Engin 103 October 18, 2011 back to e-syllabus	Topics: CW5 Introduction to LabVIEW CW6 Circuit Analysis with LabVIEW I Circuit Analysis with LabVIEW II Project 1 Progress Reports Logbook questions

Engineering 103 –UMass Boston

CW 5

(In-Class-Work 5)

1.- Import the data (metal distance and ultrasonic response) from http://www.itl.nist.gov/div898/handbook/pmd/section6/pmd631.htm into Excel (it helps to save them into a text file and then use 'Data/Get External Data/Import text file' with the 'fixed width' option). Produce a non-linear fit of the ultrasonic response Y' as a function of the metal distance X, with model Y'=exp(-b1*X)/(b2+b3*X). When importing data, note that in that website, the ultrasonic response (Y) appears in the first column, and the metal distance (X) in the second column. Plot the data and best fit on a same plot. Then copy the plot into a Word file. Also provide b1, b2, b3, and the final 'standard' deviation coefficient.

2.- Answer the following questions about data modeling

a) Using more coefficients in a model for a given data set will lead to a lower parameter s. True or false and why?

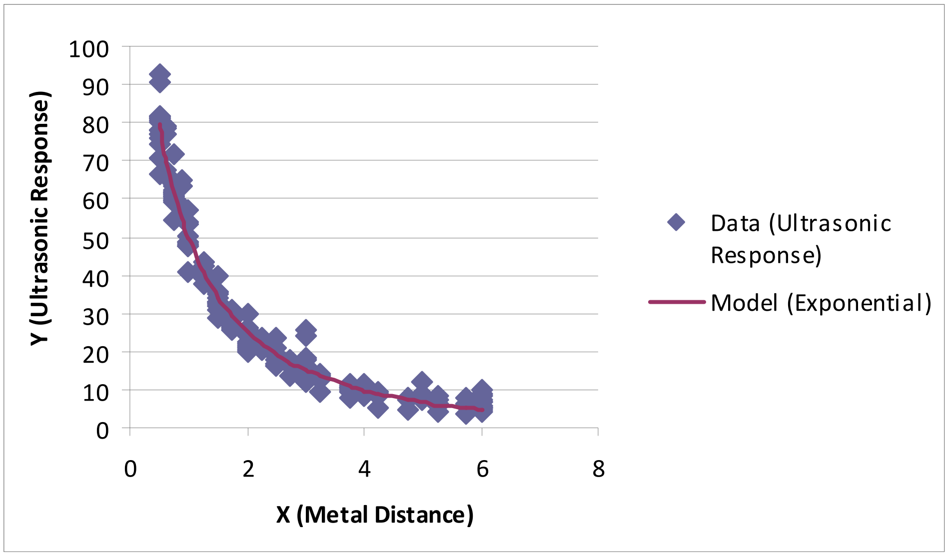
b) In studying a phenomenon, when doing data modeling, would scientists use more or less coefficients in their models, why? What would engineers do?

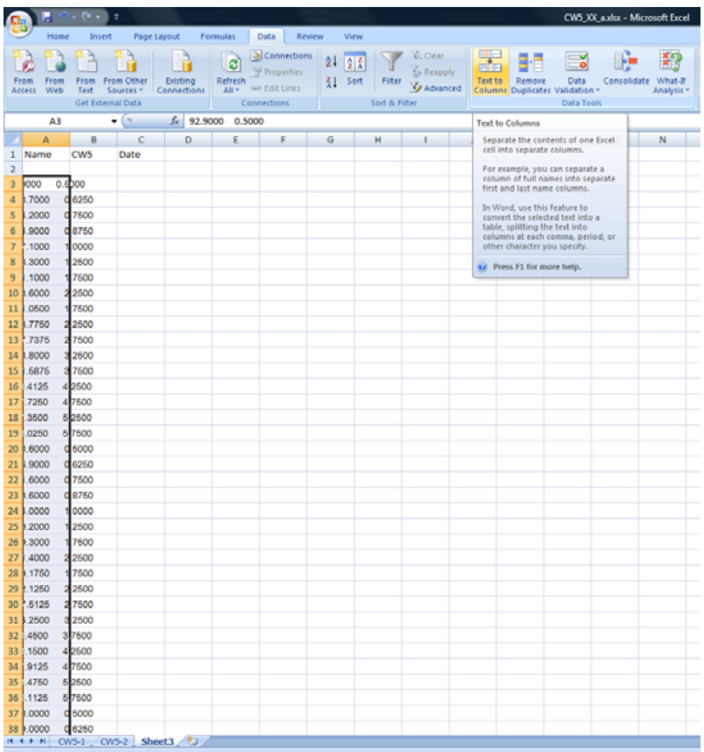
c) Does the way you build your physical system affect the quality of the mathematical model you can construct? Yes or no and why?

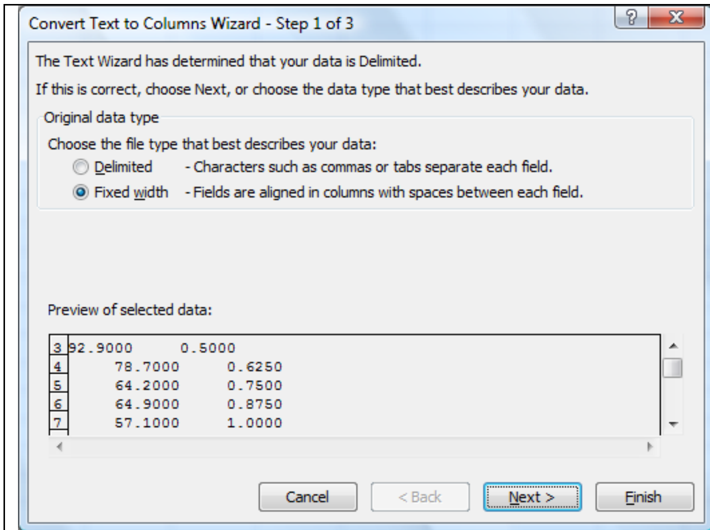
In each team, students working together at a computer numbered between 1 and 10 will submit file cw5_XX_a.xlsx, students working at a computer numbered between 11 and 20 will submit file cw5_XX_b.xlsx, to the *files* folder in the server. Replace XX by 01 if team 1, etc. Include your name within the files.

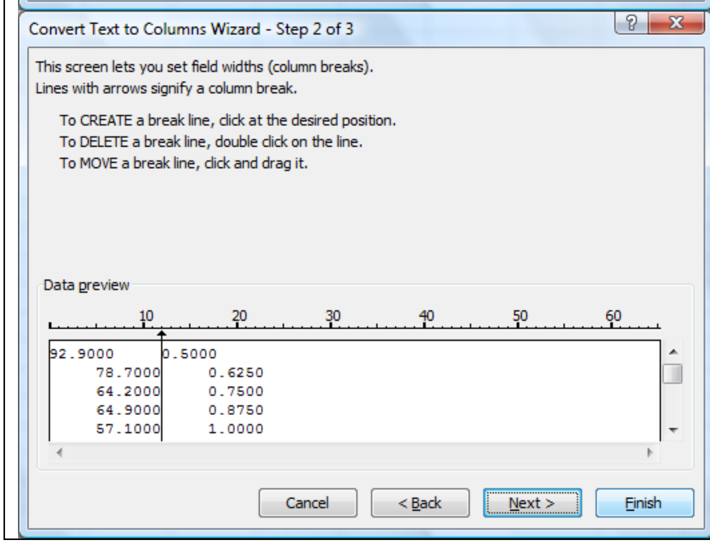
*Remember that this is an individual work (turn it in, as instructed, with your name and date). Home-works and class-works count 20% toward the course grade. Class-works are done in class.

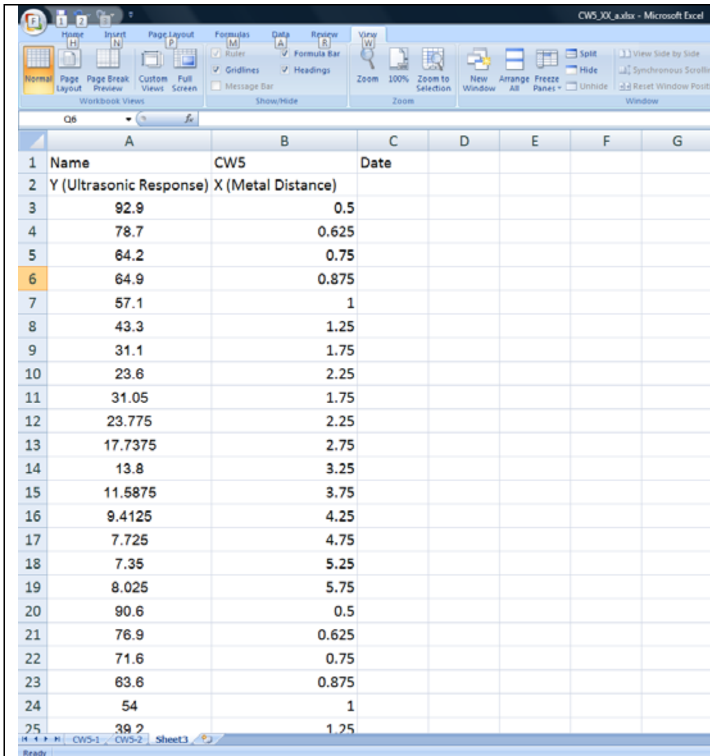
Your Excel graph should look like:

