

I. Adjacency Lists / Matrices

A) Write code to find an element in a matrix where the elements in each row and column are in a non-decreasing order

Example:

{ 2, 14, 26, 37, 43, 51, }

{ 4, 16, 28, 38, 44, 54, }

{ 6, 18, 30, 39, 45, 57, }

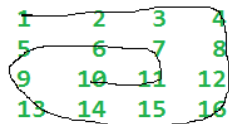
{ 8, 20, 32, 40, 46, 60, }

{ 10, 22, 34, 41, 47, 63, }

{ 12, 24, 36, 42, 48, 66, }

B) Spiral Matrix: Write code that traverses and prints out a matrix in a spiral form

Input :



1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Output :

1 2 3 4 8 12 16 15 14 13 9 5 6 7 11 10

II. Trie

A) Advantages of a Trie

B) Dis-advantages of a Trie

C) Use cases for a Trie

D) Given a trie, and knowing that each word is denoted by an "isLeaf() == true," count the total number words present in a trie denoted by an alphabet of size 26, the children of each node are represented by a simple array.

```
final static alphabetLength = 26;

static class TrieNode
{
    TrieNode[] children = new TrieNode[alphabetLength];
    boolean isLeaf;

    TrieNode(){
        isLeaf = false;
        for (int i = 0; i < alphabetLength; i++)
            children[i] = null;
    }
};
```

III. B-Tree

A) List Properties of B-Tree

IV. Graph

A) Given a list of edges in a graph or "Forest," write code to find the distinct amount of "trees" or separate nodes (e.g. other metaphors, islands in an ocean, trees in a forest, disconnected components)

Input : edges[] = {0, 1}, {0, 2}, {3, 4}

Output : 2

Explanation : There are 2 trees

```
0    3
 /\   \
1 2    4
```

V. Dijkstra - Proofs

A) Does this algorithm work for negatives - why or why not?

B) Does the shortest path change when weights of all edges are multiplied by 10?

C) Given a directed weighted graph and the shortest path from vertex 's' to 't' $\Rightarrow D(s,y)$,

If weight of every edge is increased by 10 units, does the shortest path remain same in the modified graph?