Engin 103 April 13, 2010 back to e-syllabus	Topics: Estimation CW9 CW10 Logbook questions

Estimation

Estimate the cost of leaving a light bulb on 24h

$0.12 per kW-h
60W bulb on 24h -> 24*60 W-h=1440W-h=1.44kW-h
Total cost electricity = $0.12*1.44=$0.1728

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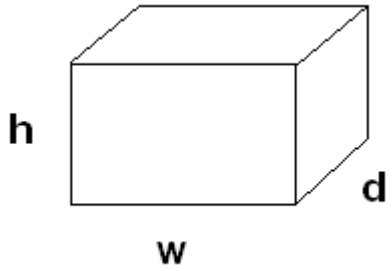
Estimation

HW3
Mass of air through your lungs per day
Start with some data: air density 1 kg/m^3 (for comparison, water density is 1000kg/m^3)
Start by estimating volume of thorax cavity: simplest shape:



Rectangular prism:
W*d*h= 0.3*0.2*0.3=0.018m^3
Assume we breathe 10 times per min: 600x24 times per day=14400 times

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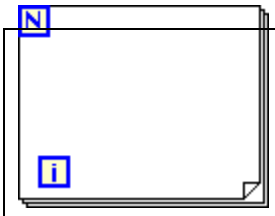
LabVIEW:

FOR LOOP I runs from 0 to N-1 (1 to N): a tool to repeat some group of operations N times where i=0,1,2,3,…, N-1



CW9 use FOR LOOP to plot a function f(t): series

Plotting=putting a dot on certain points to represent a function on a 2D plane. For each dot I need 2 coordinates: ti and $f(t_i)$

T_i time series

$F(t_i)$ function series

To generate time series t_i we will use the FOR LOOP

$T_i=t_a+i*\Delta$ (t_a the initial value; Δ: the increment)

What operations will be included in the FOR LOOP? + and *

We will also need to tell the FOR LOOP: N; the increment Δ; the initial value t_a. For now we will use Numeric Constants to enter these values

N=5;

Δ=1;

Ta=0;

T_i={0,1,2,3,4} (5 dots for my function)

What about $f(t_i)$? I need to specify the function: String Control

For each value in the time series t_i, we need LabVIEW to calculate $f(t_i)$

Eval. Of Single Variable Array

To place the dots: Waveform Graph, this requires 3 information: two to specify t_i (ta and Δ); the third is the $f(t_i)$; we need a Bundle

(under Cluster & Variant, right click on left side to add a third input)

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CW 9

(In-Class-Work 9)

Plotting a function using 1) For Loop; 2) Evaluation of Single Variable Array; 3) Waveform Graph (see class note for additional instructions)

a) Make a VI that can plot any function between 0 and 4 (using N=101 points, for example). Use LabVIEW For Loop, Eval Single-Variable Array (version 7.1: under Analyze/Mathematics/Formula/Advanced Formula Parsing; version 8.2: under Mathematics/Scripts&Formulas/1D&2D Eval), and Bundle (under Cluster) to tell the Waveform Graph the initial value, increment for t (the function's argument), and values of the function. Use cos(t) as the input function to be plotted. Click on the Light Bulb in the Diagram, and then click Run to see how the For Loop and the program work. Save the VI into a LLB file named cw9_XX_Y, as "part a" after selecting Files/Make Current Values as Default.

b) Make another VI by modifying the VI in a) such that it uses only 5 points. Note the difference. Then use trial-error method to see what is the smallest number of points that would make the graph look like the actual function. Save the VI into the same LLB file (cw8_XX_Y) as "part b" after doing Files/Make Current Values as Default with this smallest number of points

Please insert names and dates within the Front Panels. In each team, students working together at a computer numbered between 1 and 10 will submit LabVIEW LLB file cw9_XX_a.llb, students working at a computer numbered between 11 and 20 will submit LabVIEW LLB file cw9_XX_b.llb, to the *files* folder in the server. Replace XX by 01 if team 1, etc. Each LLB file should contain two VI's, named 'cw9a' and 'cw9b' corresponding to this CW. These files need to be uploaded to the server today to receive credit. Include your names 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.

