

**Submission Date - 23 Nov 2025 - 11:59 PM.**

**Submit the .py/.ipynb or the editor code directly, which allows us to check if the code is running or not. 0 will be awarded directly (without checking your logic) if your code is not running.**

**All submissions are allowed through Blackboard only. 0 marks is awarded if it is not submitted via blackboard.**

**Please read the questions carefully. 0 marks will be allotted if questions are not solved according to the instructions mentioned in the question.**

**Plagiarism is strictly prohibited, and 0 marks will be awarded as a penalty.**

**Q3 is of 1 mark, and the rest all the questions are of 2 marks each. Max marks: 15.**

**For any doubt, please contact [ak356@snu.edu.in](mailto:ak356@snu.edu.in) (Aysuhi Kaushik) or [zg317@snu.edu.in](mailto:zg317@snu.edu.in) (Zubair Nabi )**

1. Write the program to find number of roots that lie for the function  $f(x) = \sin \sin(10x) + \cos \cos(3x)$  within the interval [3,6]? Print those roots too.

**Answer:**

Number of roots when precision was upto four decimal points = 9

Roots: 3.2624, 3.3659, 3.7457, 4.2290, 4.2635, 4.7123, 5.1611, 5.1959, 5.6792

2. Write a general program to evaluate the value of s that is expressed as:

$$s = \sum_{i=0}^{100} \sqrt{\frac{ix}{100}} * \sin\left(\frac{ix}{100}\right)$$

and store value of s in a two-dimensional array for  $i = 5, 10, 15, \dots, 100$ . Calculate s for  $x = \pi$ . Do not use the in-built sin function, instead define your own function to calculate  $\sin\theta$  ( $\sin(\theta) = \theta - \theta^3/3! + \theta^5/5! - \theta^7/7! + \dots$  for all  $\theta$ ).

3. Given  $d[i] = \text{perm}[i+1] - \text{perm}[i]$  for a permutation perm of 1..n (list length n-1), reconstruct any valid perm or return None if impossible.

4. Given an expression containing single-digit nonnegative integers joined by + and \*, compute the minimum possible value obtainable by placing parentheses arbitrarily (keep order of the operators used).
5. Given a list of lowercase words, find the length of the longest chain where each next word is formed by inserting exactly one letter into the previous word (preserves the relative order).
6. Group strings where two strings are equivalent if a rotation of one can be anagrammed into the other. (Result: equivalence boils down to same multiset character)
7. Given a nested list spec where elements are single-character strings or nested lists, treat top-level elements as factors and produce the Cartesian product (choose one option from each factor), concatenating results. Implement NestedProduct as an iterator that yields strings in lexicographic order (factors options are lexicographically sorted).
8. Implement next\_permutation(arr) in-place for arrays with duplicates; return True if it transformed into the next lexicographic permutation, or False (and rearrange to first) if it was already last.

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