

Engineering 103 –UMass Boston

CW 10

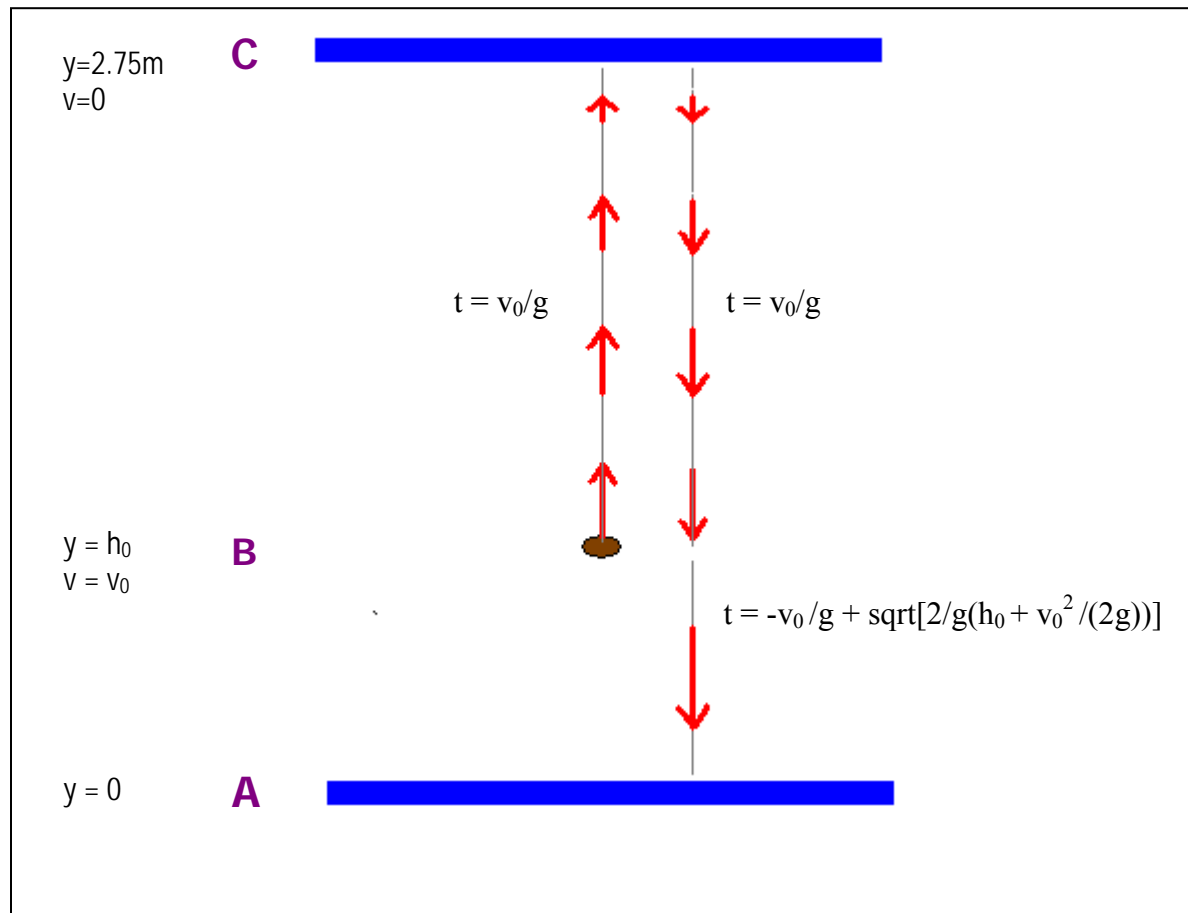
(In-Class-Work 10)

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 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.

*Remember that this is an individual work (turn it in, as instructed, with your name and date). Homeworks 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 $g=9.81\text{m/s}^2$. 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

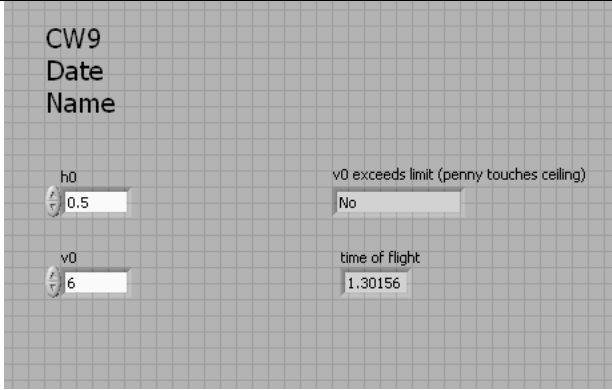
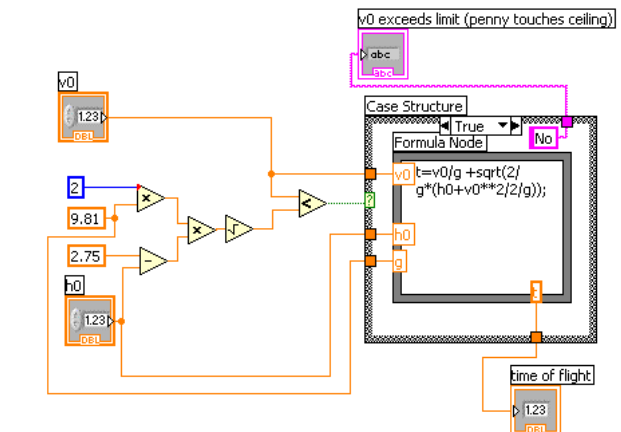
$$t_{BA} = -\frac{v_0}{g} + \sqrt{\frac{2}{g} \left(h_0 + \frac{v_0^2}{2g} \right)}$$

so the total time of flight is

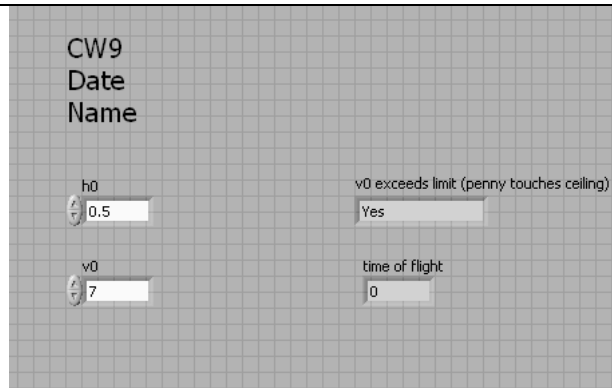
$$t_{BCBA} = \frac{v_0}{g} + \sqrt{\frac{2}{g} \left(h_0 + \frac{v_0^2}{2g} \right)}$$

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 “**”

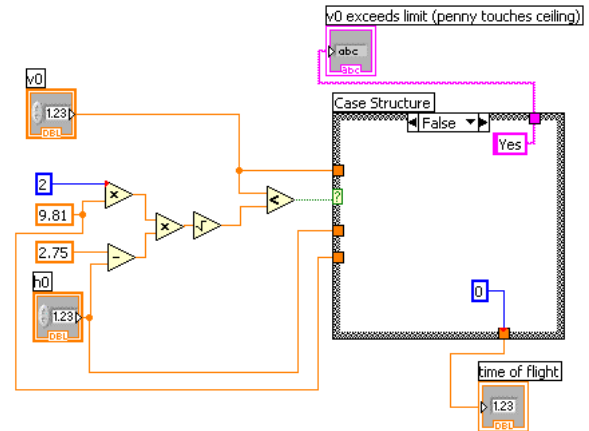
Testing the VI:

Front Panel	Block Diagram
	
At $h_0=0.5\text{m}$; $v_0=6\text{m/s}$ does not exceed the limit to	Since v_0 is less than its limit, the less-than

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.



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”

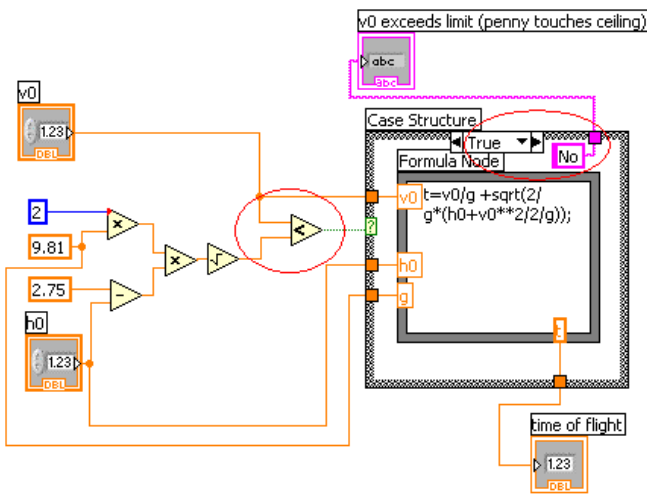


At $h_0=0.5\text{m}$; $v_0=7\text{m/s}$ exceeds the limit to keep the penny from touching the ceiling, so the answer to the question “ v_0 exceeds limit?” is “Yes”, and a time of flight is not calculated.

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”

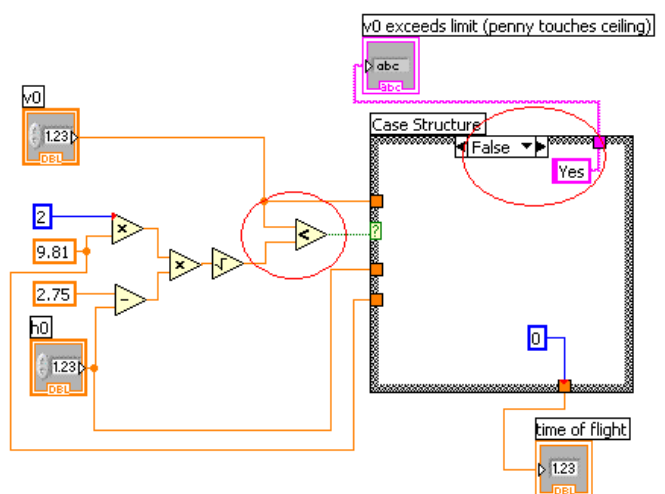
Two possible connections at the less-than comparison operator

