; the electronics does 5V (on) and 0V (off). A digital signal is composed of 0’s and 1’s, like binary numbers.

Analog to Digital conversion (A/D):

We want to write 2003 (an analog number) in digital (or binary) format:

$127 = 1*10^2 + 2*10^1 + 7*10^0$ (using powers of 10; since we use decimal system)

127= 2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0
In binary system, numbers are just 0 or 1, starting from the left, let's insert either 1 or 0 in front of the powers of 2:

$127 = 0*2^7 + 1*2^6 + 1*2^5 + 1*2^4 + 1*2^3 + 1*2^2 + 1*2^1 + 1*2^0$
127 -> 0111 1111

Now convert 2003 into digital format:

Digital to Analog conversion (D/A):

$1001 = 1*2^3 + 0*2^2 + 0*2^1 + 1*2^0 = 9$
1001 -> 9

Now convert 0101 1010 1101 0010 into analog format:

More on CW11:

2)
A/D conversion:

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

What is the highest binary number using 8 bits of information? Answer: 255

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

D/A conversion: 0101 1010 1101 0010 -> ?

3) Represent 0.5 in binary/digital:
a) First alternative:

Decimal system	Binary or Digital system
1	1111 1111 (255)
0.5	1000 0000 (128)

b) Second alternative: using a “binary dot”

2.5= 2* 10^0 + 5 * 10^{-1} (to the right of the dot: negative powers of 10)
We can use this in binary or digital format as well: to the right of the “binary dot” use negative powers of 2:

				2	·	5			
Decimal	$0*10^3$	$0*10^2$	$0*10^1$	$2*10^0$	.	$5*10^{-1}$	$0*10^{-2}$	$0*10^{-3}$	$0*10^{-4}$
Binary	$0*2^3$	$0*2^2$	$1*2^1$	$0*2^0$	.	$1*2^{-1}$	$0*2^{-2}$	$0*2^{-3}$	$0*2^{-4}$

2.5 -> 0010.1000

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Project 3

Project	Description	**Team**
A	Predict the max. temp. for the next day using previous days’ temperatures, using polynomial and other models	
B	Predict the oil price for next week using previous weeks’ prices, using polynomial and other models	
C	Detect the frequency spectrum of a given signal using Fourier Transforms	
D	Say the decimal number for a four-digit binary number	**3**
E	Make a 8 keys piano	**2**
F	Solve the quadratic equation with distinction of cases for the discriminant	
G	A VI that can calculate the areas and volumes of 5 different 3D geometrical shapes	**1**
H	A VI that produces interesting sounds from the combination of 2 or more sine waves with different frequencies	**8**
I	A VI that produces a chirp sound, that is a sound whose frequency is changing with time	**4**

Missing assignments: Teams 5,6,7,10 (please email me ASAP)
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LOGBOOK: example of a logbook page

-Use a quadrille notebook; number all pages; date all entries
-Write your notes for all activities, thoughts, problems and solutions, and learning conclusions related to Engin 103. You should write down progress, outcomes, and conclusions on projects and teamwork; conclusions from class work (including LabVIEW) and homework.
-In addition you should answer in the logbook all questions listed in these notes in blue, as shown below:

41) What are the information required by an XY Graph? What did we use the 'Build Array' for? Specify the LabVIEW version you are using and describe how to insert an "Array" of 'Numeric Controls" in the Front Panel. Also where to find the 'Linear Fit.vi' and what inputs and outputs we are using in this exercise.

42) a) Binary numbers: write 0.625 and 0.875 using 8 bit binary numbers with a "binary dot" between the two groups of four bits. b) Can you write 0.626 using 8 bits with four bits after the dot? Explain if we could achieve exact calculations using a digital computer. Can you offer a solution?

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