Important

1. Due Date: **Monday, April 24th**
2. This homework is graded out of 100 points.
3. This is an Individual Assignment. You may collaborate with other students in this class. Collaboration means talking through problems, assisting with debugging, explaining a concept, etc. Students may only collaborate with fellow students currently taking CS 1301, the TA's and the lecturer. You should not exchange code or write code for others. For individual assignments, each student must turn in a unique program. Your submission must not be substantially similar to another student's submission. Collaboration at a reasonable level will not result in substantially similar code.
4. For Help:
    - TA Helpdesk (Schedule posted on class website.)
    - Email TA's or use Piazza Forums Notes:
    - How to Think Like a Computer Scientists [http://openbookproject.net/thinkcs/python/english3e/]
    - CS 1301 Python Debugging Guide [http://www.cc.gatech.edu/classes/AY2016/cs1301_spring/CS-1301-Debugging-Guide/index.html]
5. Don't forget to include the required collaboration statement (outlined on the syllabus). Failing to include the Collaboration Statement will result in no credit.
6. Do not wait until the last minute to do this assignment in case you run into problems.
7. Comment or delete all your function calls. When your code is run, all it should do is build without any errors. Having function calls or extraneous code outside the scope of functions will result in a lower grade. (import statements and global variables are okay to be outside the scope of a function)
8. **Read the entire specifications document before starting this assignment.**
9. **IF YOUR CODE CANNOT RUN BECAUSE OF AN ERROR, IT IS A 0%.**

Introduction

The goal of this homework is for you to showcase your knowledge about recursion. For this assignment, you will need to implement 5 functions. Refer to the rubric to see how points will be rewarded for each function. You have been given HW10.py to fill out with instructions in the docstrings. However, below you will find more detailed information to complete your assignment. Read it thoroughly before you begin. You have until **Monday, April 24th** to complete this assignment. Don't forget to include your name and your collaboration statement. Re-download your submission from T-Square after you submit it to make sure that your code runs successfully.

Note: You may NOT use iteration at any point in this assignment. Any function containing a for or while loop will not receive any credit. All solutions must contain recursive calls.

Function name: `multiply`
Parameters: an integer, an integer
Returns: an integer

Description: Write a function called multiply that takes in two integer parameters and returns the result of the two parameters multiplied together. You **may not** use the multiplication operator (*) or any sort of iteration. You must use the addition operator and recursive calls. You do not have to account for negative numbers, but one of the parameters may be zero.

Test cases:
```
>>> multiply(2, 5)
10
>>> multiply(3,0)
0
```

Function name: `findLength`
Parameters: string, list, or tuple
Returns: integer

Description: Write a function called findLength that accepts one parameter that is either a list, string, or tuple. Use recursion to find the length of the data type. You may use the len() function only once, and you may **only use the len() function to check if the parameter length is zero.** You will get no credit for simply returning len(parameter) and not finding the length using recursive calls.

Test cases:
```
>>> findLength("Moana")
5
>>> findLength((5, 7, True, ["ok","now"]))
4
>>> findLength([])
0
```

Function name: `triangular`
Parameters: integer
Returns: a list

Description: Write a function called triangular that accepts one integer parameter that returns a list with the same number of terms as the value of the parameter. If the parameter is zero or a negative number, you should return an empty list

A triangular number is the sum of a positive integer and all the integers before it. The series is as follows: 1, 3, 6, 10, 15, 21, …

Test cases:
```
>>> triangular(3)
[1, 3, 6]
>>> triangular(5)
[1, 3, 6, 10, 15]
>>>triangular(-2)
[]
```

Function name: `sumList`
Parameters: a list
Returns: integer

Description: Write a function called sumList that accepts one parameter, a list of integers and sub-lists containing integers. Using recursion, you must return the sum of all the integers in all the lists. No iteration (for or while loops) allowed.

Test cases:
```
>>> sumList([4, 10, 3])
17
>>> sumList([2, 4, [[2, 1], 6]])
15
>>> sumList([])
0
>>> sumList([[8], 3, [1, 1, [1, [3, -5]]]])
12
```

Function name: `findIndex`
Parameters: a list (guaranteed to be sorted), an integer
Returns: integer

Description: Write a function called findIndex that accepts two parameters, a sorted list of numbers and a target number (numbers can be integers or floats.) Use recursion to implement binary search on the sorted list of numbers and return the index of the target if it is in the list, or -1 if it is not in the list.

Test cases:
```
>>> findIndex([3, 5, 7, 9, 20], 9)
3
>>> findIndex([4, 5, 6.2], 4)
0
>>> findIndex([1, 2, 3], 10)
-1
```

Grading Rubric

```
- multiply:            10 points
- findLength:          10 points
- triangular:          30 points
- sumList:             20 points
- findIndex:           30 points

_____________________________________________
- Total                100/100 points
```

Provided

The following file(s) have been provided to you. There are several, but you will only edit one of them:

1. `HW10.py`
   This is the file you will edit and implement. All instructions for what the methods should do are in the docstrings.

Deliverables

You must submit all of the following file(s). Please make sure the filename matches the filename(s) below. Be sure you receive the confirmation email from T-Square, and then download your uploaded files to a new folder and run them.

1. `HW10.py`
   If this file does not run (if it encounters an error while trying to run), you will get no credit on the assignment. If this file is named incorrectly (something other than HW10.py) you will get no credit on the assignment.