Engin 103 April 16, 2009 back to e-syllabus	Topics: CW9 CW10 Project 2 grades Project 3 Topic Assignment Logbook questions

Engineering 103 –UMass Boston

CW 9

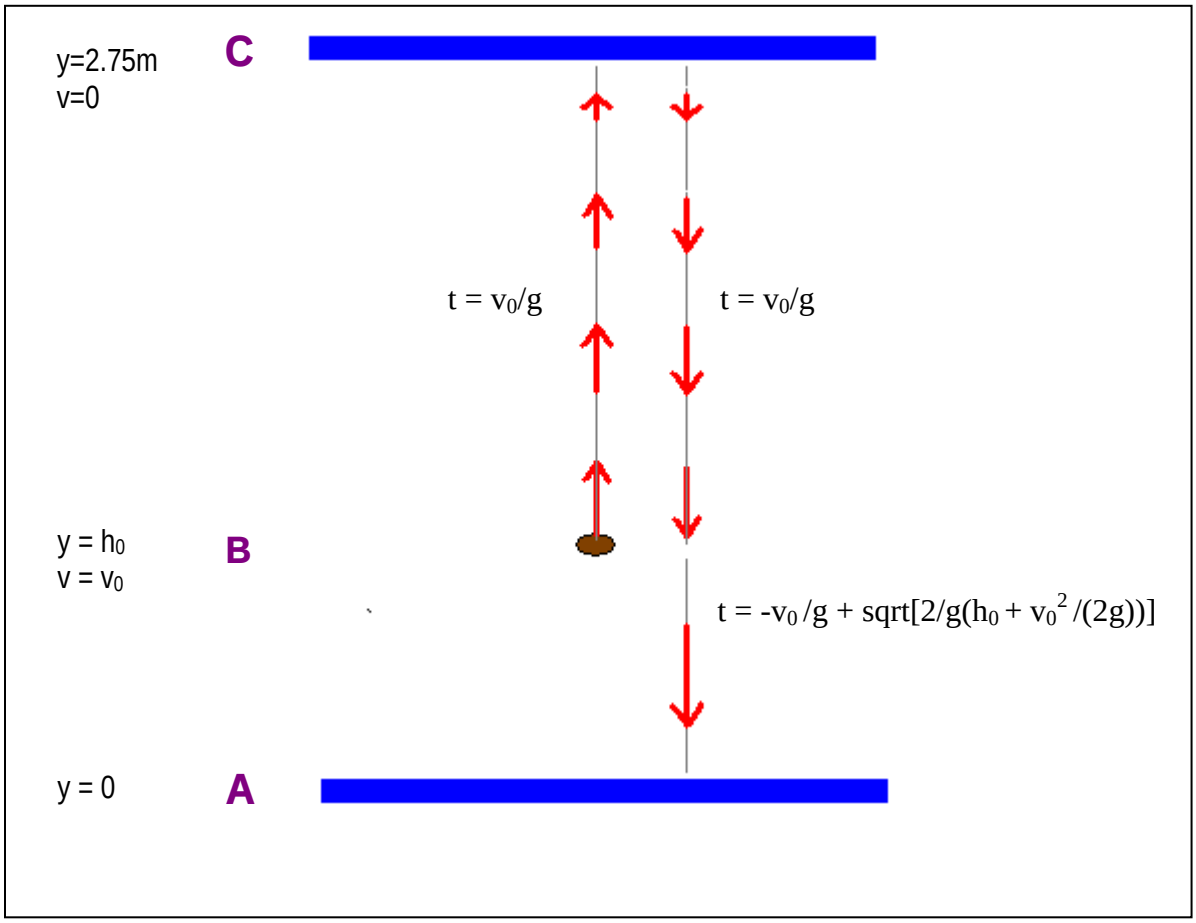
(In-Class-Work 9)

Case Structure and the Formula Node

Make a VI following the link "Time of Flight with LabVIEW"

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 cw9_XX_a.llb, the next two students will submit LabVIEW LLB file cw9_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.

