

# **Python Functions – Exercises Set 5**

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□ Write the following using Python Functions

- Get Two rectangular matrices using Lists
- Get one of the following operation required to be done (if conditions are satisfied, do the operations)
  - Multiply two matrices
  - Add Two matrices
  - Subtract Two matrices
  - Transpose
  - Finding trace
  - Finding determinant (only for 3x3)

❑ Write the following using Python Functions

- Find the LCM and GCD of five numbers

❑ Euler's totient Function

- (a) Step 1: Generate a random integer between 1 and 100. Say L
- (b) Step 2: Compute the divisor of each number in L
- (c) Step 3: Print the total number of divisors of each number in L
- (d) Step 4: For each divisor in the list, compute the Euler's totient Function and save it in a dictionary eulerphi. Euler's totient function  $\varphi(n)$  counts the positive integers up to a given integer that are relatively prime to  $n$ .
- Example: eulerphi={5 : 4, 7 : 6, 20 : 8}

□ Write a python code for the following:

- (a) Step 1: Generate 5 numbers randomly between 1 and 100. Save it in a list randlist.
- (b) Step 2: For each number in randlist, compute the divisors of it and update it in a dictionary divisors.
- Example: divisors={4 : [1,2,4], 18 : [1,2,3,6,9,18], 7 : [1,7]}
- Step 3: For each number in randlist, obtain the number divisors and update in the dictionary  $d$ . Example:  $d=\{4 : 3, 18 : 6, 7 : 2\}$
- For each number in randlist, verify the following Menon's Identity

$$\sum_{\substack{i \leq k \leq n \\ \gcd(k,n)=1}} \gcd(k-1, n) = \varphi(n)d(n)$$

Identify all  $2 \times 2$  matrices of the following type.

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} e & g \\ f & h \end{bmatrix} = \begin{bmatrix} ae & bg \\ cf & dh \end{bmatrix}$$

That is, matrix concatenation = matrix product. Here  $a, b, c, d, e, f, g, h \in \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

Example:

$$\begin{bmatrix} 3 & 4 \\ 8 & 7 \end{bmatrix} \begin{bmatrix} 7 & 2 \\ 4 & 9 \end{bmatrix} = \begin{bmatrix} 37 & 42 \\ 84 & 79 \end{bmatrix}$$

$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}, B = \begin{bmatrix} e & g \\ f & h \end{bmatrix}, C = \begin{bmatrix} ae & bg \\ cf & dh \end{bmatrix}$$

Is it possible to prove or disprove the following:

If  $AB = C$ , then at least one of the following properties will be satisfied.

- Column Sum of  $A = 11$
- Row sum of  $A = 11$
- Column Sum of  $B = 11$
- Row sum of  $B = 11$
- At least two entries of  $C$  will have the same sign

Identify all  $3 \times 3$  matrices of the following type.

$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} = \begin{bmatrix} aa & bb & cc \\ dd & ee & ff \\ gg & hh & ii \end{bmatrix}$$

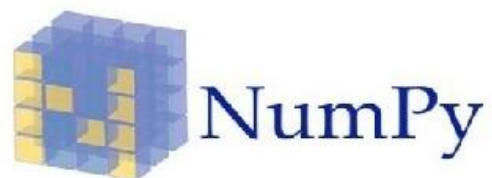
That is, matrix concatenation = matrix product. Here  $a, b, c, d, e, f, g, h, i \in \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

Example:

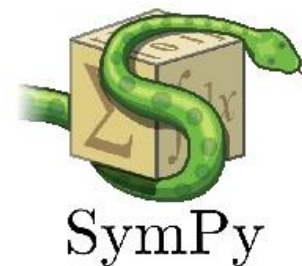
$$\begin{bmatrix} 8 & 2 & 1 \\ 8 & 2 & 1 \\ 8 & 2 & 1 \end{bmatrix} \begin{bmatrix} 8 & 2 & 1 \\ 8 & 2 & 1 \\ 8 & 2 & 1 \end{bmatrix} = \begin{bmatrix} 88 & 22 & 11 \\ 88 & 22 & 11 \\ 88 & 22 & 11 \end{bmatrix}$$



# End of Python Lab



IP[y]:  
IPython



pandas  
 $y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$

