

**NATIONAL UNIVERSITY OF COMPUTER & EMERGING SCIENCES
ISLAMABAD CAMPUS
INTRODUCTION TO COMPUTING (CS101) - FALL 2016
ASSIGNMENT # 1**

Due Date: October 9, 2016 (09:00pm) Total Marks: 10

Instructions

1. Write the Python programs.
2. Solution to all the problems should be written in a separate (.py) file.
3. Submit the source code (i.e. python code in .py file) via slate. Submissions via email will not be accepted.
4. Moreover, you must submit your notebook file (.ipynb) as well with all the codes and their outputs in different cells.
5. Use proper naming convention to name the file containing source code.

For example, the file containing the source code for first question of the first assignment should be named as **i16xxxx_assignment_1_q1.py**, replace i16xxxx with your student number.

Similarly, the third question of the second assignment should be named as **i16xxxx_assignment_2_q3.py**, etc.

3. Please write your name and roll number at the beginning of the each program using comments.

Pattern Printing: Note for Pattern Printing you are not allowed to use * operator for strings. Instead you must use nested while loops. [One Solution can be first write the program using * operator and then convert the * operator into corresponding while loop].

Plagiarism: Plagiarism is not allowed. If found doing plagiarism you will be awarded zero marks in the assignment.

Note:

- Follow the given instructions to the letter, failing to do so will result in a zero.

Question 1

Trace the evaluation of the following expressions, and give their resulting values, Please do not use the notebook: **(Please Submit Q1 and 2 in hand-written form to the TAs).**

- a) $2 + 3 * 4 - 6$
- b) $12 - 2 - 3$
- c) $14 / 7 * 2 + 30 / 5 + 1$
- d) $6/2 + 7/3$
- e) $(12 + 3) / 4 * 2$
- f) $6 * 7 \% 4$
- g) $(238 \% 10 + 3) \% 7$
- h) $3 * 4 + 2 * 3$
- i) $(18 - 7) * (43 \% 10)$
- j) $2 + 19 \% 5 - (11 * (5 / 2))$
- k) $813 \% 100/3 + 2.4$
- l) $26 \% 10 \% 4 * 3$
- m) $22 + 4 * 2$
- n) $23 \% 8 \% 3$
- o) $177 \% 100 \% 10/2$
- p) $89 \% (5 + 5) \% 5$
- q) $392/10 \% 10/2$
- r) $8 * 2 - 7/4$
- s) $37 \% 20 \% 3 * 4$
- t) $17 \% 10/4$
- u) $(2.5 + 3.5)/2$
- v) $4.0/2 * 9/2$
- w) $9/4 * 2.0 - 5/4$
- x) $2.5 * 2 + 8/5.0 + 10/3$
- y) $9/2.0 + 7/3 - 3.0/2$

2. Assume that you have a variable named count that will take on the values 1, 2, 3, 4, and so on. You are going to formulate expressions in terms of count that will yield different sequences. For example, to get the sequence 2, 4, 6, 8, 10, 12, ..., you would use the expression $(2 * \text{count})$. Fill in the following table, indicating an expression that will generate each sequence.

Sequence	Expression
4, 19, 34, 49, 64, 79, ...	
30, 20, 10, 0, -10, -20, ...	
-7, -3, 1, 5, 9, 13, ...	
97, 94, 91, 88, 85, 82, ...	

3. Write a program that produces the following output. Use nested while loops to capture the structure of the figure.

```
!!!!!!!!!!!!!!!!!!!!!!
\\!!!!!!!!!!!!!!!!!!//
\\\!!!!!!!!!!!!!!!!//
\\\\\\!!!!!!!!!!!!//
\\\\\\\\\\!!!!!!//
\\\\\\\\\\\\\\!!!!//
\\\\\\\\\\\\\\\\\\!!!!//
```

4. In physics, a common useful equation for finding the position s of a body in linear motion at a given time t , based on its initial position s_0 , initial velocity v_0 , and rate of acceleration a is the following:

$$s = s_0 + v_0 t + 0.5 a t^2$$

Write code to declare variables for s_0 , v_0 , a , and t , and then write the code to compute s based on these values.