*Remember that this is an individual work (turn it in, as instructed, with your name and date). Home-works and class-works count 20% toward the course grade. Class-works are done in class.



The coin is tossed up at B with an initial speed v_0, reaching zero speed at C, falling back to B and continuing to A. In summary its trajectory will be BCBA. The coin follows a constant deceleration motion between B and C, and constant acceleration between C and A. The constant acceleration is $g=9.81 m/s^2$. By conservation of energy, the coin accelerates from zero speed at C to the initial speed v_0 at B. The time it takes to cover BCB is

$$t_{BCB} = 2\frac{v_0}{g}$$

and the time it takes to cover BA is

$$t_{BA} = -\frac{v_0}{g} + \sqrt{\frac{2}{g}\left(h_0 + \frac{v_0^2}{2g}\right)}$$

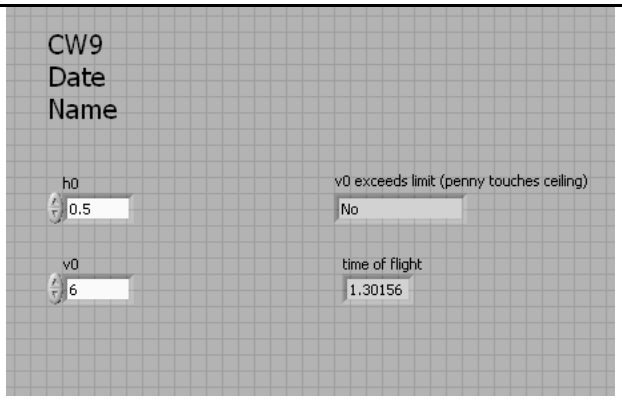
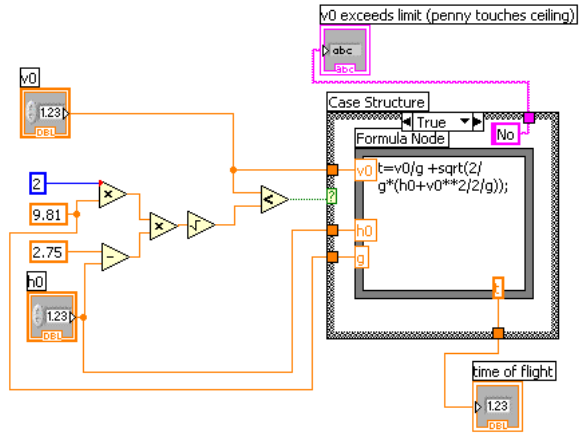
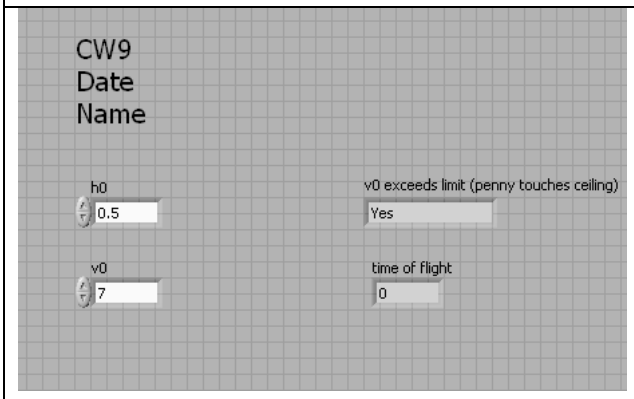
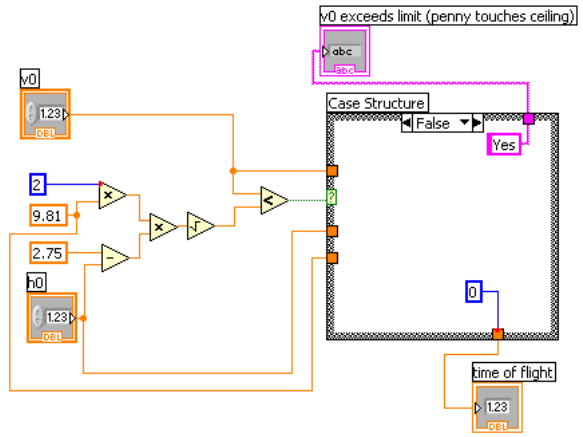
so the total time of flight is

$$t_{BCBA} = \frac{v_0}{g} + \sqrt{\frac{2}{g}\left(h_0 + \frac{v_0^2}{2g}\right)}$$

