ENGR 102 - Lab Assignment #5B

Spring 2019

You are to write three programs as described below. Remember to document your code with comments, and print labels and units when applicable. When these programs are completed, submit all files to eCampus. Remember the appropriate header information.

Program 1: Averaging Measurements

☑ *Use Python looping procedures to take user input.*
☑ *Calculate simple statistical data from a small set of measurements.*

Assume that someone has collected a set of measurements and wants some statistical data about them. Write a program that asks a user for measurements and prints the average, the maximum, and the minimum measurement. Users should be allowed to enter as many measurements as they want, until entering a negative measurement. The negative measurement should not be processed, but is just used to indicate that the user has finished entering measurements.

Note: use a while loop for this task, and do not use a list to store measurements.

Program 2: Divisors

☑ *Create a program using Python looping procedures and math functions to calculate the desired output.*

For numbers from 2 to 100, print a series of lines indicating which numbers are divisors of other numbers. For each, print out "X divides Y", where X <= Y, and both X and Y are between 2 and 100.

Example output (the first few lines will be):

```
2 divides 2
3 divides 3
2 divides 4
4 divides 4
5 divides 5
2 divides 6
3 divides 6
etc.
```

Program 3: The Angry Bird Decision

☑ *Plan and create a program that takes user input, uses Python looping procedures to calculate the required output, and format the output for the user.*

Red, our Angry Bird friend, will be shot from a catapult again. This time, you've been given the equation that projects his trajectory based on his initial velocity (v_0), his angle of launch (Θ), and the acceleration due to gravity (g).

$$y = x \tan\theta - \frac{gx^2}{2{v_0}^2 \cos^2\theta}$$

You've been informed that the wall he *must* knock down is 202.3 m away.

a. Take user input for Red's initial velocity (for testing, start with 45 m/s).
b. For the input velocity, at what angle must your catapult be set to reach the wall at a height of 1 m (+/- 0.1m)? Use Earth's gravity. Start at 0 degrees, and increase the angle until the required condition is met. Not all initial velocities will have a solution; in these cases, tell the user there is no solution for Red.
c. Plot his trajectory. Use the instructions from Lab05, Activity 2 for help in creating the plot. Do not create a plot if there is no solution for the velocity the user input.
d. This was on Earth, what if we move to Mars? *(Note: calculations pause if a plot is displayed.)*
e. Report to the user the angle you calculated and the height of impact for both Earth and Mars.

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Challenge (optional, for glory only):

Calculate Red's velocity and kinetic energy at an interval selected by the user. Start with 1m increments. (Recall Lab 3b, program 2 stepped through this process for one interval). What is his kinetic energy when he hits the wall?