DSA Practice Problems

Set – 7

1. **Next Permutaion:**

Given an array of integers **arr[]** representing a permutation, implement the **next permutation** that rearranges the numbers into the lexicographically next greater permutation. If no such permutation exists, rearrange the numbers into the lowest possible order (i.e., sorted in ascending order).

Note - A permutation of an array of integers refers to a specific arrangement of its elements in a sequence or linear order.

Input: arr = [2, 4, 1, 7, 5, 0]

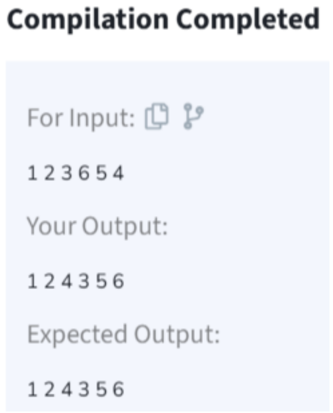
Output: [2, 4, 5, 0, 1, 7]

Explanation: The next permutation of the given array is {2, 4, 5, 0, 1, 7}.

Code:

```
class Solution {
    void nextPermutation(int[] arr) {
        // code here
        int pivot=-1;
        int n=arr.length;
        for(int i=n-2;i>=0;i--){
            if (arr[i]<arr[i+1]){
                pivot = i;
                break;
            }
        }
        if(pivot==-1){
            reverse(arr,0,n-1);
            return;
        }
        for(int i=n-1;i>pivot;i--){
            if (arr[i]>arr[pivot]){
                swap(arr,i,pivot);
                break;
            }
        }
        reverse(arr,pivot+1,n-1);
        for(int i=0;i<n;i++){

        }
    }
    public static void reverse(int[] arr, int start, int end) {
        while (start < end) {
            swap(arr, start++, end--);
        }
    }
    public static void swap(int[] arr, int i, int j) {
        int temp = arr[i];
        arr[i] = arr[j];
        arr[j] = temp;
    }
}
```



```
Compilation Completed

For Input:
1 2 3 6 5 4
Your Output:
1 2 4 3 5 6
Expected Output:
1 2 4 3 5 6
```

Time Complexity: O(n)

2. **Spiral Matrix:**

Given an m x n matrix, return *all elements of the* matrix *in spiral order*.

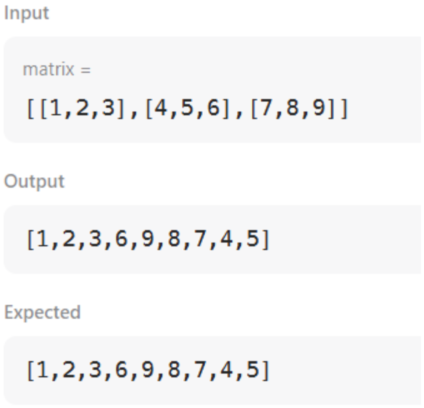
Input: matrix = [[1,2,3],[4,5,6],[7,8,9]]

Output: [1,2,3,6,9,8,7,4,5]

Code:

```
class Solution {
    public List<Integer> spiralOrder(int[][] matrix) {

        List<Integer> res = new ArrayList<Integer>();
        if (matrix == null || matrix.length == 0)
            return res;
        int startRow = 0;
        int endRow = matrix.length - 1;
        int startCol = 0;
        int endCol = matrix[0].length - 1;
        while (startRow <= endRow && startCol <= endCol) {
            // top
            for (int top = startCol; top <= endCol; top++) {
                res.add(matrix[startRow][top]);
            }
            // right
            for (int right = startRow + 1; right <= endRow; right++) {
                res.add(matrix[right][endCol]);
            }
            // bottom
            for (int bottom = endCol - 1; bottom >= startCol; bottom--) {
                if (startRow == endRow) {
                    break;
                }
                res.add(matrix[endRow][bottom]);
            }
            // left
            for (int left = endRow - 1; left >= startRow + 1; left--) {
                if (startCol == endCol) {
                    break;
                }
                res.add(matrix[left][startRow]);
            }
            startRow++;
            endRow--;
            startCol++;
            endCol--;
        }
        return res;
    }
}
```



Input

matrix =

```
[[1,2,3],[4,5,6],[7,8,9]]
```

Output

```
[1,2,3,6,9,8,7,4,5]
```

Expected

```
[1,2,3,6,9,8,7,4,5]
```

Time Complexity: O(n*m)

3. **Longest Substring without repeated characters:**

Given a string **s**, find the length of the longest substring with all distinct characters.

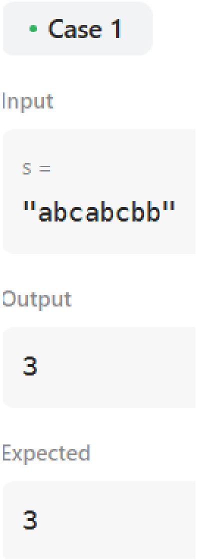
Input: s = "geeksforgeeks"

Output: 7

Explanation: "eksforg" is the longest substring with all distinct characters.