Common errors (click on the broken RUN arrow to view error list)	Reasons
Formula Node: undefined variable	The variables you defined as inputs (left border of the Formula Node) or outputs (right border of the Formula Node) did not match the variables you typed in the equation.
Formula Node: missing semicolon	The equation within the Formula Node needs to end with a semicolon.
Tunnel: missing assignment to tunnel	Every output element outside the Case Structure needs to be connected to elements in BOTH the True and False windows.
Formula Node: integer type required	The power operation in the new LabVIEW editions should read "**"

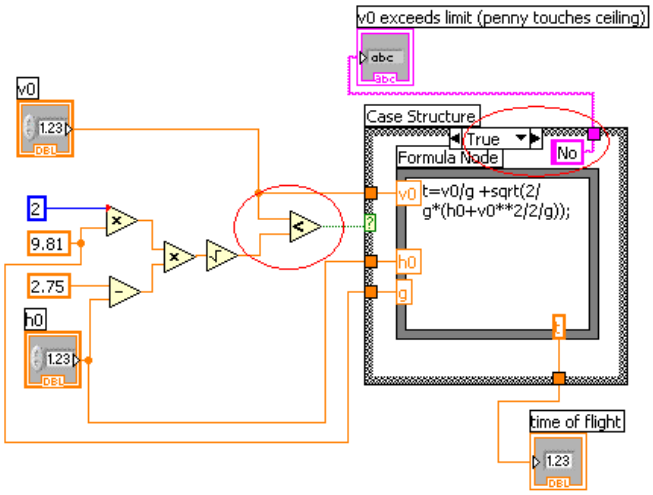
Testing the VI:

Front Panel	Block Diagram

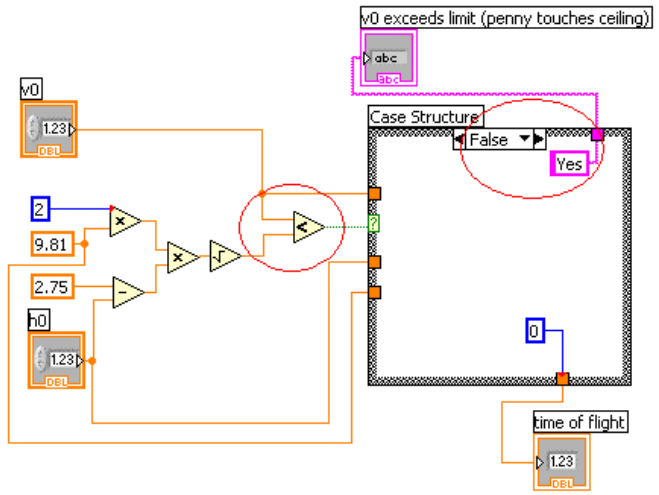
	
At h_0=0.5m; v_0=6m/s does not exceed the limit to keep the penny from touching the ceiling, so the answer to the question "v_0 exceeds limit?)" is "No", and a time of flight is shown.	Since v_0 is less than its limit, the less-than comparison operator produces a "true" that activates the true window of the Case Structure, which contains a Formula Node that calculates the time of flight, and a String Constant containing a "No"
	
At h_0=0.5m; v_0=7m/s exceeds the limit to keep the penny from touching the ceiling, so the answer to the question "v_0 exceeds limit?)" is "Yes", and a time of flight is not calculated.	Since v_0 is greater than its limit, the less-than comparison operator produces a "false" that activates the false window of the Case Structure, which contains a Numeric Constant showing a 0 for the time of flight, and a String Constant containing a "Yes"