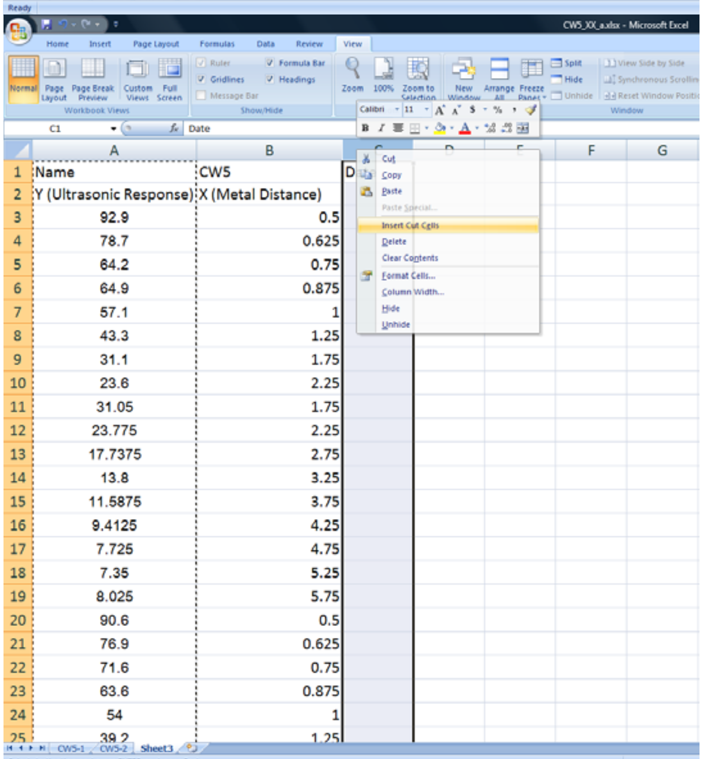

Y (Ultrasonic Response)
100
90
80
70
60
50
40
30
20
10
0
0
2
4
6
8
X (Metal Distance)
Data (Ultrasonic Response)
Model (Exponential)

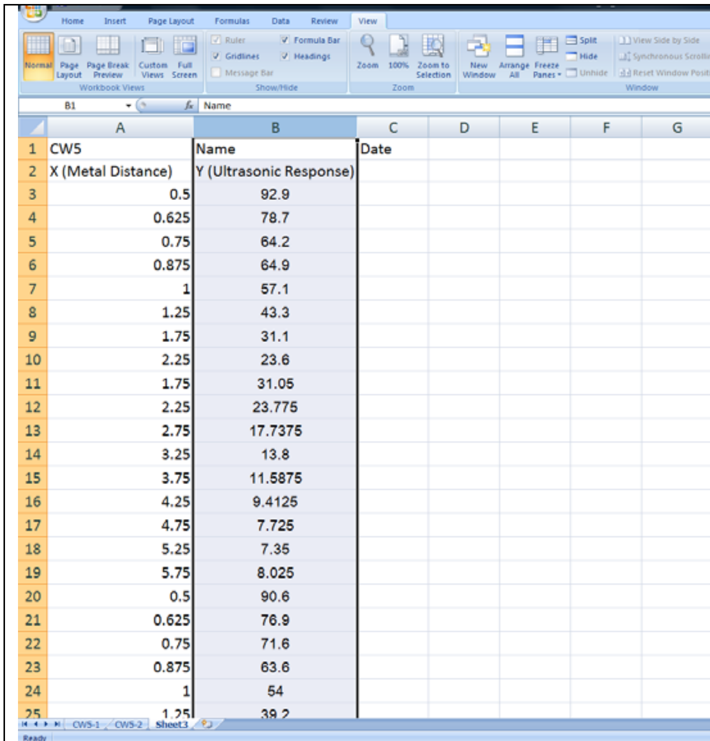



Convert Text to Columns Wizard - Step 1 of 3
The Text Wizard has determined that your data is Delimited.
If this is correct, choose Next, or choose the data type that best describes your data.
Original data type
Choose the file type that best describes your data:
Delimited - Characters such as commas or tabs separate each field.
Fixed width - Fields are aligned in columns with spaces between each field.
Preview of selected data:
3 92.9000 0.5000
4 78.7000 0.6250
5 64.2000 0.7500
6 64.9000 0.8750
7 57.1000 1.0000
Cancel
< Back
Next >
Finish

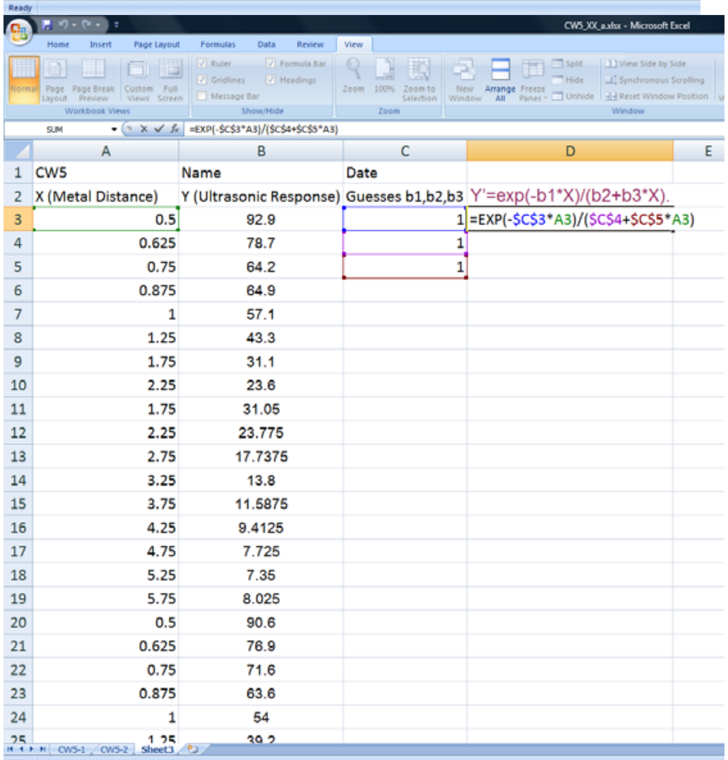

Convert Text to Columns Wizard - Step 2 of 3
This screen lets you set field widths (column breaks).
Lines with arrows signify a column break.
To CREATE a break line, click at the desired position.
To DELETE a break line, double click on the line.
To MOVE a break line, click and drag it.
Data preview
10 20 30 40 50 60
92.9000 0.5000
78.7000 0.6250
64.2000 0.7500
64.9000 0.8750
57.1000 1.0000
Cancel
< Back
Next >
Finish


CW5_XX_a.xlsx - Microsoft Excel
Home
Insert
Page Layout
Formulas
Data
Review
View
Normal
Page Layout
Page Break Preview
Custom Views
Full Screen
Workbook Views
Ruler
Formula Bar
Gridlines
Headings
Message Bar
Show/Hide
Zoom
100%
Zoom to Selection
New Window
Arrange All
Freeze Panes
Split
Hide
Unhide
Window
Q6
Name
CW5
Date
Y (Ultrasonic Response)
X (Metal Distance)
92.9 0.5
78.7 0.625
64.2 0.75
64.9 0.875
57.1 1
43.3 1.25
31.1 1.75
23.6 2.25
31.05 1.75
23.775 2.25
17.7375 2.75
13.8 3.25
11.5875 3.75
9.4125 4.25
7.725 4.75
7.35 5.25
8.025 5.75
90.6 0.5
76.9 0.625
71.6 0.75
63.6 0.875
54 1
39.2 1.25
CW5-1
CW5-2
Sheet3
Ready


CW5_XX_a.xlsx - Microsoft Excel
Home
Insert
Page Layout
Formulas
Data
Review
View
C1
Date
Name
CW5
Y (Ultrasonic Response)
X (Metal Distance)
Cut
Copy
Paste
Paste Special...
Insert Cut Cells
Delete
Clear Contents
Format Cells...
Column Width...
Hide
Unhide
92.9 0.5
78.7 0.625
64.2 0.75
64.9 0.875
57.1 1
43.3 1.25
31.1 1.75
23.6 2.25
31.05 1.75
23.775 2.25
17.7375 2.75
13.8 3.25
11.5875 3.75
9.4125 4.25
7.725 4.75
7.35 5.25
8.025 5.75
90.6 0.5
76.9 0.625
71.6 0.75
63.6 0.875
54 1
39.2 1.25
CW5-1
CW5-2
Sheet3
Select destination and press ENTER or choose Paste



	A	B	C	D	E	F	G
1	CW5	Name	Date				
2	X (Metal Distance)	Y (Ultrasonic Response)					
3	0.5	92.9					
4	0.625	78.7					
5	0.75	64.2					
6	0.875	64.9					
7	1	57.1					
8	1.25	43.3					
9	1.75	31.1					
10	2.25	23.6					
11	1.75	31.05					
12	2.25	23.775					
13	2.75	17.7375					
14	3.25	13.8					
15	3.75	11.5875					
16	4.25	9.4125					
17	4.75	7.725					
18	5.25	7.35					
19	5.75	8.025					
20	0.5	90.6					
21	0.625	76.9					
22	0.75	71.6					
23	0.875	63.6					
24	1	54					
25	1.25	39.2					



=EXP(-$C$3*A3)/($C$4+$C$5*A3)

	A	B	C	D	E
1	CW5	Name	Date		
2	X (Metal Distance)	Y (Ultrasonic Response)	Guesses b1,b2,b3	Y'=exp(-b1*X)/(b2+b3*X).	
3	0.5	92.9	1	=EXP(-$C$3*A3)/($C$4+$C$5*A3)	
4	0.625	78.7	1		
5	0.75	64.2	1		
6	0.875	64.9			
7	1	57.1			
8	1.25	43.3			
9	1.75	31.1			
10	2.25	23.6			
11	1.75	31.05			
12	2.25	23.775			
13	2.75	17.7375			
14	3.25	13.8			
15	3.75	11.5875			
16	4.25	9.4125			
17	4.75	7.725			
18	5.25	7.35			
19	5.75	8.025			
20	0.5	90.6			
21	0.625	76.9			
22	0.75	71.6			
23	0.875	63.6			
24	1	54			
25	1.25	39.2			

SUM =(D3-B3)^2

	A	B	C	D	E	F	G
1	CW5	Name	Date				
2	X (Metal Distance)	Y (Ultrasonic Response)	Guesses b1,b2,b3	Y'=exp(-b1*X)/(b2+b3*X).	(Y'-Y)^2		
3	0.5	92.9	1	0.404353773	=(D3-B3)^2		
4	0.625	78.7	1	0.329391648			
5	0.75	64.2	1	0.269923744			
6	0.875	64.9		0.22232641			
7	1	57.1		0.183939721			
8	1.25	43.3		0.127335465			
9	1.75	31.1		0.063190525			
10	2.25	23.6		0.032430531			
11	1.75	31.05		0.063190525			
12	2.25	23.775		0.032430531			
13	2.75	17.7375		0.01704743			
14	3.25	13.8		0.009123343			
15	3.75	11.5875		0.004951104			
16	4.25	9.4125		0.002716997			
17	4.75	7.725		0.001504643			
18	5.25	7.35		0.000839603			
19	5.75	8.025		0.000471523			
20	0.5	90.6		0.404353773			
21	0.625	76.9		0.329391648			
22	0.75	71.6		0.269923744			
23	0.875	63.6		0.22232641			
24	1	54		0.183939721			
25	1.25	39.2		0.127335465			