Code:

```
class Solution {
  public int lengthOfLongestSubstring(String s) {
    int maxLength = 0;
    int left = 0;
    Map<Character, Integer> count = new HashMap<>();
    for (int right = 0; right < s.length(); right++) {
      char c = s.charAt(right);
      count.put(c, count.getOrDefault(c, 0) + 1);
      while (count.get(c) > 1) {
        char leftChar = s.charAt(left);
        count.put(leftChar, count.get(leftChar) - 1);
        left++;
      }
      maxLength = Math.max(maxLength, right - left + 1);
    }
    return maxLength;
  }
}
```



• Case 1

Input

s =

"abcabcbb"

Output

3

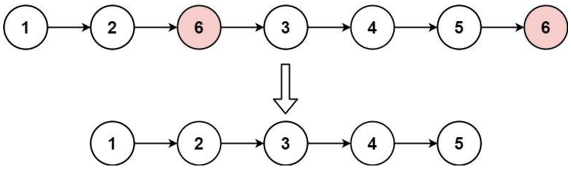
Expected

3

Time Complexity: O(n)

4. **Remove linked list Elements:**

Given the head of a linked list and an integer val, remove all the nodes of the linked list that has Node.val == val, and return *the new head*.



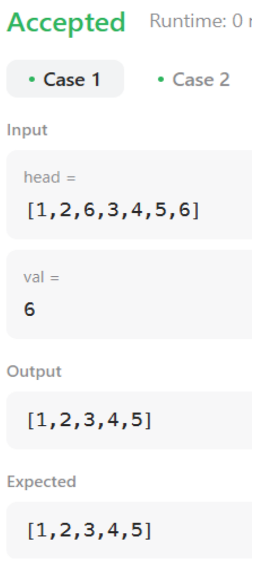
Input: head = [1,2,6,3,4,5,6], val = 6

Output: [1,2,3,4,5]

Code:

```
class Solution {
  public ListNode removeElements(ListNode head, int val) {
        ListNode temp = new ListNode(0) , curr = temp;
        temp.next = head;
        while(curr.next != null ){
            if(curr.next.val == val) curr.next = curr.next.next;
            else curr = curr.next;
        }
        return temp.next;
    }
}
```

Time Complexity: O(n)



Accepted Runtime: 0

• Case 1 • Case 2

Input

head =
[1,2,6,3,4,5,6]

val =
6

Output

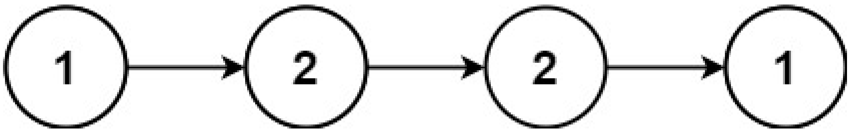
[1,2,3,4,5]

Expected

[1,2,3,4,5]

5. Palindrome Linked List:

Given the head of a singly linked list, return true *if it is a palindrome or* false *otherwise*.



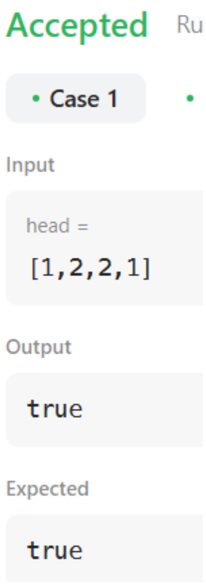
Input: head = [1,2,2,1]

Output: true

Code:

```
class Solution {
    public boolean isPalindrome(ListNode head) {
        List<Integer> list = new ArrayList();
        while(head != null) {
            list.add(head.val);
            head = head.next;
        }
        int left = 0;
        int right = list.size()-1;
        while(left < right && list.get(left) == list.get(right)) {
            left++;
            right--;
        }
        return left >= right;
    }
}
```

Time Complexity: O(n)



Accepted Ru

• Case 1 •

Input

head =
[1,2,2,1]

Output

true

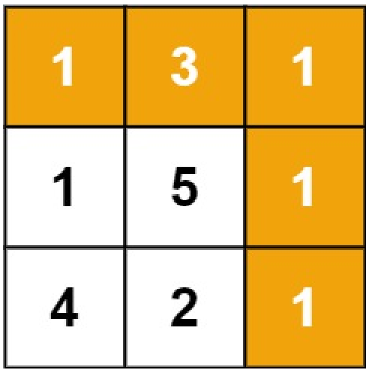
Expected

true

6. Minimum path sum:

Given a m x n grid filled with non-negative numbers, find a path from top left to bottom right, which minimizes the sum of all numbers along its path.