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Plotting a Function with LabVIEW I: 1)For Loop 2) Eval Single Var. Array 3) Waveform Graph:

$t_i = t_a + i*\Delta$

t_a = initial value in the series

Δ= the increment

i= running index

We can obtain numbers by adding increments

(multiple of Δ) to an initial value
For example: ta=1; Δ=0.5; ti={1,1.5, 2, 2.5} (N=4)
ta=0.2; Δ=1; ti={0.2, 1.2, 2.2, 3.2, 4.2, 5.2} (N=6)
Another example: ta=0; highest ti is 4; number of elements in series (N) ti is 101; what is Δ?
Δ=(tb-ta)/(N-1) (tb is the highest value in the series)
Δ=(4-0)/(101-1)=0.04

-The computer is very good in automatic generation of long series of numbers: a) start with an initial value b) use an increment to produce the next value c) how many numbers in the series

To plot a function f(t) between ta (initial value) and tb (final value) using N points we will generate a time series (horizontal axis)

$$ti = ta + i*\Delta$$

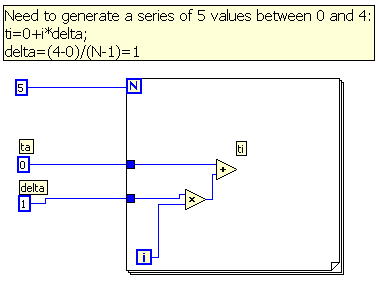
where i =0, 2, …, N-1 (with Δ the increment; Δ=(tb-ta)/(N-1);
t1=ta and tN=tb); ti: the next value: or value "i" is equal to the initial value ta plus "i" times the increment.

For example, we would like to generate N=101 values, with initial value of 0; final value of 4, what is the formula?

ti= 0 +i*Δ= i*0.04 (i= 0,1,2,3, ..., 100)
Δ=(tb-ta)/(N-1) = (4-0)/(101-1)=0.04

What if we would like a different series, starting from 4, going to 10; using 37 values?
ti=4+i*(10-4)/36=4+i*1.6667;

To do this in LabVIEW we will use the FOR LOOP

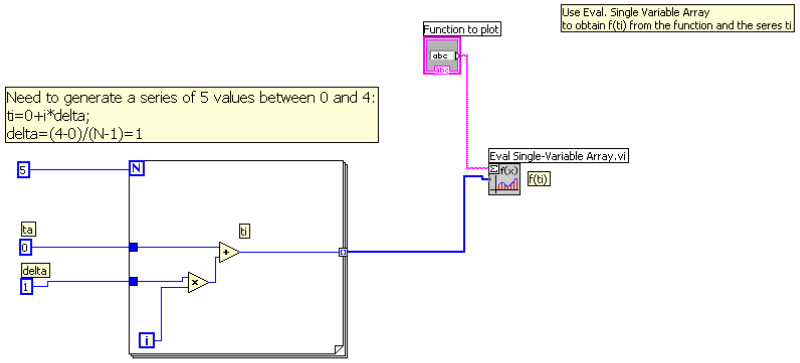


To plot f(t) (vertical axis of our 2D Waveform Graph) versus t (horizontal axis of our Graph), we now need to evaluate f(t) at ti, i.e. obtaining f(ti). Then plot the points (ti, f(ti)) using the Waveform Graph. LabVIEW automatically connect these points with lines. We will enter a function using a String Control in the Front

Panel.

Eval. Single Variable Array

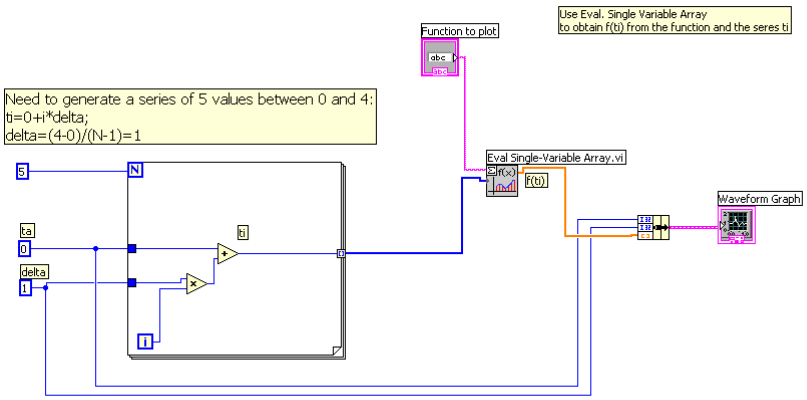
(version 7.1: under Analyze/Mathematics/Formula/Advanced Formula Parsing; version 8.2: under Mathematics/Scripts&Formulas/1D&2D Eval) takes as inputs the function f(t) and the input series ti , and produces the output series f(ti)

