**PURDUE UNIVERSITY NORTHWEST DEPARTMENTS OF ENGINEERING**

**ENGR15100: SOFTWARE TOOLS FOR ENGINEERS**

**Pre-Laboratory 9**

**PURPOSE:** To introduce the use of a Function.

**STEP 1:** Create the script file rocket2h2.m as given in the sample code. Please note that some sections of code are reused and can simply be copied and pasted, A PERFECT SCENARIO FOR USE OF A FUNCTION!!!

**STEP 2:**

1. Create the script file Lastname\_prelab9.m as given in the sample code.
2. Run Lastname\_prelab9.
3. Enter 6 for the burn time, 6000 for the desired height.
4. Rerun Lastname\_prelab9 but this time enter 7 and 5000.

%ENGR15100 Prelab9.m

%

clc

clear

disp('ENGR15100 Prelab 9')

disp('Your name here')

disp(' ')

%Run script file for rocket calculations

rocket2h2

%rocket2h2.m

%

clc

b=input('Enter desired burn time ');

disp(' ')

h\_des=input('Enter desired height ');

disp(' ')

dt=.1;

m=10;

f=2000;

g=32.2;

%calculate constants

v\_b=(f/m-g)\*b;

h\_b=0.5\*(f/m-g)\*b^2;

h\_p=h\_b+v\_b^2/(2\*g);

t\_p=b+v\_b/g;

figure(2)

%Begin calculating flight

h=0;

k=0;

while h>=0

t=k\*dt;

k=k+1;

if t<=b

h=0.5\*(f/m-g)\*t^2;

v=(f/m-g)\*t;

else

%calc rest of unpowered ascent

h=h\_b-.5\*g\*(t-b)^2+v\_b\*(t-b);

v=v\_b-g\*(t-b);

end

plot(t,h,'b.')

hold on

end

%disp('Time to desired height is:')

disp('Time to hit the ground is:')

disp(t)

disp(' ')

hold off

%Next based on burn time and desired altitude the code will determine time to reach %altitude if possible check if peak height greater than altitude desired.

if h\_p>h\_des %do-able!

h=0;

k=0;

t=0;

while h<h\_des

t=k\*dt;

k=k+1;

if t<=b

h=0.5\*(f/m-g)\*t^2;

v=(f/m-g)\*t;

else

%calc rest of unpowered ascent

h=h\_b-.5\*g\*(t-b)^2+v\_b\*(t-b);

v=v\_b-g\*(t-b);

end

end

disp('Time to desired height is:')

disp(t)

else

disp('Rocket will not achieve desired altitude of:')

disp(h\_des)

end

**Laboratory 9\_Step 1**

**PURPOSE:** To motivate the use of a function. Each Script file below is to be stand alone and should begin with clc and clear.

**Problem 1**

Based on the rocket code of pre-lab 9, write a script file firstname\_lastname\_lab9\_probem1.m to:

1. Ask the user to enter the values of the rocket mass m in lbs, engine force f in lbs, and the engine burn time b in seconds. In the input prompt strings specify that m is to be between 5 and 15 lb, f is to be between 50 and 500 lbs, and b between 5 and 20 seconds. Note that the numbers do not have to be integers.
2. Calculate the flight parameters of rocket velocity at engine shut down v\_b, rocket altitude at engine shut down h\_b, peak altitude h\_p, and the time to peak altitude t\_p.
3. Display (using fprintf) messages with values of the four variables calculated above, including the correct associated units.

**Problem 2**

Based on the rocket code of pre-lab 8, write a script file firstname\_lastname\_lab9\_problem2.m to:

1. Calculate the altitude h from the time of launch to ground impact. Again ask the user to input the values as in Problem 1, and again use dt = 0.1 s.
2. Create the plot of h versus t in figure 2, add x and y labels, title, and a grid.

**Problem 3**

Based on the rocket code of pre-lab 8, write a script file firstname\_lastname\_lab9\_problem3.m to:

1. Calculate the velocity v and altitude h of the rocket from the time of launch to ground impact. Use inputs and values as before.
2. Create a two-row, one-column subplot in figure 3, where subplot one shows altitude h versus time, while subplot two shows velocity v versus time.

**Problem 4**

Based on the rocket code of pre-lab 8, write a script file firstname\_lastname\_lab9\_problem4.m to:

1. Determine the time at which h =3000 ft on the way up. Use a FOR loop technique, a time step dt = 0.1 s, and other values and inputs as before. Print an error message if h = 3000 ft is not reached.
2. Use fprintf to display the result.

**Problem 5**

Based on the rocket code of pre-lab 8, write a script file firstname\_lastname\_lab9\_problem5.m to:

1. Determine the time at which h =3000 ft on the way up. Use a WHILE loop technique and a time step of dt = 0.05 s, and other values and inputs as before. Print an error message if h = 3000 ft is not reached.
2. Use fprintf to display the result.

**SUBMITTING YOUR LAB:**

Submit your lab by uploading .m file using the Blackboard Assignment feature no later than the date specified.