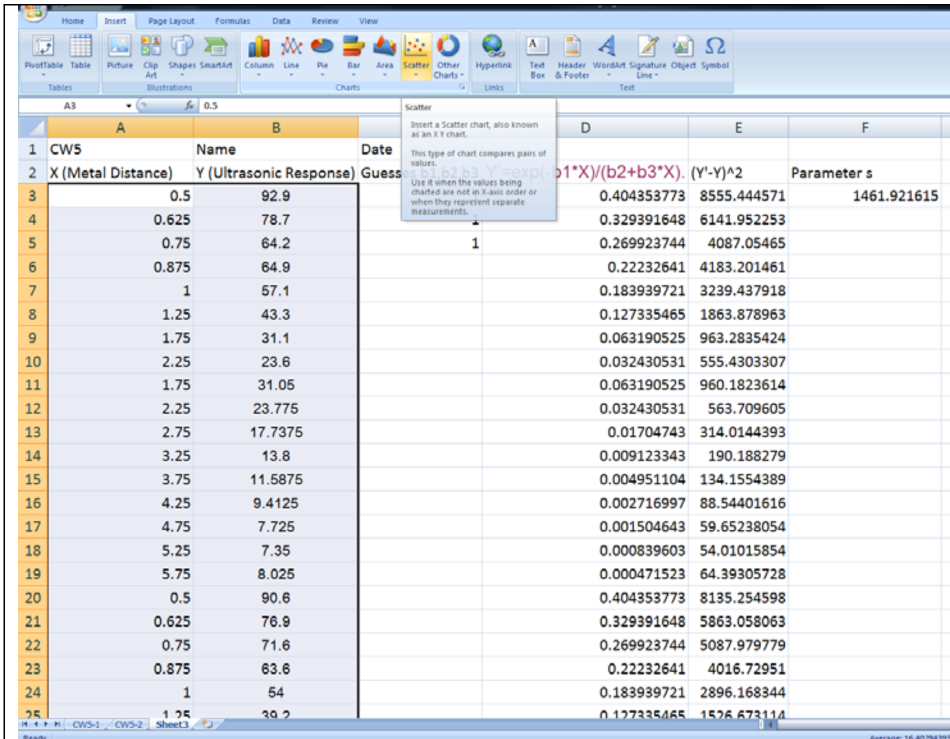
CW5-1 CW5-2 Sheet3

CW5_XX_a.xlsx - Microsoft Excel

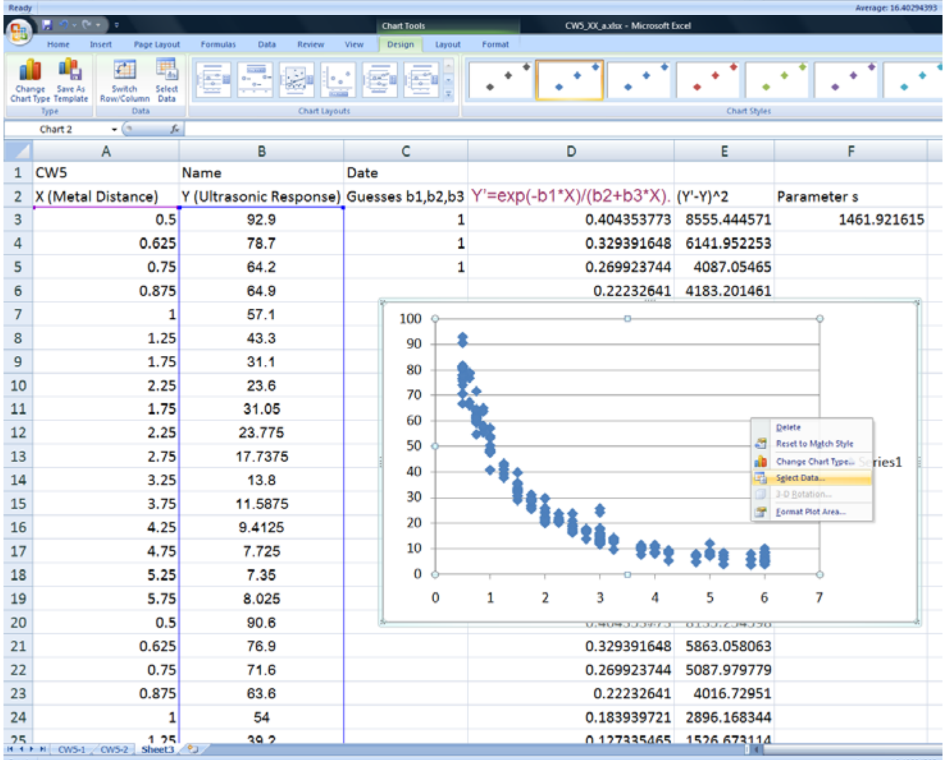
SUM =AVERAGE(E3:E216)

	A	B	C	D	E	F
1	CW5	Name	Date			
2	X (Metal Distance)	Y (Ultrasonic Response)	Guesses b1,b2,b3	Y'=exp(-b1*X)/(b2+b3*X).	(Y'-Y)^2	Parameter s
3	0.5	92.9	1	0.404353773	8555.444571	=AVERAGE(E3:E216)
4	0.625	78.7	1	0.329391648	6141.952253	
5	0.75	64.2	1	0.269923744	4087.05465	
6	0.875	64.9		0.22232641	4183.201461	
7	1	57.1		0.183939721	3239.437918	
8	1.25	43.3		0.127335465	1863.878963	
9	1.75	31.1		0.063190525	963.2835424	
10	2.25	23.6		0.032430531	555.4303307	
11	1.75	31.05		0.063190525	960.1823614	
12	2.25	23.775		0.032430531	563.709605	
13	2.75	17.7375		0.01704743	314.0144393	
14	3.25	13.8		0.009123343	190.188279	
15	3.75	11.5875		0.004951104	134.1554389	
16	4.25	9.4125		0.002716997	88.54401616	
17	4.75	7.725		0.001504643	59.65238054	
18	5.25	7.35		0.000839603	54.01015854	
19	5.75	8.025		0.000471523	64.39305728	
20	0.5	90.6		0.404353773	8135.254598	
21	0.625	76.9		0.329391648	5863.058063	
22	0.75	71.6		0.269923744	5087.979779	
23	0.875	63.6		0.22232641	4016.72951	
24	1	54		0.183939721	2896.168344	
25	1.25	39.2		0.127335465	1526.673114	