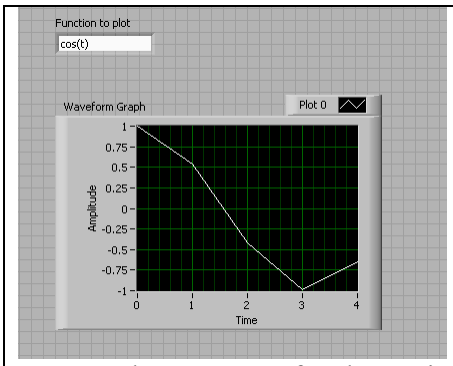


Use Waveform Graph, it has one input terminal, but requires three information:

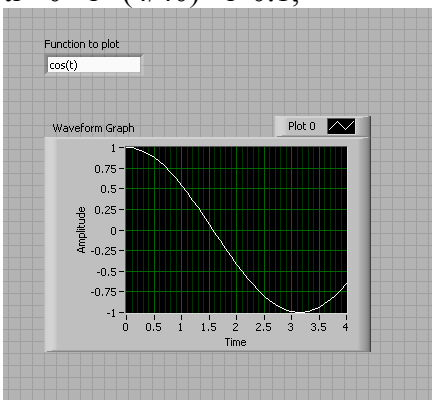
1) Initial value for the horizontal axis
2) Increment for the time series
3) f(ti)

To "bundle" these 3 information into one terminal, we will use "bundle"
Bundle (under Cluster, then right-click on its left side to "Add Input" to have three input terminals, since the Waveform Graph requires three inputs in this order: ta, Δ, and f(ti))



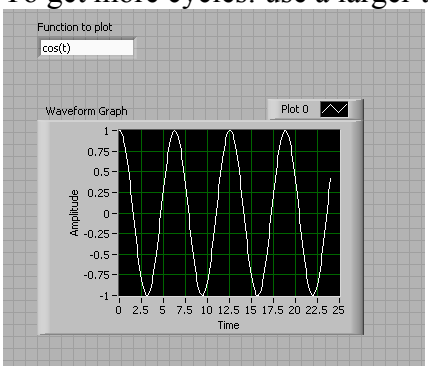


To get a better curve for the cosine function: we need to change the time series:
we need to change N, since the graph shows just 5 points (ti, f(ti)) connected with lines.
N=41;
ti= 0 +i* (4/40)= i*0.1;



If the number of points is large or
the increment Δ is small, then the lines are so short that the overall curve looks smooth
which resembles the function we are trying to plot.

To get more cycles: use a larger tb by using more points with the same delta



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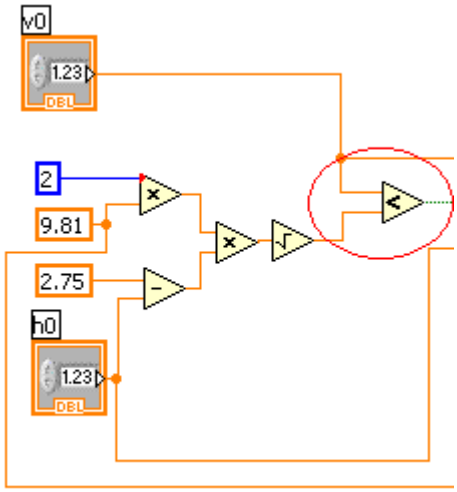
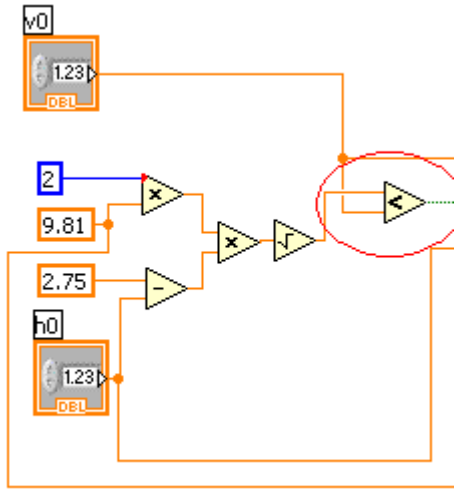
LOGBOOK: example of a logbook page

-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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