Two possible connections at the less-than comparison operator

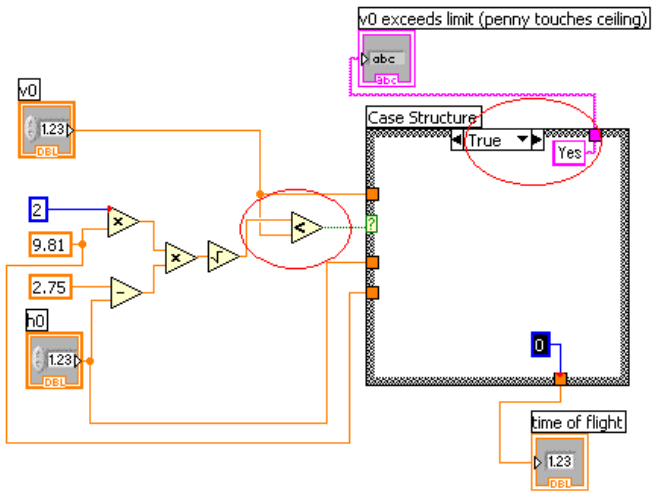
True window if v_0 is on the left side of the less-than comparison	False window if v_0 is on the left side of the less-than comparison

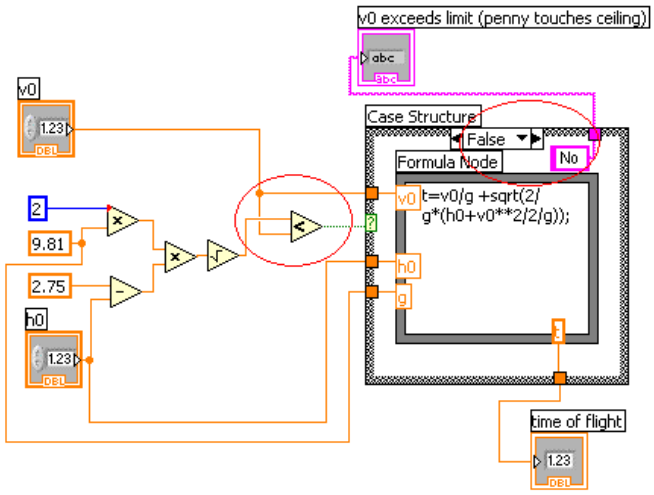


True window if v_0 is on the right side of the less-than comparison



False window if v_0 is on the right side of the less-than comparison





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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

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

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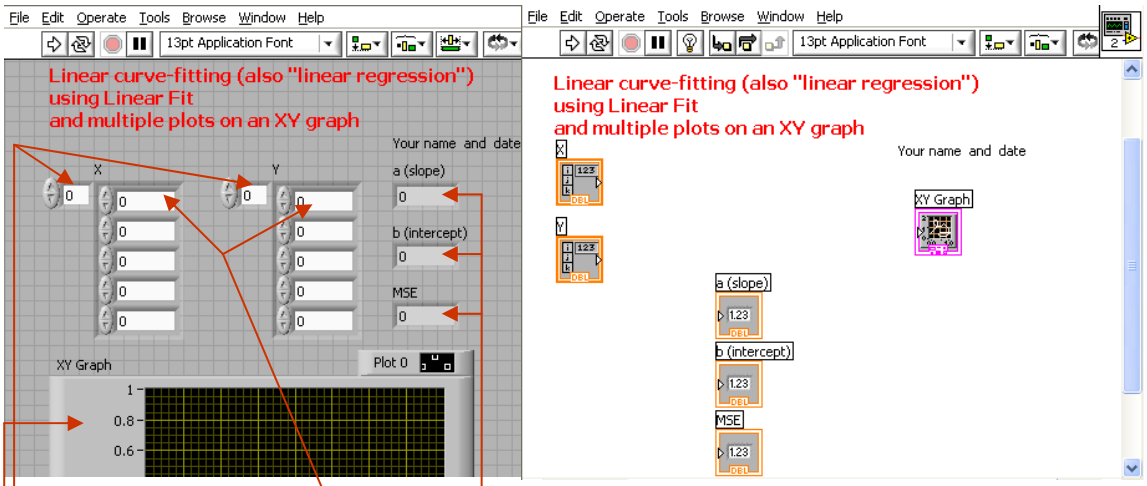
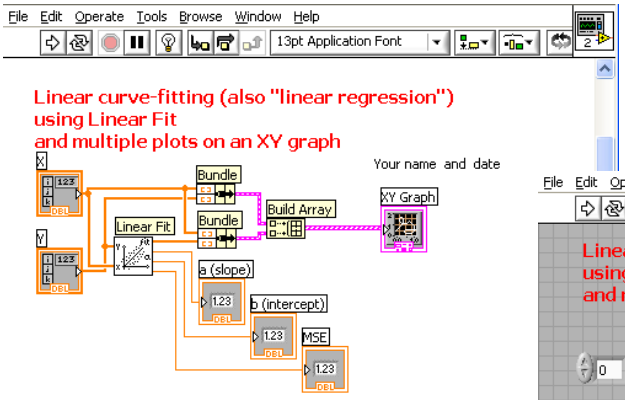
XY Graphs:

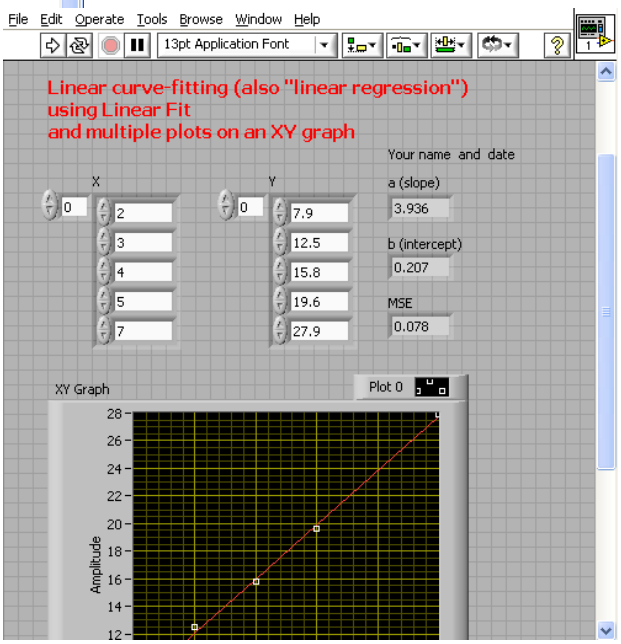
When you have two numeric series or arrays, if you want to plot one against the other you can use the XY Graph (we will use the Express XY Graph). An XY Graph, unlike the Waveform Graph, requires two information: X series and Y series: we will need a 'Bundle' with two inputs.
We will also produce two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





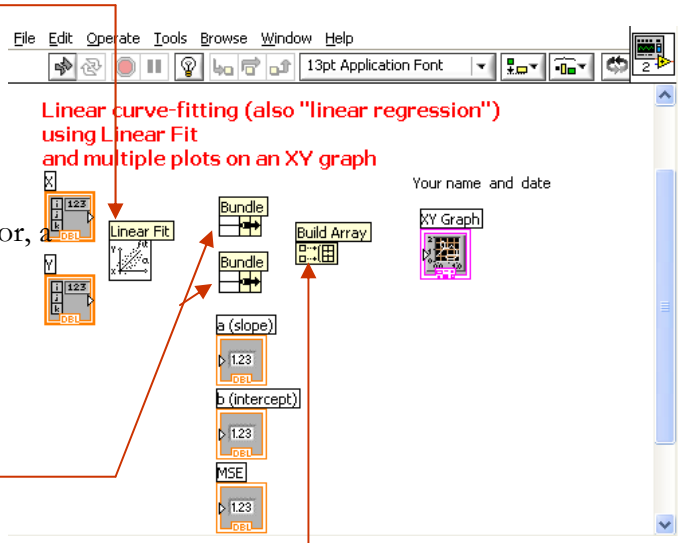
Wiring: rearrange icons for minimum wiring and least wire crossings.