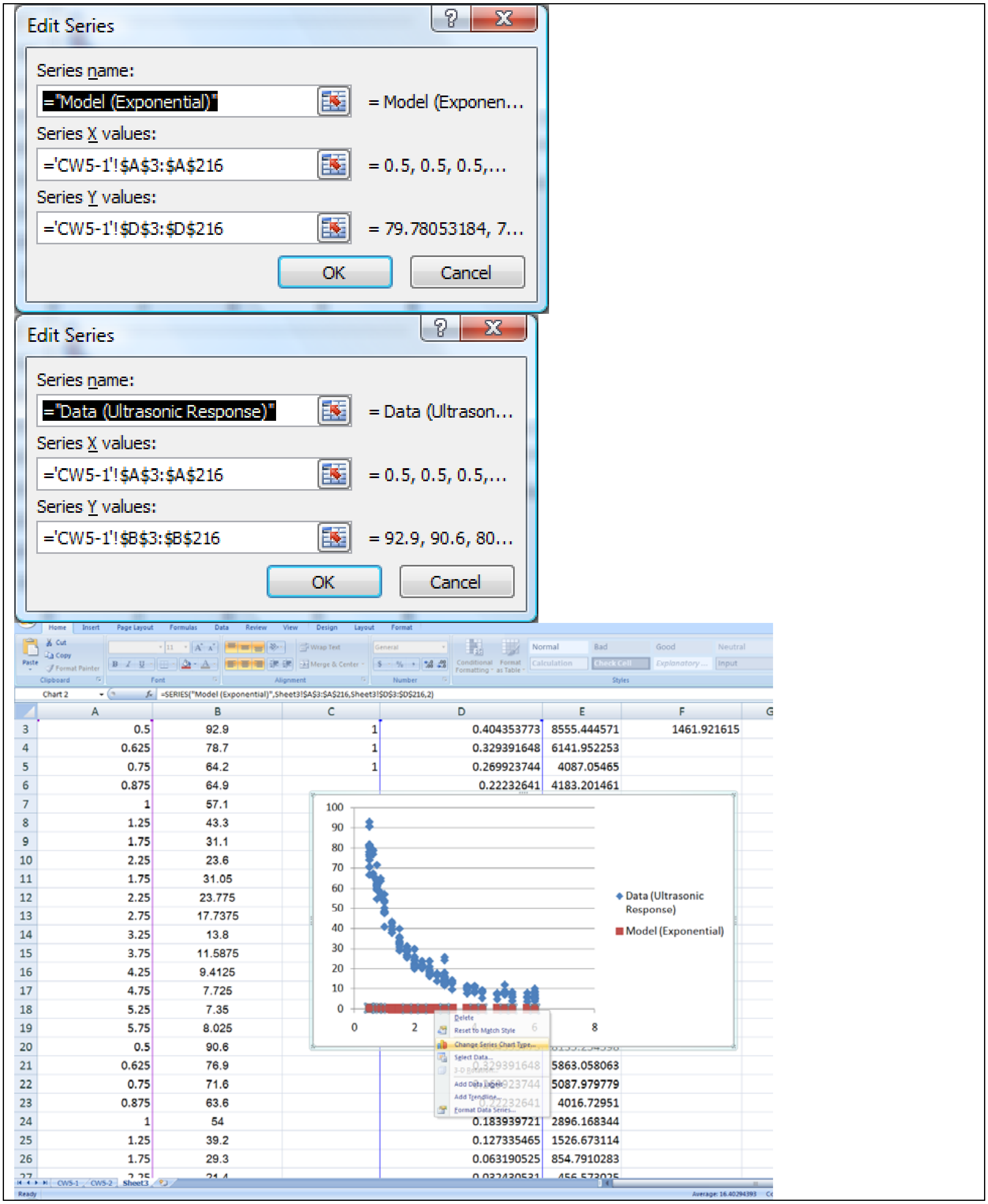
CW5-1 CW5-2 Sheet3



	A	B	C	D	E	F
1	CW5	Name	Date			
2	X (Metal Distance)	Y (Ultrasonic Response)	Guesses b1,b2,b3	Y'=exp(-b1*X)/(b2+b3*X).	(Y'-Y)^2	Parameter s
3	0.5	92.9		0.404353773	8555.444571	1461.921615
4	0.625	78.7		0.329391648	6141.952253	
5	0.75	64.2	1	0.269923744	4087.05465	
6	0.875	64.9		0.22232641	4183.201461	
7	1	57.1		0.183939721	3239.437918	
8	1.25	43.3		0.127335465	1863.878963	
9	1.75	31.1		0.063190525	963.2835424	
10	2.25	23.6		0.032430531	555.4303307	
11	1.75	31.05		0.063190525	960.1823614	
12	2.25	23.775		0.032430531	563.709605	
13	2.75	17.7375		0.01704743	314.0144393	
14	3.25	13.8		0.009123343	190.188279	
15	3.75	11.5875		0.004951104	134.1554389	
16	4.25	9.4125		0.002716997	88.54401616	
17	4.75	7.725		0.001504643	59.65238054	
18	5.25	7.35		0.000839603	54.01015854	
19	5.75	8.025		0.000471523	64.39305728	
20	0.5	90.6		0.404353773	8135.254598	
21	0.625	76.9		0.329391648	5863.058063	
22	0.75	71.6		0.269923744	5087.979779	
23	0.875	63.6		0.22232641	4016.72951	
24	1	54		0.183939721	2896.168344	
25	1.25	39.2		0.127335465	1526.673114	



	A	B	C	D	E	F
1	CW5	Name	Date			
2	X (Metal Distance)	Y (Ultrasonic Response)	Guesses b1,b2,b3	Y'=exp(-b1*X)/(b2+b3*X).	(Y'-Y)^2	Parameter s
3	0.5	92.9	1	0.404353773	8555.444571	1461.921615
4	0.625	78.7	1	0.329391648	6141.952253	
5	0.75	64.2	1	0.269923744	4087.05465	
6	0.875	64.9		0.22232641	4183.201461	
7	1	57.1				
8	1.25	43.3				
9	1.75	31.1				
10	2.25	23.6				
11	1.75	31.05				
12	2.25	23.775				
13	2.75	17.7375				
14	3.25	13.8				
15	3.75	11.5875				
16	4.25	9.4125				
17	4.75	7.725				
18	5.25	7.35				
19	5.75	8.025				
20	0.5	90.6				
21	0.625	76.9		0.329391648	5863.058063	
22	0.75	71.6		0.269923744	5087.979779	
23	0.875	63.6		0.22232641	4016.72951	
24	1	54		0.183939721	2896.168344	
25	1.25	39.2		0.127335465	1526.673114	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Series name:
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= Model (Exponen...
Series X values:
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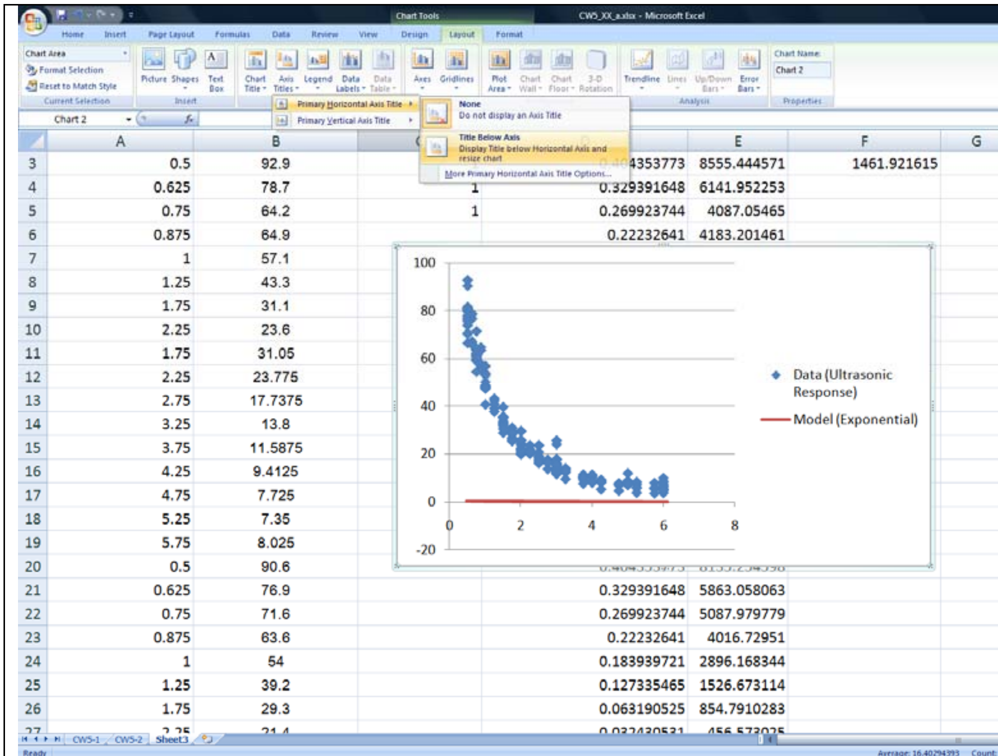
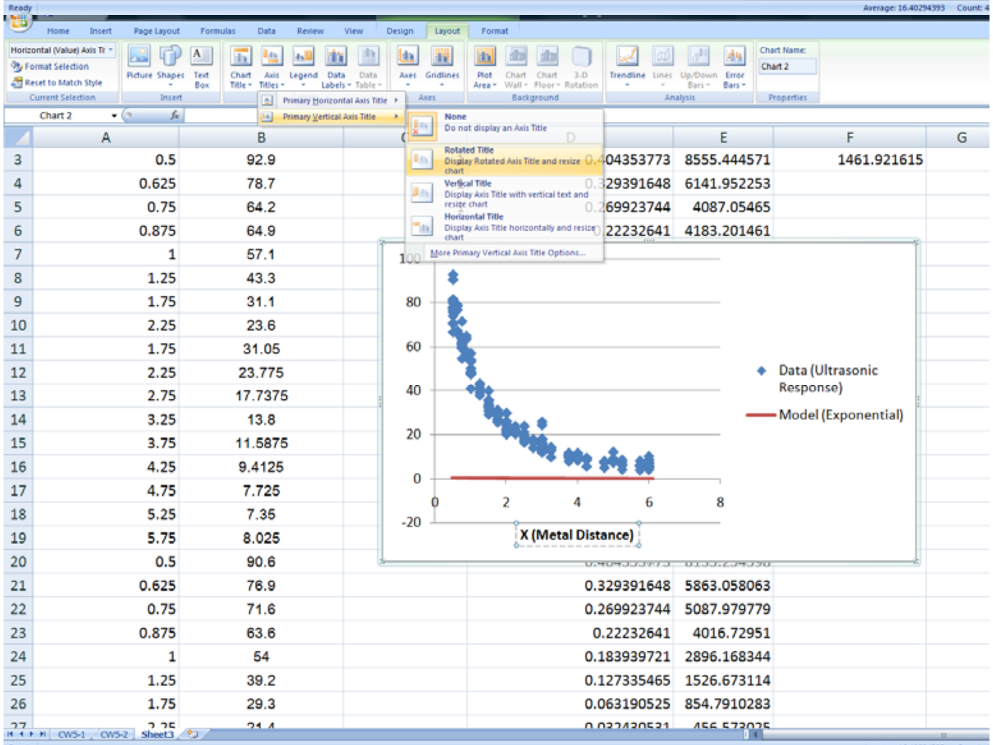
= 0.5, 0.5, 0.5,...
Series Y values:
='CW5-1'!$D$3:$D$216
= 79.78053184, 7...
OK
Cancel
Edit Series
Series name:
="Data (Ultrasonic Response)"
= Data (Ultrason...
Series X values:
='CW5-1'!$A$3:$A$216
= 0.5, 0.5, 0.5,...
Series Y values:
='CW5-1'!$B$3:$B$216
= 92.9, 90.6, 80...
OK
Cancel
Data (Ultrasonic Response)
Model (Exponential)


CW5_XX_a.xlsx - Microsoft Excel
Chart Tools
Home Insert Page Layout Formulas Data Review View Design Layout Format
Chart Area
Format Selection
Reset to Match Style
Current Selection
Picture Shapes Text Box
Chart Title Axis Titles Legend Data Labels Data Table
Axes Gridlines
Plot Area Chart Wall Chart Floor 3-D Rotation
Trendline Lines Up/Down Bars Error Bars
Analysis
Chart Name: Chart 2
Properties
Primary Horizontal Axis Title
Primary Vertical Axis Title
None
Do not display an Axis Title
Title Below Axis
Display Title below Horizontal Axis and resize chart
More Primary Horizontal Axis Title Options...
Data (Ultrasonic Response)
Model (Exponential)
CW5-1 CW5-2 Sheet3
Ready


