ROSE-HULMAN INSTITUTE OF TECHNOLOGY

Department of Mechanical Engineering

ME 123 — Computer Programming

Exercises for Day 7

Exercise 1. Recall that we previously used a `for` loop and a recursive assignment to calculate the value of y:

$$y = \sum_{x=0}^{5} x^2 = 0^2 + 1^2 + 2^2 + 3^2 + 4^2 + 5^2$$

Type in this script:

Day7_Exerxcise1.m

```
1 -     clc
2 -     clear variables
3 -     y=0;
4 -     for x=0:5
5 -         y=y+x^2;
6 -     end
7 -     fprintf('y=%2.0f\n',y);
```

Use the debugger to complete the table to the right. (There aren't any mistakes in the script — we just want you to practice with the debugger.)

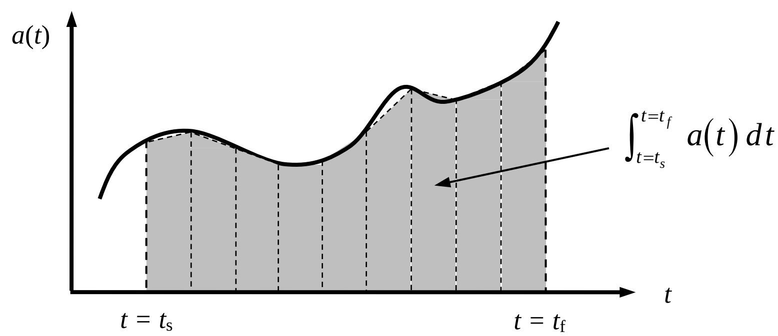
Turn in this sheet with your homework. (You don't need to turn in the script.)

Line #	Value of variables just ***before*** the line executes	
	x	y
1	--	--
2	--	--
3	--	--
4	--	0
5	0	0
6		
5		
6		
5		
6		
5		
6		
5		
6		
5		
6		
7		

Exercise 2. To learn more about how to use the debugger, go to the course web site and download the script called `debugthis.m`. This code calculates the two-dimensional rocket trajectory with a launch speed of 80 m/s and a launch angle of 50°. When you run this program, you'll see it doesn't work; it needs to be debugged. The correct results should give a maximum vertical altitude of 191 m after 6 sec of flight time.

Starting from the *original* copy of `debugthis.m` you downloaded, add comments in CAPITAL LETTERS pointing out how your corrected each error that you found. Turn in your corrected version of `debugthis.m` (with comments) along with the trajectory output table that it produces.

Exercise 3. In yesterday's homework, we approximated the area under an acceleration function by breaking it up into many rectangles. In this homework, you will be asked to perform a similar approximation strategy using *trapezoids* instead:



The approximate area under the acceleration curve can be given by

$$v(t) = \int_{t=t_s}^{t=t_f} a(t)\,d\,t \approx \sum_{i=1}^{N} \left[\frac{a(t_i) + a(t_{i+1})}{2} \right] \Delta t$$

where

$$t_i = t_s + (i - 1)\,\Delta t$$

$$t_{i+1} = t_i + \Delta t$$

$$\Delta t = (t_f - t_s) / N$$

(Here, N is the total number of trapezoids used to slice up the interval between $t = t_s$ and $t = t_f$.)

Write a MATLAB program that sums the approximate area under the increasing acceleration curve

$$a(t) = 0.2\,\exp(2.1\,t)\ \text{m/s}^2$$

from $t = 0$ s to $t = 5$ s using 2000 trapezoids. (2000 trapezoids should give you an answer that is as accurate as 1 million rectangles.) ***Hint***: Make use of the debugger to help you find any logical errors in your MATLAB code!