ENGR 102 – Fall 2021
Lab Assignment #3

Deliverables for Lab Assignment #3:

Lab Assignment #3 consists of two team activities. Please submit the following files to Mimir. You will submit a total of 7 .py files.

- `Lab3a_Act1_x.py` where `x` represents one of the letters (a) through (f) (six program files total)
- `Lab3a_Act2.py`

Please include the team header information at the top of each file with the names of all contributing team members. Please submit all files on the list as one submission. This is a team assignment, but everyone in the team must submit the same 7 files.

Activity #1: *Team activity – writing useful programs*

This activity is meant to help illustrate the process of asking a user for input, reading the input, performing processing, and outputting a result. Many programs will follow that basic format. Unit conversions (and print statements) may seem to be a trivial exercise. But, both can be critically important, as mishandling the proper communication of units can lead to project failure or even loss of human life. Please search and read a little bit about the Mars Climate Orbiter, and read the two statements from NASA:

- https://mars.nasa.gov/msp98/news/mco990930.html
- https://mars.nasa.gov/msp98/news/mco991110.html

For each unit conversion listed below, write a short program that prompts the user to enter a number, stores it in an appropriately named variable, performs the necessary calculations, and outputs the results to the screen with proper labels and two (2) decimal places. ***Write a separate program for each case***. Name the program files as follows: Lab3a_Act1_a.py, Lab3a_Act1_b.py, and so on. Upon completion of this Activity, you will have 6 .py files.

a) Pounds (force) to Newtons
b) Kilometers to miles
c) Atmospheres to millimeters of mercury
d) Watts to BTU per hour
e) Liters per second to gallons per minute
f) Degrees Celsius to degrees Rankine

See the example output on the next page for the exact wording of the input prompts and output statements. With respect to the example output below, you do **NOT** need to make your input text appear red and bold; this is only done below to highlight the example input. As always, include descriptive comments in your code so that someone may follow your programming logic.

Example output (example input is shown in bold, **red text**):

```
Please enter the number of pounds to be converted to Newtons: 1
1.00 pounds is equivalent to 4.45 Newtons

Please enter the number of kilometers to be converted to miles: 1
1.00 kilometers is equivalent to 0.62 miles

Please enter the number of atmospheres to be converted to millimeters
of mercury: 1
1.00 atmospheres is equivalent to 760.00 millimeters of mercury

Please enter the number of watts to be converted to BTU per hour: 1
1.00 watts is equivalent to 3.41 BTU per hour

Please enter the number of liters per second to be converted to
gallons per minute: 1
1.00 liters per second is equivalent to 15.85 gallons per minute

Please enter the number of degrees Celsius to be converted to degrees
Rankine: 1
1.00 degrees Celsius is equivalent to 493.47 degrees Rankine
```

Activity #2: *Team Activity – Writing a larger program, creating functions*

This activity is meant to give your team experience writing a larger program together. Your program should take as input the time and location of a moving object at two points. Using interpolation, calculate the position at several intermediate times. Your program needs to perform the following tasks:

- Prompt the user to enter the time and position (3-D) at two points (see example output below)
- Use interpolation to calculate the times and positions for three evenly spaced points between the two points entered by the user
- Print the results using nice formatting
  - Display the times using one (1) decimal place
  - Display the positions using two (2) decimal places

In your program, write a function named `interpolate()` that calculates and prints your results.

Before writing your program:

It's good practice to think before you code. As a team, follow the steps below.

1. Make a list of the variables that your team will use in this program. Be sure to include:
   a. The variable names
   b. The type of each variable (data type)
   c. A *very brief* description of what each variable is (you can write one description for multiple variables if it is clear what they all are)

2. Write a brief description of the calculations your program will perform, including a sample calculation done by hand.
3. Finally, write your code as a team. Please name this file Lab3a_Act2.py for submission. Remember to test you code to make certain it works properly.

Example output (example input is shown in bold, **red text**):

```
Enter time 1: 1
Enter the x position of the object at time 1: 1
Enter the y position of the object at time 1: 1
Enter the z position of the object at time 1: 1
Enter time 2: 2
Enter the x position of the object at time 2: 2
Enter the y position of the object at time 2: 2
Enter the z position of the object at time 2: 2

At time 1.0 seconds the object is at (1.00, 1.00, 1.00)
At time 1.2 seconds the object is at (1.25, 1.25, 1.25)
At time 1.5 seconds the object is at (1.50, 1.50, 1.50)
At time 1.8 seconds the object is at (1.75, 1.75, 1.75)
At time 2.0 seconds the object is at (2.00, 2.00, 2.00)
```