Home Insert Page Layout Formulas Data Review View Design Layout Format
Horizontal (Value) Axis Ti
Format Selection
Reset to Match Style
Current Selection
Primary Horizontal Axis Title
Primary Vertical Axis Title
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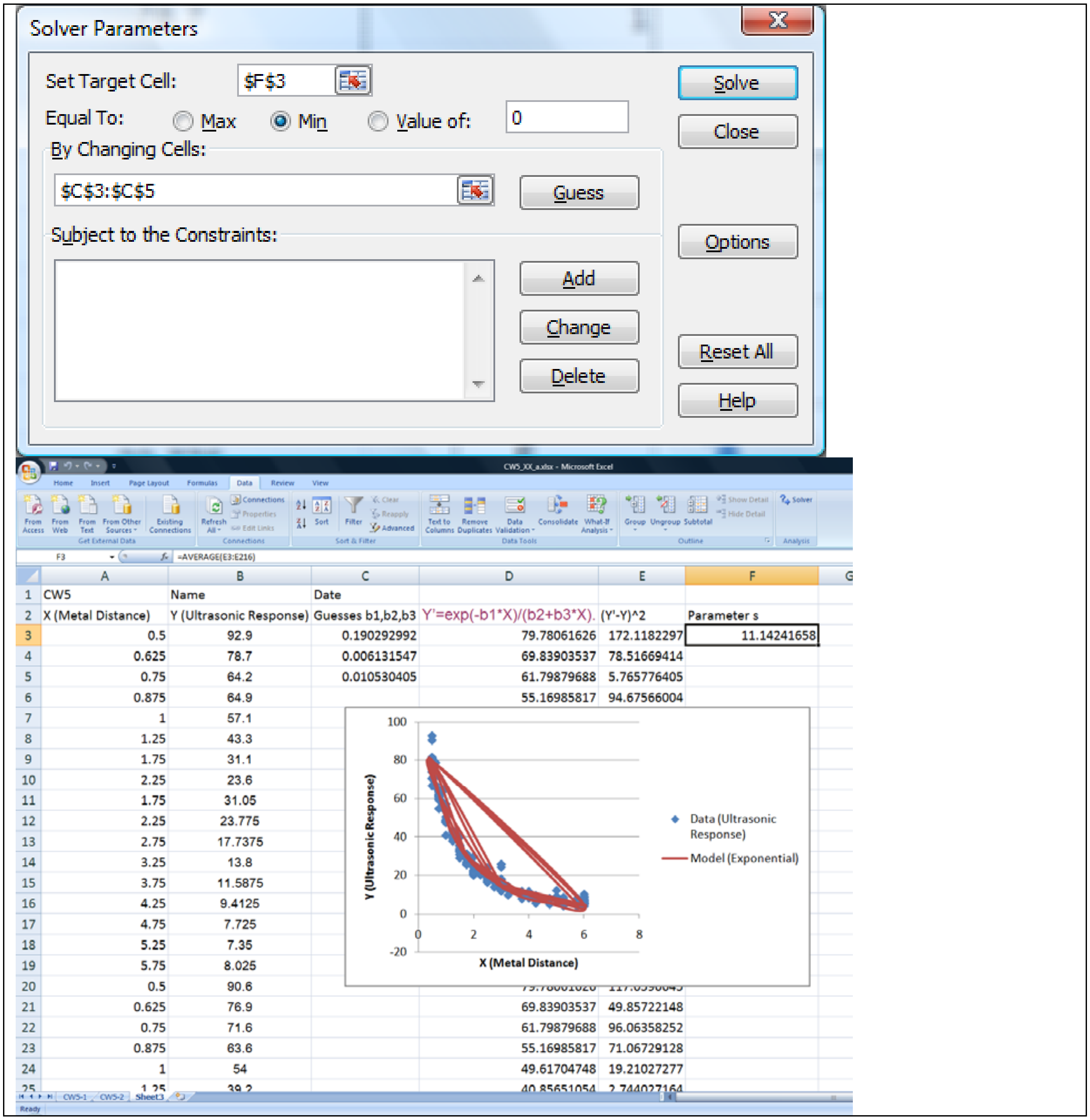
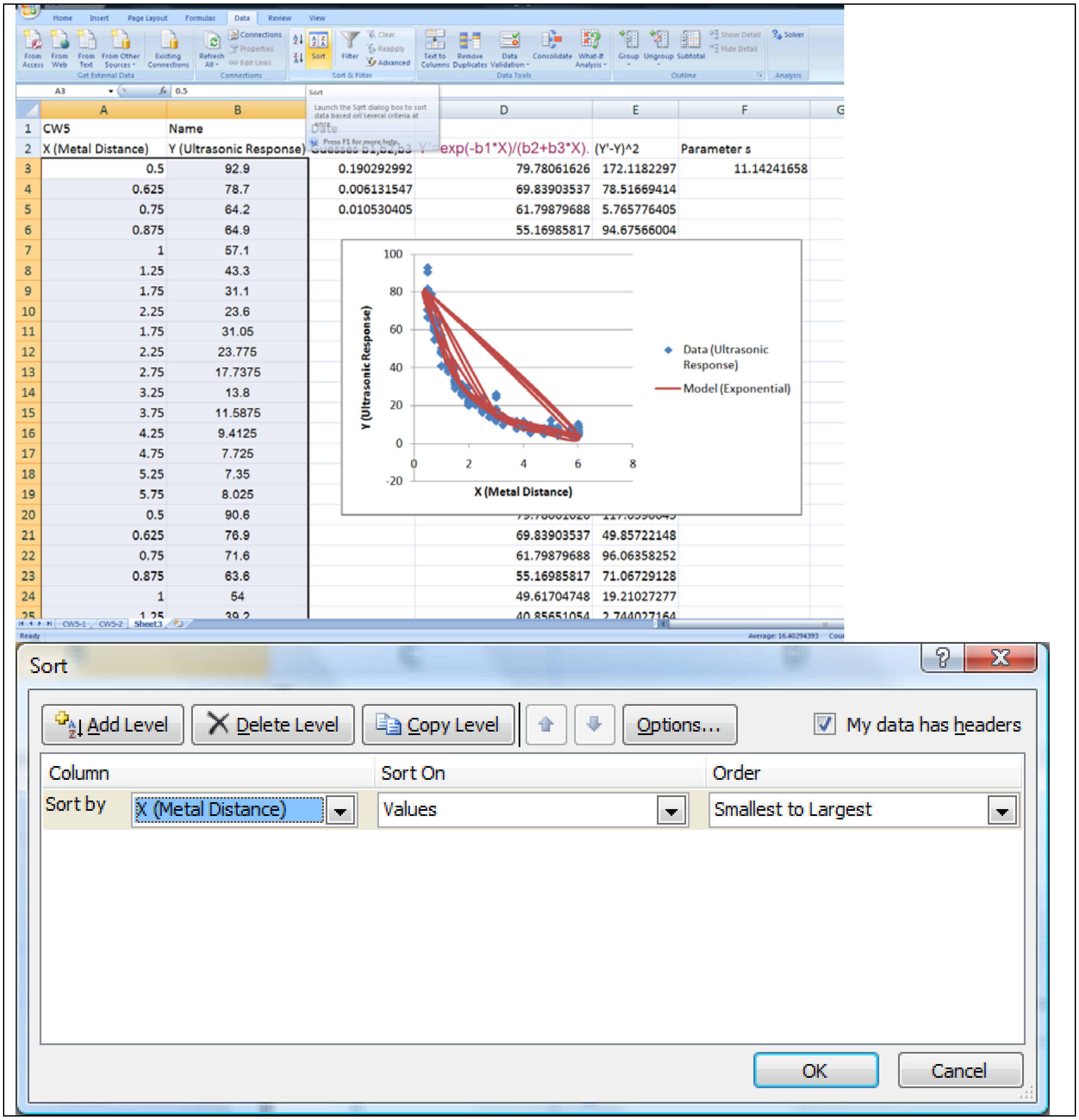
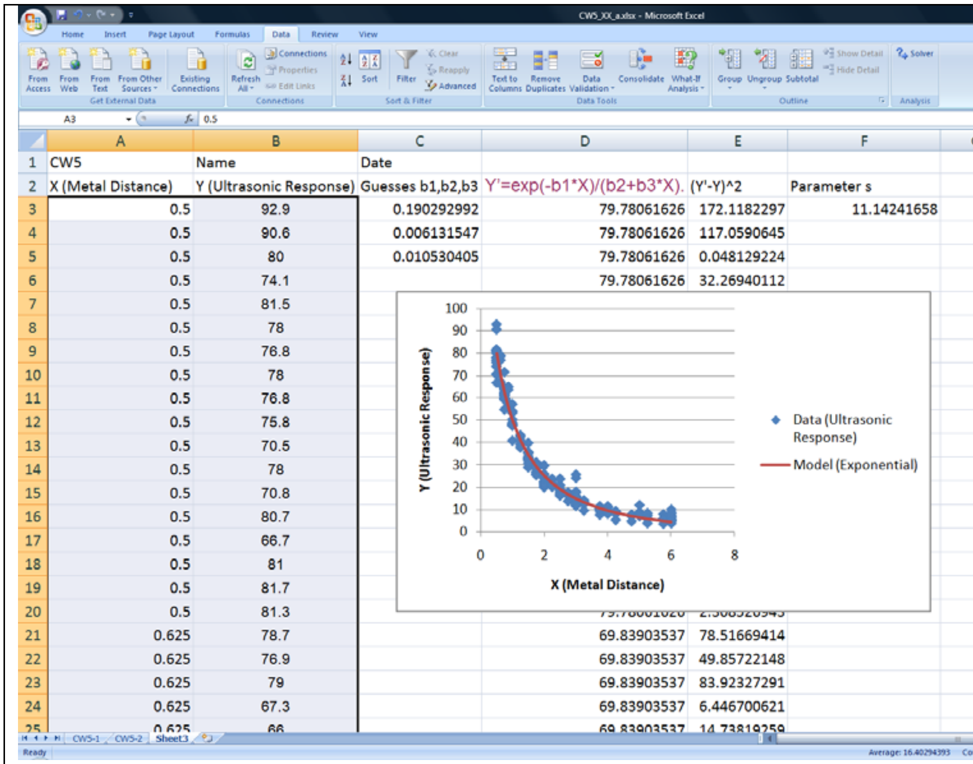
Do not display an Axis Title
Rotated Title
Display Rotated Axis Title and resize chart
Vertical Title
Display Axis Title with vertical text and resize chart
Horizontal Title
Display Axis Title horizontally and resize chart
More Primary Vertical Axis Title Options...
Chart Name: Chart 2
Data (Ultrasonic Response)
Model (Exponential)
X (Metal Distance)
CW5-1 CW5-2 Sheet3
Ready



Solver Parameters
Set Target Cell:
$F$3
Equal To:
Max
Min
Value of:
0
By Changing Cells:
$C$3:$C$5
Subject to the Constraints:
Solve
Close
Guess
Options
Add
Change
Delete
Reset All
Help
=AVERAGE(E3:E216)
CW5
Name
Date
X (Metal Distance)
Y (Ultrasonic Response)
Guesses b1,b2,b3
Y'=exp(-b1*X)/(b2+b3*X).
(Y'-Y)^2
Parameter s
11.14241658
0.190292992
0.006131547
0.010530405
Data (Ultrasonic Response)
Model (Exponential)
Y (Ultrasonic Response)
X (Metal Distance)