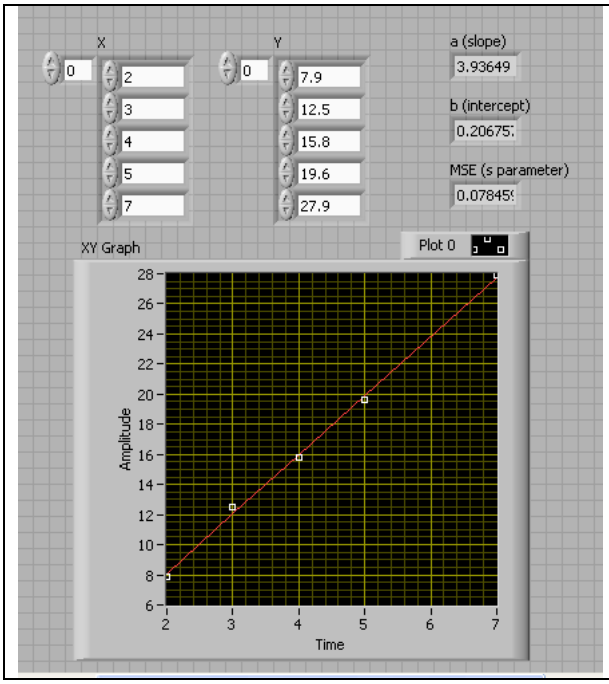
Testing: input data and check your results (remember non-grammar errors are not detected by the software). To show data Points as dots: right-click on "Plot 0" Select Common Plots/Scattered Plots.

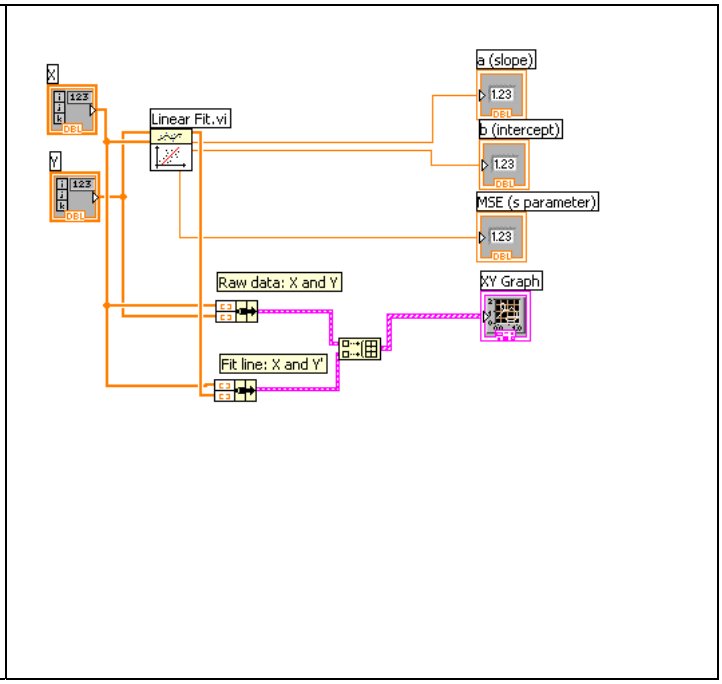
Linear Fit: All Functions/Analyze/
Mathematics/Curve Fitting/
Inputs are data series X and Y;
Outputs are best fit series Y'=aX+b;
Coeff. a (slope); coeff. b (intercept);
and MSE/Residue (Mean Square Error, a
parameter which is equivalent to our
"s parameter" in doing curve-
fitting with Excel.

