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School of Advanced Sciences
Department of Mathematics
M.Sc. Data Science
PMDS508P - Python Programming Lab
Slot: L19+L20+L29+L30
Lab Assignment #02

Assignment #02 - Control Structures and Data Collections

Due-date to Upload of the Assignment Records to VTOP is 07-Sep-2024[1]

1. Write a list comprehension version to generate prime numbers up to a given number.
2. Write a Python program (without list comprehension and with list comprehension) to transpose a given matrix as a list of lists.

   For example, if $A = [[1, 2, 3], [4, 5, 6]]$ then the output should be $AT = [[1, 4], [2, 5], [3, 6]]$.
3. Write a dictionary comprehension version to accept a list of numbers (with repetitions) and then create a dictionary where the key is the number, and the value is the number of times that value is present in the given list.

   For example if $L = [1, 2, 2, 1, 4, 2, 3, 3]$ then output should be $D = \{1 : 2, 2 : 3, 3 : 2 : 4 : 1\}$.
4. A triplet (a, b, c) is said to be a Pythagorean triplet if $c^2 = a^2 + b^2$. For example, $(3, 4, 5)$ is a Pythagorean triplet as $5^2 = 3^2 + 4^2$.

   Write a Python program to generate Pythagorean triplets for a given limit on c, say $c = 100$.

   First, write the version without list comprehension and then convert it to a list comprehension version.
5. Write a Python program to generate a list of cumulative sums and the product of a given list of numbers without and with list comprehension.

   For example, if the list of numbers is: $L = [1, 2, 3, 4, 5, 6, 7, 8, 9]$, then the output should be:

   Cumulative sum is: $CSL = [1, 3, 6, 10, 15, 21, 28, 36, 45]$

   Cumulative product is: $CPL = [1, 2, 6, 24, 120, 720, 5040, 40320, 362880]$.

   Hint: To find the sum, you can use the `sum` function; to find the product, you can use the `math.prod()` function from the `math` package.
6. Write a Python program with the help of list comprehension to verify whether a given number is an Armstrong number or not.
7. Write a Python program using list comprehension to find the digital root of a given number.
8. Write a Python program using the list comprehension technique to verify whether a given number is an Abundant number (or) a Deficient number (or) a Perfect number.
9. Write a Python program (without list comprehension and with list comprehension) to find the product of two matrices. The inputs to the program should be matrices in the form of a list of lists. The program should take care of the restriction that the matrix product of $A_{m\times p_1}$ and $B_{p_2\times n}$ is possible only when $P_1 = P_2$.

   For example if $A = [[1, 2, 3], [4, 5, 6]]$ and $B = [[1, 2], [3, 4], [5, 6]]$ then $AB = [[22, 28], [49, 64]]$.

[1] Upload the Assignments in PDF format only