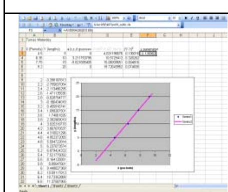
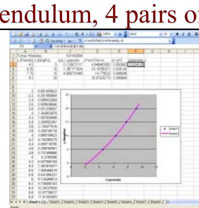
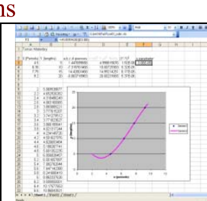
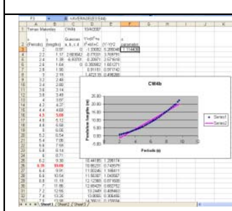
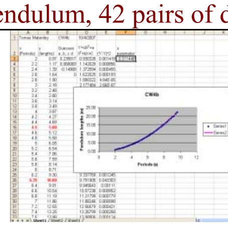
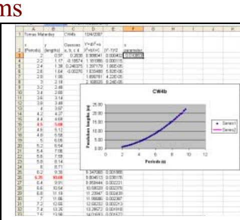
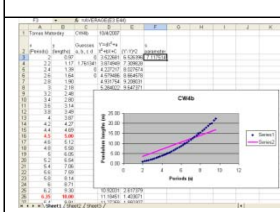
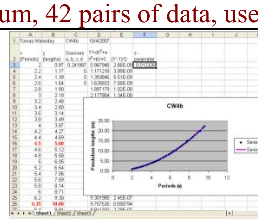
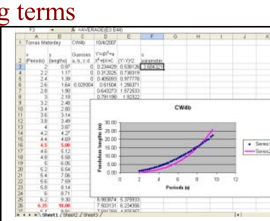


CW5
Name
X (Metal Distance)
Y (Ultrasonic Response)
Guesses b1,b2,b3
Y'=exp(-b1*X)/(b2+b3*X).
(Y'-Y)^2
Parameter s
0.5 92.9 0.190292992 79.78061626 172.1182297 11.14241658
0.625 78.7 0.006131547 69.83903537 78.51669414
0.75 64.2 0.010530405 61.79879688 5.765776405
0.875 64.9 55.16985817 94.67566004
1 57.1
1.25 43.3
1.75 31.1
2.25 23.6
1.75 31.05
2.25 23.775
2.75 17.7375
3.25 13.8
3.75 11.5875
4.25 9.4125
4.75 7.725
5.25 7.35
5.75 8.025
0.5 90.6
0.625 76.9 69.83903537 49.85722148
0.75 71.6 61.79879688 96.06358252
0.875 63.6 55.16985817 71.06729128
1 54 49.61704748 19.21027277
Y (Ultrasonic Response)
X (Metal Distance)
Data (Ultrasonic Response)
Model (Exponential)
Sort
Add Level
Delete Level
Copy Level
Options...
My data has headers
Column
Sort On
Order
Sort by
X (Metal Distance)
Values
Smallest to Largest
OK
Cancel



Data Modeling and Science vs. Engineering

The summary of CW4 results is shown in the table below.

Linear	Quadratic	Cubic
	Pendulum, 4 pairs of data, used all terms	
		 Best
	Pendulum, 42 pairs of data, used all terms	
		 Best s=0.010853
	Pendulum, 42 pairs of data, used only leading terms	
	 Best s=0.012326	

When only the leading term was used, the quadratic model showed the lowest s parameter. This means our data behave more in line with a quadratic term rather than a cubic or a linear term. In deed, based on Newton's Laws and the Universal Law of Gravitation, the period of an ideal pendulum (mass of string is negligible, bob is not so large, and friction is ignored) is given by

$$T = 2\pi\sqrt{\frac{L}{g}} \quad \text{or} \quad L = \frac{gT^2}{4\pi^2}$$

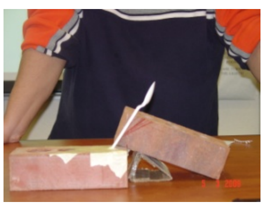
where T is the period, L is the length, and g is the acceleration of gravity.

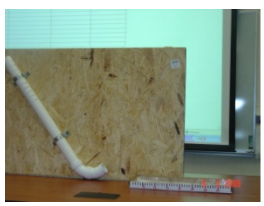
From the value of the coefficient A, you can derive the constant acceleration of gravity g. In fact a method to measure this constant at different latitudes and longitudes is to measure the periods of a pendulum of different lengths, then extract g from the coefficient of the quadratic term.

-While doing data modeling, can we distinguish between an engineer and a scientist approach?

Engineers tend to make a more precise model of a system (getting lower s parameter) by including additional terms. Scientists tend to idealize a system in quest of a universal model that is simpler, but also less accurate when applied to a real system. Precision and universality satisfy a complementary relation similar to that of the uncertainty principle in quantum mechanics.

Data Modeling and System Design





A good design will affect the quality of X,Y data, which will affect the quality of a mathematical model. In the two systems above, which one will allow better data, and so model, and why?

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Introduction to LabVIEW

-LabVIEW: background for HW1 questions 4 and 5. **How to locate different functions within the Front Panel** (user interface: inputs and outputs quantities) **and within the Block Diagram** (programmer interface: operations, analysis).

-Things belonging to the Front Panel will be found under **Controls palette**, abbreviation is C, which can be brought up by 'right-clicking' (click on the mouse's right button) on the Front Panel.

-Things belonging to the Block Diagram will be found under **Functions palette**, abbreviation is F, which can be brought up by 'right-clicking' on the Block Diagram.

-Things to operate VI (Virtual Instruments) will be found under **Tools palette**, abbreviation is T, which can be brought up by clicking on Window, then select 'Show Tools Palette'

For example, where to locate 'Array'?. We start by guessing whether this is an input/output or an operation, it is more of a numeric input utility, so right-click on the Front Panel to bring up the Controls palette (C), then select sub-palette All Controls, then select sub-palette Array and Cluster, to find Array in the first button. So the complete location for Array reads C/All Controls/Array and Cluster.

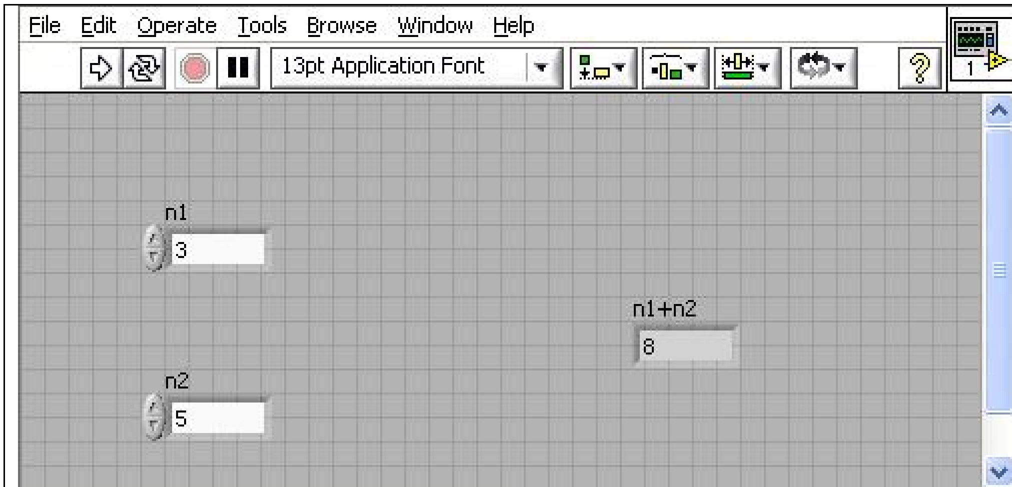
For example where to locate ‘Reciprocal’?. This is more of an operation (getting the reciprocal of x is doing 1/x). So right-click on the Block Diagram to bring up the Functions palette (F), then select All Functions, then Numeric, and find Reciprocal under button 1/x. So the location for Reciprocal is F/All Functions/Numeric

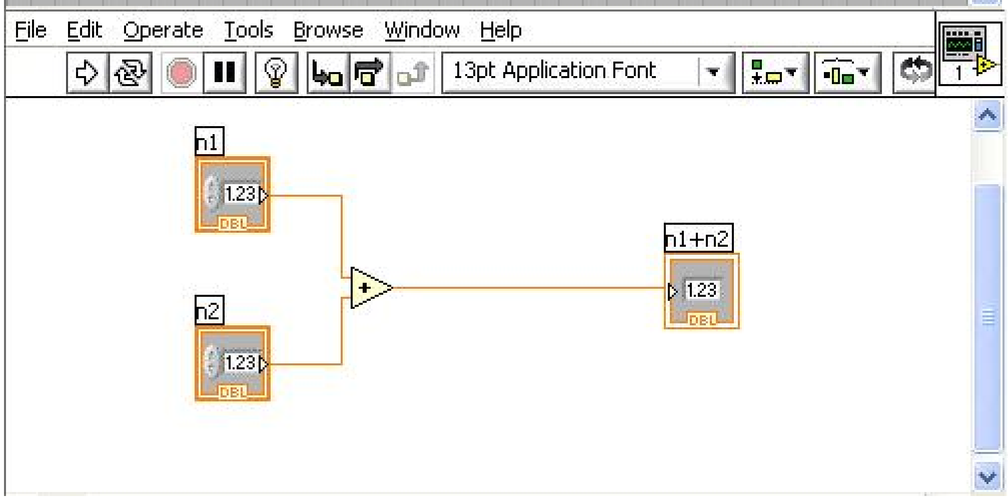
-As a background to changing values on a Numeric Control, we make a simple addition VI. We will need two inputs (Numeric Controls) and one output (Numeric Indicator) in the Front Panel, where the user will input the numbers she/he would like to add, where she/he will read the result, respectively. We should label the inputs as n1 and n2, and the output as n1+n2. This is necessary to identify identical elements on the Block Diagram, and as part of the user interface. **Label** can be entered by typing into the blank box that is shown when an element is placed in the Front Panel. The blank box can be brought up by right-click on the element and select ‘**Show Label’**. To edit labels, select the Text tool, under Tools Palette, then click on the label.

To tell LabVIEW how to produce the output from these inputs, the programmer goes to the Block Diagram to place the addition operation (F/All Functions/Numeric), then wire the inputs n1 and n2 into the left terminals of the addition by selecting the **wiring too**l (under T), click to start, click to end, double-click to finish a wiring. Note that since the addition is commutative, n1 and n2 can be individually connected to either the left upper terminal or the left lower terminal of the addition operator. Should we have a division, the upper terminal is divided by the lower terminal, or the left terminals are different. In a subtraction, the upper terminal is subtracted by the lower one.