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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Project 2 grades

Project 2 -part I/ Teams	1	2	3	4	5	6	7	8	10
Project completed (35)									

Choice of problem (15)									
Performance (LabVIEW elements)(25)									
Presentation (12.5) and web page (12.5)									
Total part I (100)									
Project 2 -part II/ Teams	1	2	3	4	5	6	7	8	10
Project completed (35)									
Choice of problem (15)									
LabVIEW elements and subVI's (25)									
Presentation (12.5) and web page (12.5)									
Total part II(100)									
Total Project 2 Pres. (200)									

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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	**6**
B	Predict the oil price for next week using previous weeks' prices, using polynomial and other models	**10**
C	Detect the frequency spectrum of a given signal using Fourier Transforms	**4**
D	Say the decimal number for a four-digit binary number	**5**
E	Make a 8 keys piano	**2**
F	Solve the quadratic equation with distinction of cases for the discriminant	**8**
G	A VI that can calculate the areas and volumes of 5 different 3D geometrical shapes	**3**
H	A VI that produces interesting sounds from the combination of 2 or more sine waves with different frequencies	**9**
I	A VI that produces a chirp sound, that is a	**7**

	sound whose frequency is changing with time	
J	Make a "sound recording utility" that can record voice from a microphone, display it and its FFT, then save it into a file. When a 'playback button' is pressed it will play the recorded sound.	**1**

Team	Choices	Time received	Assigned
Team 3	G,F,B,A	4/14 @10:11	G
Team 5	D,B	4/14 @10:05	D
Team 8	F,G	4/14@10:15	F
Team 6	G,A,E	4/14@10:18	A
Team 2	E,H,I	4/14@10:53	E
Team 10	B	4/15@8:37pm	B
Team 7	E,I,H	4/16@10:02	I
Team 9	H	4/16@10:18	H
Team 4	C,E,I	4/16@10:35	C
Team 1			J

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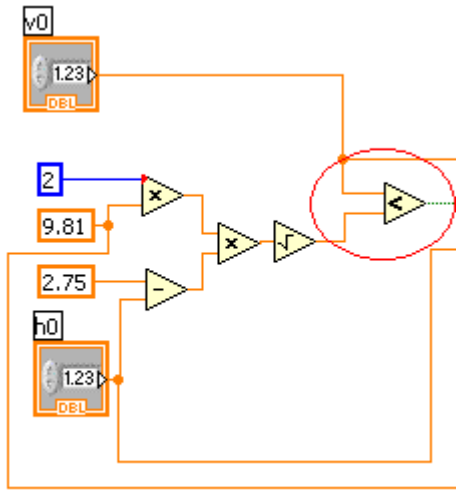
LOGBOOK: example of a logbook page

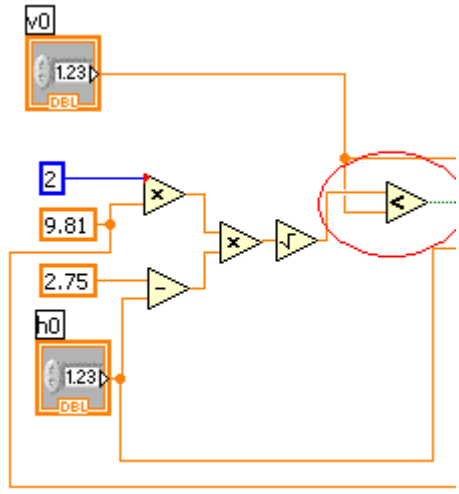
-Use a quadrille notebook; number all pages; date all entries
-Write your notes for all activities, thoughts, problems and solutions, and learning conclusions related to Engin 103. You should write down progress, outcomes, and conclusions on projects and teamwork; conclusions from class work (including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

41) In the LabVIEW exercise we completed today (CW9), the result of what operation decides which window (True or False) of the Case Structure will be used? How do you call a variable that can take only two possible values (for example: 1 or 0; or True or False)?

42) Include a print-out of your Block Diagram for CW9. Answer questions a) and b) for two possible connections at the less-than operator shown in the table below:

If v_0 and its limit are connected to the less-than comparison as shown below	**a) Within the True window of the Case Structure, what do you write inside the String Constant?**	**b) Within the False window of the Case Structure, what do you write inside the String Constant?**





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