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

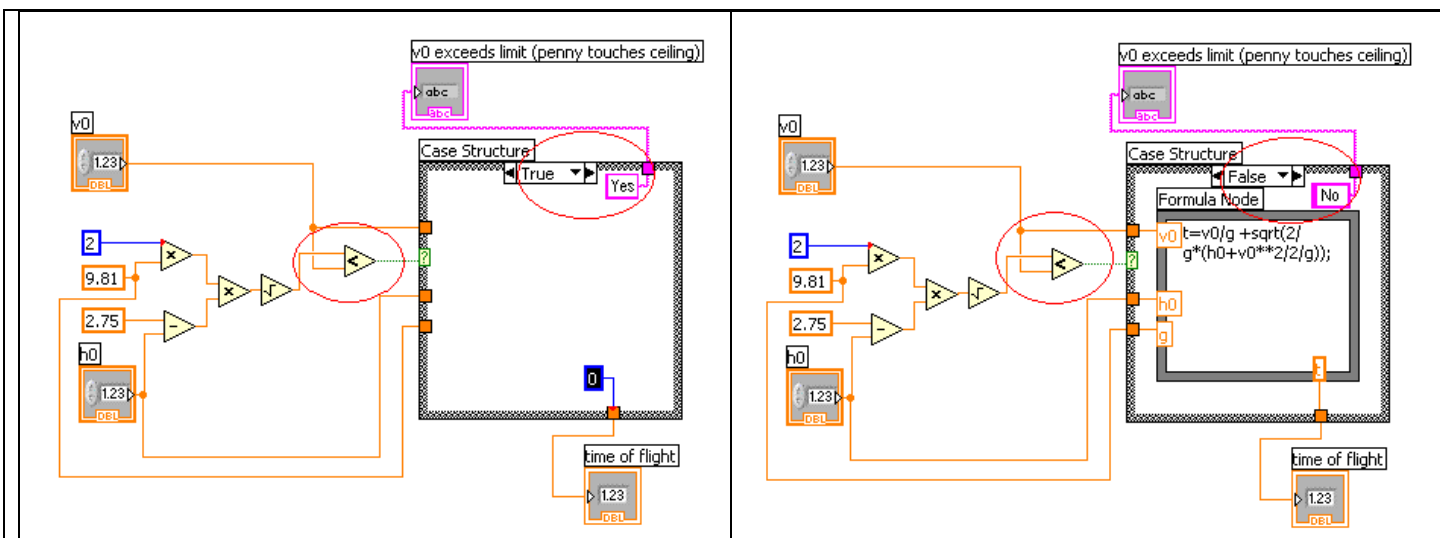


True window if v_0 is on the right side of the less-than comparison

False window if v_0 is on the left 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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Estimation

Estimate the cost of leaving a light bulb on 24h

\$0.12 per kW-h

60W bulb on 24h -> $24 \times 60 \text{ W-h} = 1440 \text{ W-h} = 1.44 \text{ kW-h}$

Total cost electricity = $\$0.12 \times 1.44 = \0.1728

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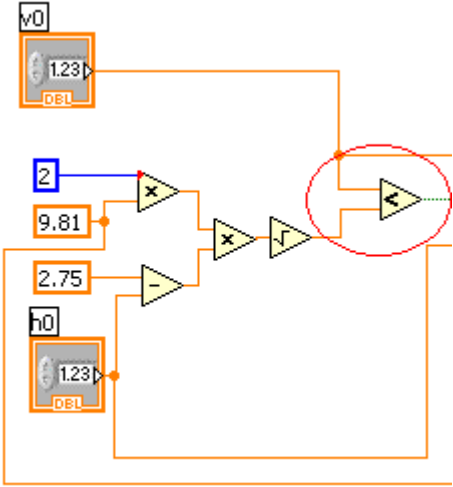
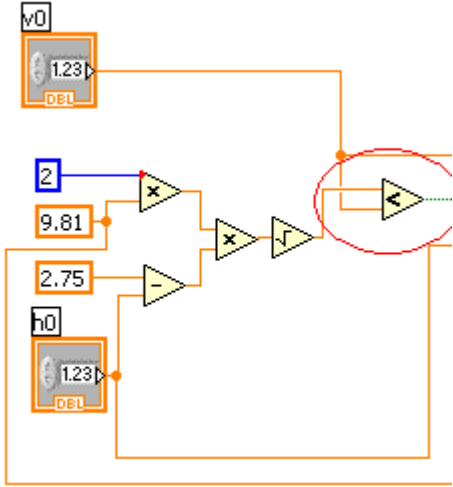
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LOGBOOK: [example of a logbook page](#)

- 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 (CW10), 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 CW10. Answer questions a) and b) for two possible connections at the less-than operator shown in the table below:

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

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