If we need to remove any piece of wire, use the **Select tool** (arrow under T) to select that piece, then hit ‘backspace’ on the keyboard.

Then it comes to put in values into the Numeric Controls to test our addition VI: using the **Operate Value tool** (finger, under T) and click on the left handles to increase or decrease by an integer unit. To run the VI, click on the **Run button** (right arrow in the upper left corner), the results should show as expected. If we would like to scan through different inputs and outputs without having to hit the Run button every time we change the inputs, then use **Run Continuously** (found to the right of the Run button). Under this mode, the VI should be stopped before any modification can be made.





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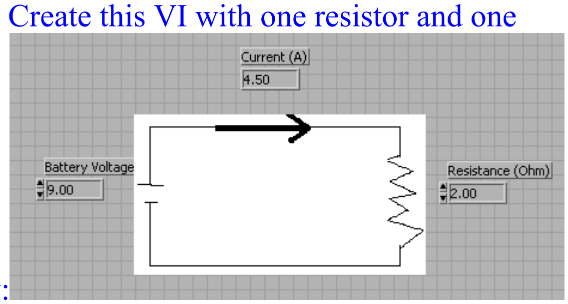
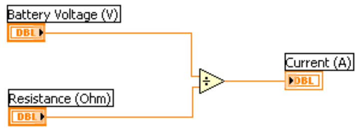
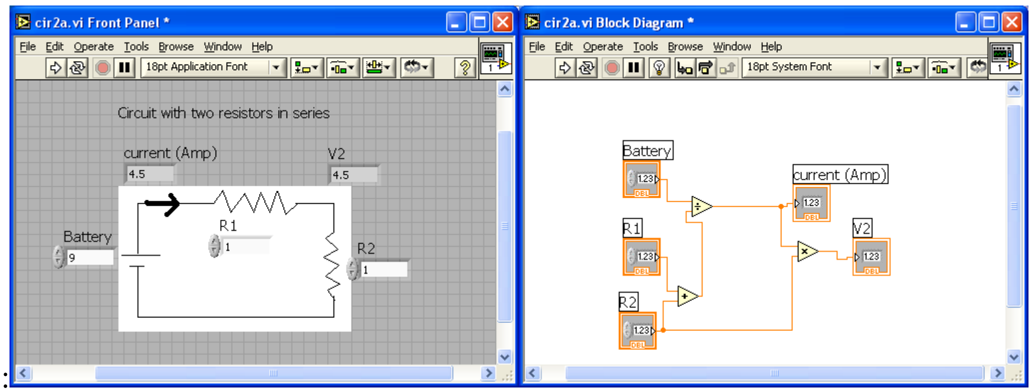
CW6: Introduction to LabVIEW

a) Create this VI with one resistor and one battery:



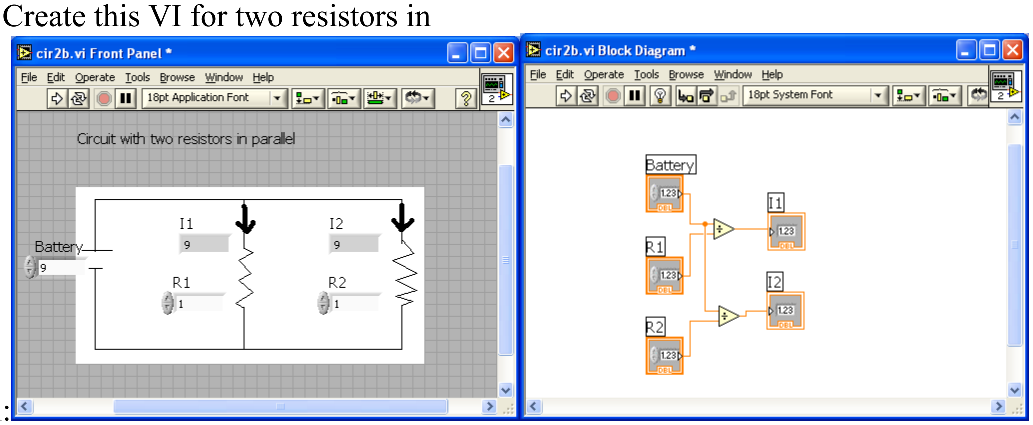


b) Create this VI for two resistors in



series:

c) Create this VI for two resistors in



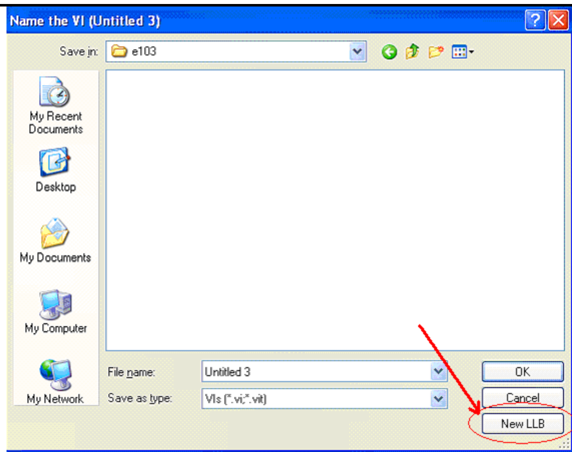
parallel:

In each team, students working together at a computer numbered between 1 and 10 will submit LabVIEW LLB file cw6_XX_a.llb, students working at a computer numbered between 11 and 20 will submit LabVIEW LLB file cw6_XX_b.llb, to the *files* folder in the server. Replace XX by 01 if team 1, etc.

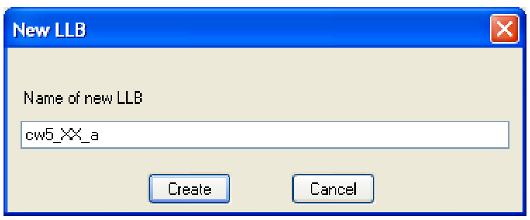
Include your names within the files.

Save each VI into a LLB file (LabVIEW library) as follows:

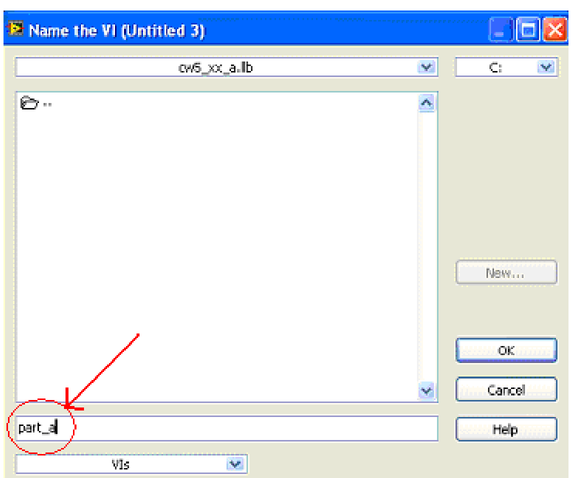
Creating library file cw5_XX_a.llb and saving part a) in there.	**Saving part b) or c) into cw5_XX_a.llb**



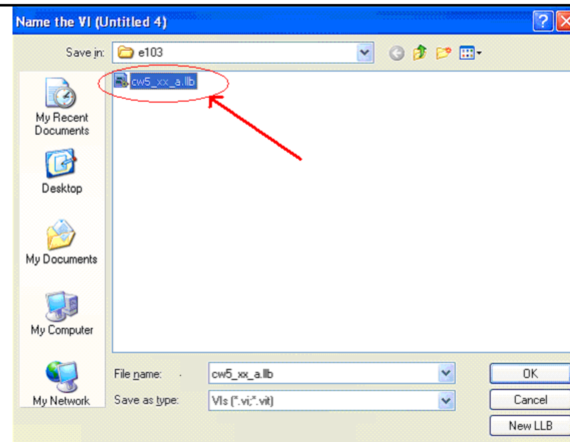
After select Save, click on New LLB



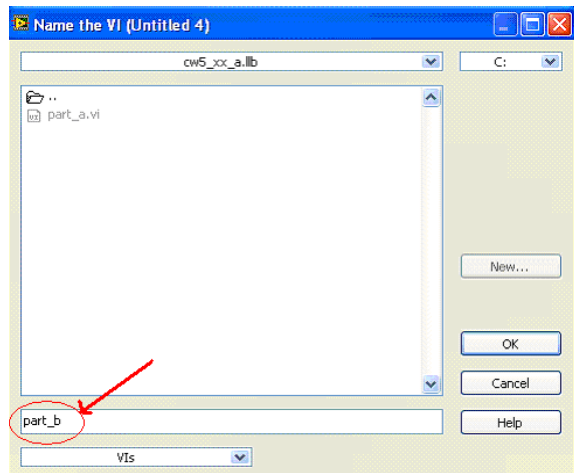
Type in "cw5_XX_a", where XX is the two digit team number, and "a" or "b" based on your subgroup within the team. Then click Create.



Type in the file name for the VI: in this case "part_a". Then click OK



After select Save, double click on the library you created cw5_XX_a.llb



Type in the file name for the VI: in this case "part_b". Then click OK

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Circuit Analysis with LabVIEW I (see also link in the e-syllabus).

Example: a VI that solves a simple electrical circuit with one battery and one resistance:

Developing a Virtual Instrument consists of the following steps:

1) Define the problem you want to solve, specify what will be the inputs and the outputs.
The inputs are the battery voltage V (in Volts) and the resistance of the light bulb R in (in Ohms). The output is the current flowing in the circuit I (in Amps)

2) Determine the equations or operations needed to produce the outputs from the inputs
We need an equation that gives I in terms of V and R. It is Ohm's law:
I=V/R

3) Implement the controls and indicators and graphs in the Control Panel and the operations in the Block Diagram
Control panel: enter a numeric control for V, another one for R; a numeric indicator (without handle on the left side) for the current I

Block Diagram: enter the "divide" operation, then wire V and R to this operator, and the output to I

4) Fix any error and implement modifications as needed

If there is a broken wire, that needs to be fixed
If there is no error, the arrow on the upper left corner ("Run") is not broken

5) Test the final results against expected theoretical values.
Enter V=9V; R=2 Ohm, I should read 4.5 A
In circuits with more than one resistor, if the output does not agree with our calculation, the Block Diagram needs to be revised.

