BMGT 404 Lab 2

What to turn in

Turn in your Python codes through ELMS by **8:00AM on Wednesday, February 19th** (make sure readability of your code is good).

Please submit one Python source file, named as: YourFirstName_YourLastName_Lab2.py

Exercise 2.1 (10 points)

Write a program that asks the user to enter a positive integer *n*, and calculates the sum of the integers 1 + 3 + 5 + 7 + ... + (2*n*-1) and prints out this sum to the screen. Your program should be able to handle the invalid case where the input is negative. Note that the texts in blue are inputs from the keyboard.

Sample Run 1 (suppose the n here is 5)

Enter a positive integer: 5

The sum is: 25

Sample Run 2 (suppose the n here is -5)

Enter a positive integer: -5

The input you gave is not valid. It must be positive.

Exercise 2.2 (20 points)

Write a program that asks the user to enter a positive integer n, and prints out the following shape. You must use nested loop in your program. The gap between two numbers could be a space or a tab.

Sample Run (suppose the n here is 5)

1
1 2
1 2 3
1 2 3 4
1 2 3 4 5

Exercise 2.3 (20 points)

In mathematics, the *Leibniz* formula for π, named after Gottfried Leibniz, states that

$$\sum_{n=0}^{\infty} \frac{(-1)^n}{2n+1} = \frac{\pi}{4}$$

Which is,

$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \cdots = \frac{\pi}{4}$$

Write a Python program that calculates π. The more terms you sum up; the more accurate result you can obtain.

Hints:

1. Make an infinite loop
2. If the stopping criterion satisfies, then stop the loop
3. Some simple stopping criteria:
    - The number of terms you add up is a large number (e.g., 10000);
    - The sum difference between the current one (with one more term) and the previous one is very small (e.g., 0.001)

Exercise 2.4 (25 points)

Marble Game

Write a program that allows to players to play the marble game using combinations of loop and conditional statements. In the marble game, you ask the user to enter how many marbles to start with. Then, the game begins. The first player must take 1, 2 or 3 marbles. Then the second player goes and must take 1, 2 or 3 marbles. The winner is the player who takes the last marble. Allow two users to play this game and print out the winner (player #1 or player#2). Assume that both players enter valid inputs (1, 2 or 3, and they never try to take more marbles than there are in the pile.) Note that the texts in blue are inputs from the keyboard.

Sample Run 1

How many marbles to start with? 10
Player #1, there are 10 marbles left. How many marbles will you take? 2
Player #2, there are 8 marbles left. How many marbles will you take? 2
Player #1, there are 6 marbles left. How many marbles will you take? 2
Player #2, there are 4 marbles left. How many marbles will you take? 1
Player #1, there are 3 marbles left. How many marbles will you take? 3
Player #1, you took the last marble and have won!

Sample Run 2

How many marbles to start with? 10
Player #1, there are 10 marbles left. How many marbles will you take? 2
Player #2, there are 8 marbles left. How many marbles will you take? 3
Player #1, there are 5 marbles left. How many marbles will you take? 3
Player #2, there are 2 marbles left. How many marbles will you take? 2
Player #2, you took the last marble and have won!

Exercise 2.5 (25 points)

Write a program that asks the user to enter a positive integer *n* as the height of the following shape and prints out this shape. **You must use loop to do this task**. The height of the following shape is *n* = 5 (*n* can be any value).

```
*                 *
***               ***
*****           *****
*******       *******
*********************
```

Optional Question (Hard)

There are 2 sorted arrays A and B of size *n* each. Write a Python program to find the median of the array obtained after merging the above 2 arrays (i.e. array of length 2*n*). The complexity should be O(log(n)).