5. Write a while loop that produces the following output:

```
1 4 9 16 25 36 49 64 81 100
```

6. Write while loops to produce the following output:

```
  1
 2
3
4
5
```

7. Write while loops to produce the following output:

```
  1
 22
333
4444
55555
```

8. Write while loops to produce the following output, with each line 40 characters wide:

```
-----
_ ^ _ ^ _ ^ _ ^ _ ^ _ ^ _ ^ _ ^ _ ^ _ ^ _ ^
1122334455667788990011223344556677889900
-----
```

9. It's common to print a rotating, increasing list of single-digit numbers at the start of a program's output as a visual guide to number the columns of the output to follow. With this in mind, write nested while loops to produce the following output, with each line 60 characters wide:

```
      |           |           |           |           |
123456789012345678901234567890123456789012345678901234567890
```

10. Write a program that produces the following output (with loops):

```

***** ////////////// *****
***** //////////////\ \ *****
**** //////////////\ \ ****
*** //////////////\ \ ***
** //////////////\ \ **
* //////////////\ \ *
  \ \ \ \ \ \ \ \ \ \

```

11. Write a program that produces the following output (with loops, **Remember Divide and Conquer**):

```

+-----+
|  ^  ^  |
|  ^  ^  |
|  ^  ^  |
|  ^  ^  |
|  ^  ^  |
+-----+
| v    v |
| v    v |
|  vv   |
| v    v |
| v    v |
|  vv   |
+-----+

```

12. Write a program that produces the following output (with loops):

```

+-----+
|      *      |
|     /*\     |
|    /**\    |
|   /**\*\   |
|  /**\*\*\  |
| /**\*\*\*  |
| \*\*\*/\   |
|  \*\*/\   |
|   \*/\    |
|    *     |
+-----+
|  \*\*\*/\  |
|   \*\*/\  |
|    \*/\   |
|     *    |
|     *    |
|    /*\   |
|   /**\   |
|  /**\*\  |
+-----+

```

13. Write code to find the minimum point of following function. [Hint: Evaluate the function for a large domain of x and y values and find the values where minimum value occur].

$$f(x, y) = (1 - x)^2 + 100(y - x^2)^2$$

14. Print the first 20 numbers of the series 4, 1, 16, 9, 36 , 25, 64, 49, 100, 81....

15. Birth Date Application: Now write a Python program that allows the user to enter two names. For each name, enter a 6-digit integer representing the person's age in years, months and days. For example, Asim's age is 14 years, 10 months and 7 days. In this case, his age should be entered as 141007(YYMMDD).

Your program should then separate each 6-digit number into three separate numbers to represent the **days, months, and years** [Hint: Use the % and / (integer division) operators] and print out both names, each followed by their ages written in the following standard format **DD/MM/YY**.

For example:

- Asim's age is 7/10/14 .
- Asad's age is 15/8/7.

Next your program should determine who is the oldest by testing the age and then should print out his/her name as follows:

- Asim is older than Asad!

If the two people have the same age, then the message should be : Asim and Asad are the same age!

16. **Guess the Number Game:** Now write a program that will ask the user to guess a secret number selected randomly by your program in 3 trials. After each trial, you should inform the user if she didn't guess correctly, the number trials remaining, and inform the user that she lost or won the game (when she guessed correctly.)

When game is over, ask the user to play again: If the user types "yes", have the game start again.

If the user types "no", then stop playing the game. [Hint: You can use `random.random()` function to get a random number in the range of [0,1], you can multiply the random number to another number X to get an integer random number in the range [0,X], i.e.

```
import random
x=round ( random.random() *100 ) # now x will have a random number
# in the range [0,100], multiplying with any other number will
# produce the number in that range.
```

17. Write a program that allows a user to convert positive numbers from binary (base 2) to decimal (Base 10). Use simple and accurate algorithm to produce the correct result. Here is an example of an algorithm illustrating how to convert from binary (base 2) to Decimal (base 10):

The binary or base-2 number 1 0 0 1 0 1 0 1 can be converted to a decimal number as follows:

$$1*2^7+0*2^6+0*2^5+1*2^4+0*2^3+1*2^2+0*2^1+1*2^0 = 128 + 16 + 4 + 1$$

$$= 149$$

The binary number 1 0 0 1 0 1 0 1 is written as 149 in the decimal system.

18. The management of Islamabad High School has approached you to help them in developing a Fee-calculator. The fee for Grade-1 is Rs. 7,000, which increases by 15% in each grade up to Grade-12. However, in Islamabad High School, each sibling gets 10% more discount on tuition fee than his or her immediate sibling, who is also enrolled in this school. Plus there is an additional cost for materials and stationary. Stationary cost is Rs. 10,000 per annum, while material cost is Rs. 6000 in first grade and increases by Rs. 1,000 every year.

Write the Python code that helps parents calculate the total amount he/she has to pay to the school. It should take student's grade as input and should continue as long as there are other siblings, whose fee is to be calculated.

19. Write a program that accepts two integer input "lines" and "cheers" and prints a series of "cheer" lines at increasing levels of indentation. The first parameter represents the number of lines of output to print, and the second represents the number of "cheers" per line. For example, if lines=2 and cheers =4 then you should print 2 lines of output, each containing 4 "cheers." A "cheer" is an occurrence of the word "Go" in the output. Neighboring cheers are separated by the word "Buddy" (of course you can put name of your favourite political person here as well :)), so 1 cheer is printed as "Go", 2 cheers as "Go Buddy Go", 3 cheers are printed as "Go Buddy Go Buddy Go", and so on.

The lines you print should be displayed at increasing levels of indentation. The first line displayed should have no indentation, but each following line should be intended by 3 spaces more than the one before it. In other words, the 2nd line of output should be indented by 3 spaces, the 3rd line by 6 spaces, and so on. You may assume that both parameters passed your function will have values of at least 1.

Input	Lines=2 Cheers=1	Lines=4 Cheers=3	Lines=2 Cheers=4
output	Go Go	Go Buddy Go Buddy Go Go Buddy Go Buddy Go Go Buddy Go Buddy Go Go Buddy Go Buddy Go	Go Buddy Go Buddy Go Buddy Go Go Buddy Go Buddy Go Buddy Go

20. Write Python code using while loops to produce following output.

```
V
V
VV
VV
VVV
VVV
VVVV
VVVV
VVVVV
VVVV
VVVV
VVV
VVV
VV
VV
V
V
V
V
V
VV
VV
VVV
VVV
VVVV
VVVV
VVVVV
VVVV
VVVV
VVV
VVV
VV
VV
V
V
```

21. Write Python code using while loops to produce following output.

Input :5

```
....1
...2.
..3..
.4...
5....
```

Input 7:

```
.....1
.....2.
.....3..
....4...
...5....
..6.....
.7.....
```

22. Write a program that asks from a user how many rectangles he want and then prompts him for a width and height for each rectangle. It then outputs all of the rectangles made of stars and their combined area. The user will be guaranteed to input valid positive integers for each value when prompted.

The following should be the output of your code.

<p>Run 1</p> <p>How many rectangles? 3</p> <p>Width 1? 2</p> <p>Height 1? 3</p> <p>***</p> <p>***</p> <p>***</p> <p>Width 2? 3</p> <p>Height 2? 2</p> <p>***</p> <p>***</p> <p>Width 3? 10</p> <p>Height 3? 1</p> <p>*****</p> <p>Total area: 22</p>	<p>Run 2</p> <p>How many rectangles? 4</p> <p>Width 1? 5</p> <p>Height 1? 2</p> <p>*****</p> <p>*****</p> <p>Width 2? 4</p> <p>Height 2? 2</p> <p>****</p> <p>****</p> <p>Width 3? 3</p> <p>Height 3? 2</p> <p>***</p> <p>***</p> <p>Width 4? 2</p> <p>Height 4? 2</p> <p>**</p> <p>**</p> <p>Total area: 28</p>
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23. [The Most Interesting One] PakAsia is a country that has currency notes of 6, 9 and 20 PakAsia Rupees (PAR) only. Thus, it is possible, for example, to exchange exactly 15 Pakistani Rupees (PKR) (with one note of 6 Rs and a second note of 9 Rs will add up to make 15, since 1PKR == 1PAR), but it is not possible to exchange exactly 16 PKR, since no non-negative integer combination of 6's, 9's and 20's notes of PAR add up to 16 PKR. To determine if it is possible to exchange exactly n PKR to PAR, one has to find non-negative integer (can be 0) values of a , b , and c such that

$$6a + 9b + 20c = n$$

Now write a Python code that takes, ' n ' PKR from user as input, and prints if it is possible to exchange it with a combination of 6, 9 and 20 PAR such that the total sum of PakAsia Rupees equals n , and otherwise prints it is not possible.