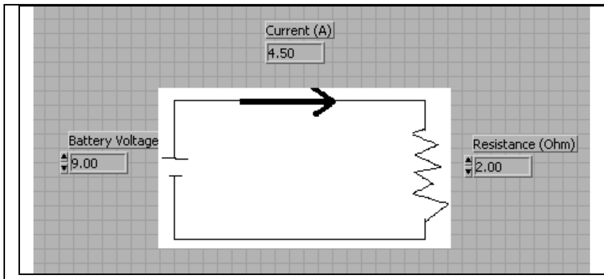
Insert a text box by clicking on "A" (Edit Text) in the tool palette
Insert a circuit diagram made in Paint by selecting (using the dotted rectangle in Paint left menu), then Edit/Copy; then in the Front Panel of LabVIEW, Edit/Paste

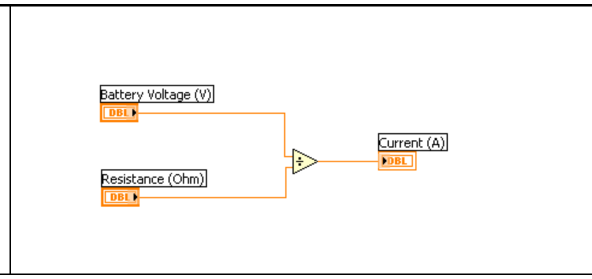
Front Panel: enter two numeric controls, label them as V and R; enter one numeric indicator, label it as I

Block Diagram: enter the "Divide" operator from Arith/Compare/Numeric
Group V and R together with the "Divide" on the left side of the Block Diagram, and the I on the right.

Check if the "Run" button is continuous

Enter values in the Numeric Controls V and R boxes and check the result at the numeric indicator I box after clicking on the "Run" button.





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Circuit Analysis with LabVIEW II (see also link in e-syllabus)

Example: a VI that solves a simple electrical circuit with one battery and two resistors in series.

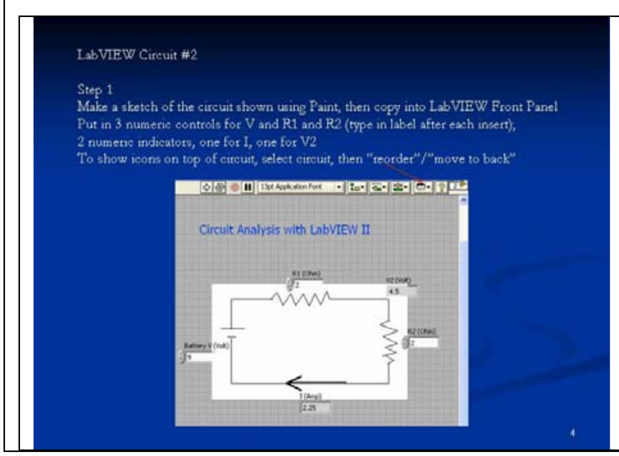
1) Define inputs: V; R1; R2
Define outputs: V2 (voltage across R2); and I (current for this circuit of 2 resistances in series

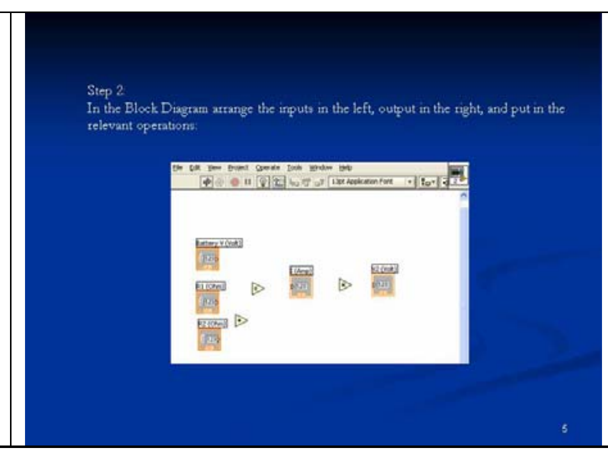
2) Equations: I=V/(R1+R2); V2=I*R2

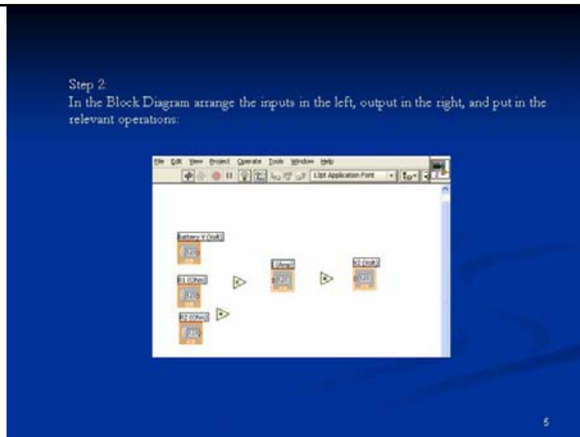
3) Front Panel: Circuit diagram using Paint; then enter three numeric controls for V, R1, and R2; two numeric indicators for V2 and I
Block Diagram: order elements for least number of cross wires (to facilitate the debugging process), group V, R1, R2 on the left, I and V2 on the right
Enter an "add" operator, a division (both for producing I from V, R1 and R2 using the given equation), and a "multiply" to produce V2 from I and R2.
Use "Connect Wire" in the tools palette to connect the elements

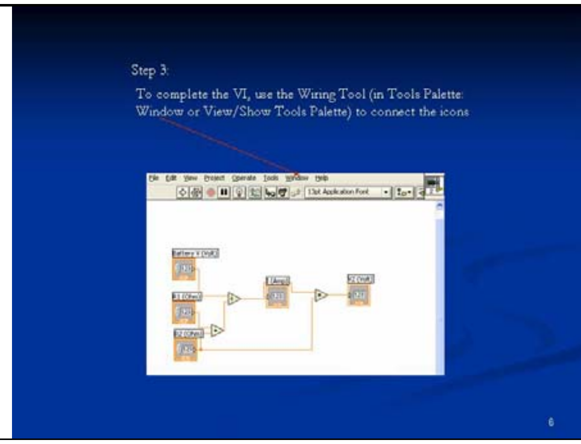
4) Check for errors.

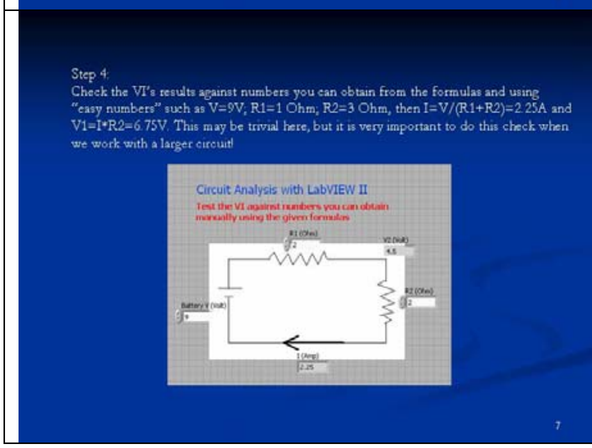
5) Testing: enter V=9 V; R1=2 Ohm; R2=2 Ohm; I should read 9/4=2.25 Amp; and V2 should read 2.25*2= 4.5V



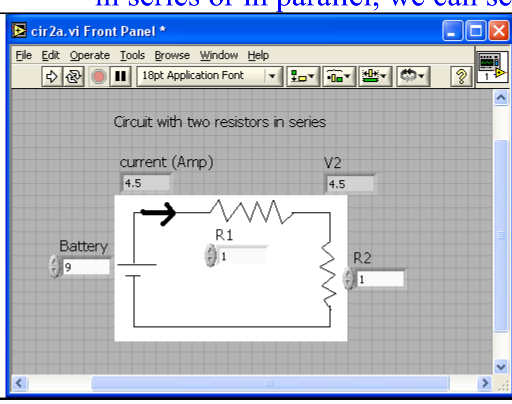


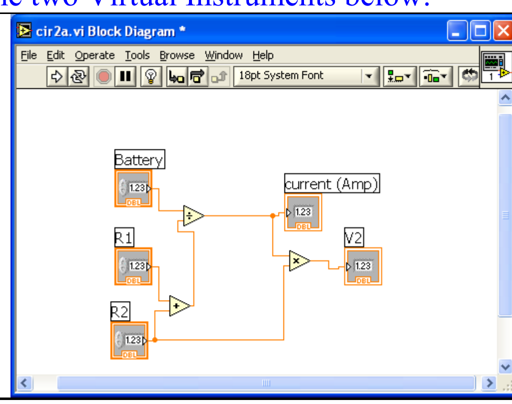


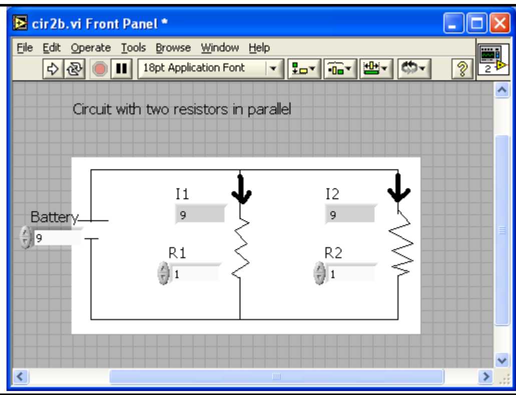


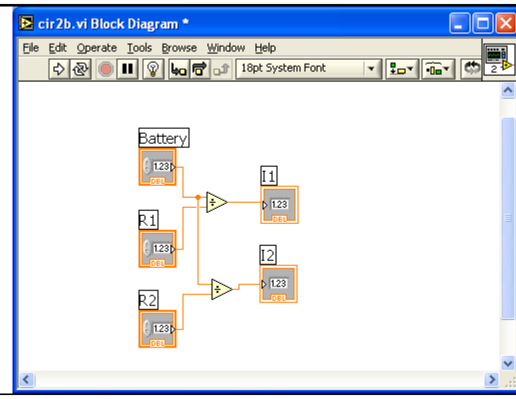


To compare how much current is flowing through each resistor when they are connected in series or in parallel, we can set up the two Virtual Instruments below:









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Project 1 Results

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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:

21) Insert the three tables shown in CW4 with values of the polynomial coefficients and s parameters in the logbook. Describe the differences in the graphs of the three tables in CW4.
22) Calculate the constant acceleration of gravity g (in m/s^2) using the quadratic coefficient A from your table #3 of CW4 using the formula provided above; show the calculations and the final result in your logbook

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