ENGR 102 - LAB ASSIGNMENT #11

Fall 2021

General course learning outcomes:

- *demonstrate the construction of computer programs, including techniques to declare and use functions to solve computing-related problems.*
- *apply programming techniques to solve problems in engineering.*
- *complete a team programming assignment that ties together concepts learned in the class.*

Remember to document your code with comments, and print labels and units when applicable. When these programs are completed, submit all files to Mimir. Remember the appropriate header information.

Deliverables – 3 .py files:

1.) Lab11a_Act1
2.) Lab11a_Act2
3.) Lab11a_Act3

Activity 1: Again - to do in lab (team)

☑ *Create and use functions in Python*

Write a function and have the main program 'test' the function. For example, you might include several function calls and display the results or create a program where a user can enter values and see the results.

Write a function that takes in a list and returns the minimum, mean, and maximum values from the list. You may use the min, mean, and/or max built-in functions to do so.

Activity 2: Keanu Reeves Starring in "Average Velocity"

☑ *Use basic engineering equations and write a Python program to perform the calculations.*
☑ *Create and use functions in Python*

Write a function and have the main program 'test' the function. For example, you might include several function calls and display the results or create a program where a user can enter values and see the results.

Write a function that takes in two parallel lists: a list of times (in increasing order), and a list of distance traveled by that point in time. The function should return a new list giving the average velocity between consecutive time measurements. *(Note: the new list should have length one less than the original lists.)*

Activity 3: Bravery!, Humility!, Anger-y!- to do in lab (team)

☑ *Create and use functions in Python*

Our Angry Bird friends need your help—again. This time, mysterious random piggy points are appearing on various planets, and Red and friends are the only ones who can catapult themselves into heroic action.

The main program has been created already (provided on the following page). It's your team's job to create the functions (and add any needed import statements) that will make it work for Red, Chuck, Bomb, and Terence. The user will be able to make repeated inputs of initial velocity and initial angle guesses to see if they can hit the 'pig' target. The program will pick a random distance (x direction), height (y direction), and size for the target. (This portion of the code is already provided in the 'Main Program'.) Note: You can think of the 'pig' target as a sphere or circle.

- When asking users to select items, provide nicely formatted informational menus. Provide at least the following options:

  Birds: Red = red, small bird; Chuck = yellow, small bird; Bomb = black, large bird; Terence = red, large bird

  Planets: Earth = 9.807 m/s^2, Mars = 3.711 m/s^2, Moon = 1.625 m/s^2, Jupiter = 24.79 m/s^2

- When plotting the trajectory, the target should be a menacing bright green pig-like circle, and the trajectory should be a dotted line representing the color and size of the bird thrown. If the bird hits the target, a large red X should mark the successful hit.
- Make your program smart enough to account for the location and size of the target when determining a 'hit'. Presume the target is in the shape of a circle
- You must use all of the provided lines of code, exactly as they appear.

```
# Standard Header Here

# ---------------------------------------- IMPORT STATEMENTS----------------------------------------
# (Put the necessary import statements first)
```

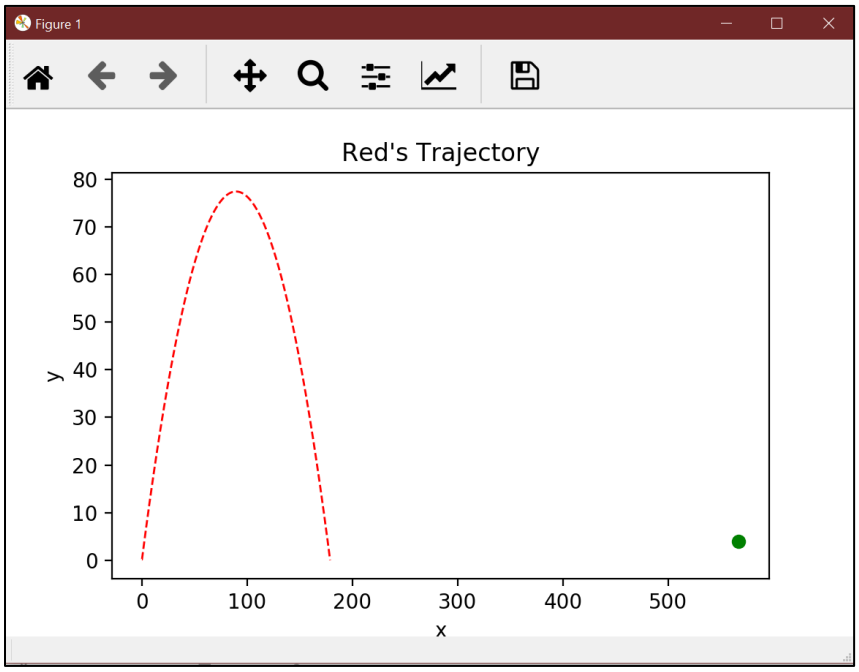
Place the necessary import statements here

```
# ---------------------------------------- FUNCTION DEFINITIONS----------------------------------------
# (Create and place any needed function definitions in this part of the program)
# If you see a function being used that doesn't already have a definition in this area, you will
# need to create it.

def get_basics():
    """Takes user selections for active bird and planet. Returns (bird, planet). 'Bird' includes name,
       color and size. 'Planet' includes name and gravity. """
    a = bird_picker()                               # Runs fn to provide bird menu
    b = planet_picker()                             # Runs fn to provide planet menu
    return a, b


def trajectory_y(x, g, vo, angle):
    """Returns (y-value) of the trajectory for a given x-value, gravity, initial velocity, and angle."""
    angle = radians(angle)
    return (x*tan(angle))-(g*x**2)/(2*(vo**2)*cos(angle)**2)
```

Create the additional necessary functions here

```
# ---------------------------------------- MAIN PROGRAM ----------------------------------------
# (The Main Program is below - you WILL NOT need to make any changes or additions to this part.)

# Sets up loop so user can repeat the game as many times as desired ('y' to continue, 'n' to quit)
pig_counter = 0
again = 'y'
while again == 'y':

    # Program will pick a random distance (x from 10-1000), height (y from 0-50) and size of a target
    target = (random.randint(10, 1000), random.randint(0, 50), random.randint(10, 50))

    # Obtains user selections and initial guesses
    bird, g = get_basics()                          # Runs fn to get bird and planet (gravity) selection
    v_guess, theta_guess = get_guesses()            # Runs fn to get initial velocity and angle guesses

    # Loops guesses until bird hits target
    x, y = trajectory(g, v_guess, theta_guess)      # Runs fn to create current x- and y- value lists
    while not hit(x, y, target):                    # Program cycles until thrown bird hits the target
        birds_plot(x, y, target, bird)              # Plots trajectory & target of miss
        v_guess, theta_guess = get_guesses()        # Gets updated guesses from user
        x, y = trajectory(g, v_guess, theta_guess)  # Creates updated lists of x- and y-values

    # Handles winning case and asks if user would like to play again
    print('Yay!')
    pig_counter += 1
    # Plots trajectory and target of a hit
    birds_plot(x, y, target, bird, True)
    again = input('Would you like to play again? (y/n)')
    while again not in {'y', 'n'}:
        again = input('Please type either y or n only. Would you like to play again? (y/n)')

# Exiting when user decides to quit
print('\nThanks for playing! you popped {} pig(s) today!'.format(pig_counter))
```

Example of a plot for a miss.:



Example of a plot for a hit.: