Nested Loops

Nested For Loops

1. Predict the output of the following program. Run it to check your prediction.

```
for x in range(3):
   for y in range(1,5):
        print("$"*y)
```

2. Spreadsheets often refer to cells using the notation A1, A2, …, B1, B2, …, C1, etc. Use two for loops to print the names of cells A1 through G8.
3. In mathematics, the *Cartesian product* is an operation that generates a new set from two given sets, X and Y. Specifically, the Cartesian product generates all ordered pairs, (x, y), where x is an element of X and y is an element of Y. For example, the Cartesian product of the sets $X=\{1, 2\}$ and $Y=\{3, 4\}$ consists of the pairs (1, 3), (1, 4), (2, 3) and (2, 4). Write a program that generates the Cartesian product of two tuples of arbitrary length, formatted as a set of ordered pairs.
4. *Pseudo-Scrabble*: Generate 10 random "words" of 3-8 letters each. Each letter is worth a certain number of points: 3 for the letters "X", "Y" or "Z", 2 for any other consonant, and 1 for a vowel. Display each word, along with the total number of points in the word (e.g. "BXAL [6 points]"), then determine the total number of points from all 10 words.

Nested While Loops

5. Write a program that simulates rolling two dice, then displays their sum. After each sum is displayed, ask the user if s/he wants to roll again. The user should enter "yes" if so, or "no" if not. Use a loop to ensure that the user enters only "yes" or "no" – all other input is invalid. Roll as many times as the user wants.
6. Write a program that implements a nested menu system. Your main menu should ask the user to select either French or Spanish, or to Quit the program. Once a language is selected, the user should select a phrase to translate – "Hello" ("Bonjour"/"Hola"), "Goodbye" ("Au revoir"/"Adios"), or "Thank You" ("Merci"/"Gracias") – or to return to the Main Menu.

Challenges

7. If all three sides of a right-angled triangle are integers, the set of these three numbers is known as a *Pythagorean triple*. For example, (3, 4, 5) is a Pythagorean triple because $3^2+4^2=5^2$. Write a program that displays all Pythagorean triples where the hypotenuse is no larger than 500 units.
8. The number 6 is special because it can be written as the sum of two or more consecutive positive integers, in this case $1+2+3$. Other numbers, like 4, cannot be written in this way. The number 15 is even more special, because there are three ways to write it as the sum of two or more consecutive positive integers: $7+8$, $4+5+6$ and $1+2+3+4+5$. To classify each positive integer, assign a rank to each number based on the number of ways in which it can be written as the sum of two or more consecutive positive integers. Thus, 6 has a rank of 1, 4 has a rank of 0, and 15 has a rank of 3. Write a program that takes as input a positive integer n. Your program should ensure that the number entered is indeed positive. Your program should determine *all* ways of writing n as the sum of consecutive positive integers (and display all of them to the screen) and determine the rank of n.