Fundamentals of CS and Programming

Lab 06: Nested loops & Functions

Exercises

1. Write a python program that computes the values of the following series. Your program should accept the value of n from the user.
   a. $1 + 4 + 9 + 16 + \ldots n^2$
   b. $1 + 4 + 27 + \ldots n^n$
   c. $1! + 2! + 3! + \ldots + n!$

2. Write python programs that print the following patterns to the screen using as few print statements as possible.

```
a )  *                     b )  * * * * *      c )  * * * * *    d )                 *
     * *                        * * * *             * * * *                       * *
     * * *                      * * *               * * *                       * * *
     * * * *                    * *                  * *                       * * * *
     * * * * *                  *                     *                       * * * * *
```

```
e )  1 * * * * * * * * 1
     1 2 * * * * * * 2 1
     1 2 3 * * * * 3 2 1
     1 2 3 4 * * 4 3 2 1
     1 2 3 4 5 * 5 4 3 2 1
```

3. Write a python program that generates all prime numbers less than 1000.
4. Write a python program that generates all perfect numbers less than 1000.
5. Write a python program that approximates the value of the mathematical constant e by using the formula:

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \ldots$$

Prompt the user for the desired accuracy of e (i.e., the number of terms in the summation).

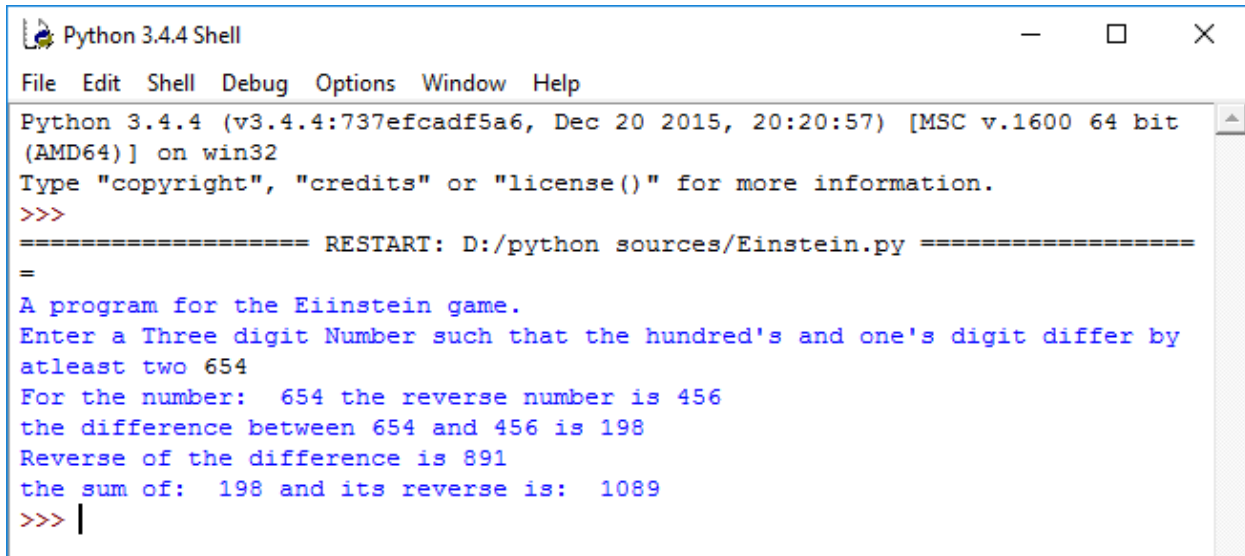6. Write a python program that estimates the value of e^x by using the formula

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots$$

Prompt the user for the desired accuracy of e (i.e., the number of terms in the summation).

7. Write a python program that consists of two functions. The first function should compute factorial of a number passed to it as argument. And the second function should accept three numbers from the user and print their factorials by calling the first function.
8. Write a program that prints the first N Fibonacci numbers. Your program should have two functions: one that determines the ith number of the sequence and a main function that accepts a value for N and prints the sequence.

LAB QUIZE:

1. Write a program to play the Einstein game. Your program should request the user to enter a three digit number such that the hundreds and ones digits differ by at least two. It then will computes the reverse of the number and prints it, compute the difference b/n the number and its reverse (this should always be positive). Finally it concluded by stating the sum of the difference with its reverse is 1089. Your program should behave as follows.

```
Python 3.4.4 Shell                                               —    □    ×
File  Edit  Shell  Debug  Options  Window  Help
Python 3.4.4 (v3.4.4:737efcadf5a6, Dec 20 2015, 20:20:57) [MSC v.1600 64 bit
(AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
=================== RESTART: D:/python sources/Einstein.py ===================
=
A program for the Eiinstein game.
Enter a Three digit Number such that the hundred's and one's digit differ by
atleast two 654
For the number:  654 the reverse number is 456
the difference between 654 and 456 is 198
Reverse of the difference is 891
the sum of:  198 and its reverse is:  1089
>>> |
```

2. There is a popular myth about the man who invented chess. This man invented the chess and present it to his king. The king was so pleased with the invention that he offered the inventor a great reward in gold. The inventor suggested an alternative reward: he would get one grain of wheat on the first square of the chess board, two grains on the second square, four on the third, eight on the fourth, etc., doubling the number of grains each time. The ruler saw that this must be a much better deal for him, and he accepted. The board has 64 squares. Write a program to determine the following:

   a) How many total grains of wheat did the ruler have to pay the inventor?
   b) If a wheat grain weighs approximately 50 mg. How much did the wheat weigh?
   c) And if the wheat was to be placed over the surface of Ethiopia how deeply Ethiopia would be covered with that quantity of wheat. Prompt for the area of the region and then output the depth, including the units you use.