Note: You can only move either down or right at any point in time.



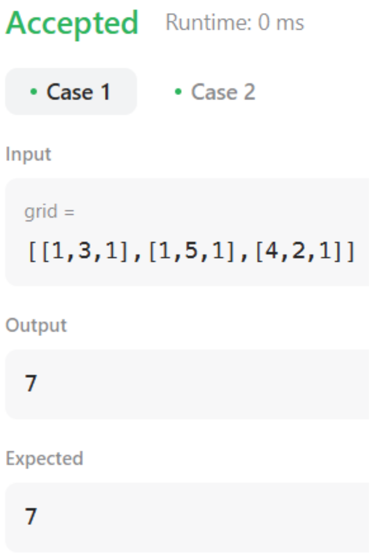
1	3	1
1	5	1
4	2	1

Input: grid = [[1,3,1],[1,5,1],[4,2,1]]

Output: 7

Code:

```
class Solution {
   public int minPathSum(int[][] grid) {
      int m = grid.length, n = grid[0].length;
      for (int j = 1; j < n; j++) {
         grid[0][j] += grid[0][j - 1];
      }
      for (int i = 1; i < m; i++) {
         grid[i][0] += grid[i - 1][0];
      }
      for (int i = 1; i < m; i++) {
         for (int j = 1; j < n; j++) {
            grid[i][j] += Math.min(grid[i - 1][j], grid[i][j - 1]);
         }
      }
      return grid[m - 1][n - 1];
   }
}
```



Accepted Runtime: 0 ms

• Case 1 • Case 2

Input

grid =
[[1,3,1],[1,5,1],[4,2,1]]

Output

7

Expected

7

Time Complexity:o(m*n)

7. Word ladder:

Given two words, beginWord and endWord, and a dictionary wordList, return *the* ***number of words*** *in the* ***shortest transformation sequence*** *from* beginWord *to* endWord*, or* 0 *if no such sequence exists.*

Input: beginWord = "hit", endWord = "cog", wordList = ["hot","dot","dog","lot","log","cog"]

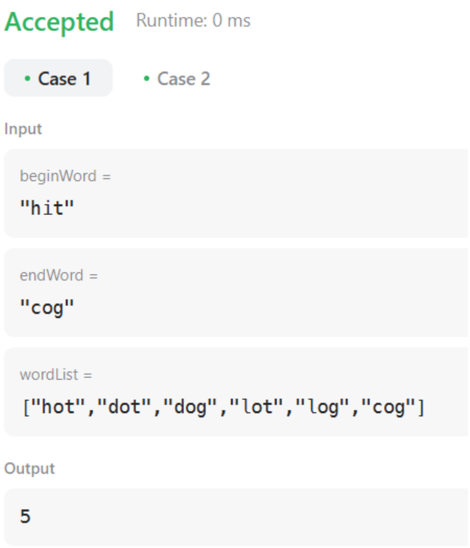
Output: 5

Explanation: One shortest transformation sequence is "hit" -> "hot" -> "dot" -> "dog" -> cog", which is 5 words long.

Code:

```
class Solution {
  public int ladderLength(String beginWord, String endWord, List<String> wordList) {
    Set<String> wordSet = new HashSet(wordList);
    Queue<String> queue = new LinkedList();
    Set<String> visited = new HashSet();
    queue.add(beginWord);
    visited.add(beginWord);
    int level = 0;
    while(!queue.isEmpty()) {
      for(int size = queue.size(); size > 0; size--) {
        String word = queue.poll();
        if(word.equals(endWord))
          return level + 1;
        char[] ch = word.toCharArray();
        for(int i = 0; i < ch.length; i++) {
```

```
                    char backup = ch[i];
                    for(char c='a'; c <= 'z'; c++) {
                        ch[i] = c;
                        String nextWord = String.valueOf(ch);
                        if(!visited.contains(nextWord) && wordSet.contains(nextWord)) {
                            queue.add(nextWord);
                            visited.add(nextWord);
                        }
                    }
                    ch[i] = backup;
                }
            }
            level++;
        }
        return 0;
    }
}
```



Accepted Runtime: 0 ms

Input

beginWord =
"hit"

endWord =
"cog"

wordList =
["hot","dot","dog","lot","log","cog"]

Output

5

Time Complexity:O(m^2*n)

8. **Word ladder II:**

There are a total of numCourses courses you have to take, labeled from 0 to numCourses - 1. You are given an array prerequisites where prerequisites[i] = [a_i, b_i] indicates that you **must** take course b_i first if you want to take course a_i.

For example, the pair [0, 1], indicates that to take course 0 you have to first take course 1.

Return true if you can finish all courses. Otherwise, return false.

Input: numCourses = 2, prerequisites = [[1,0]]

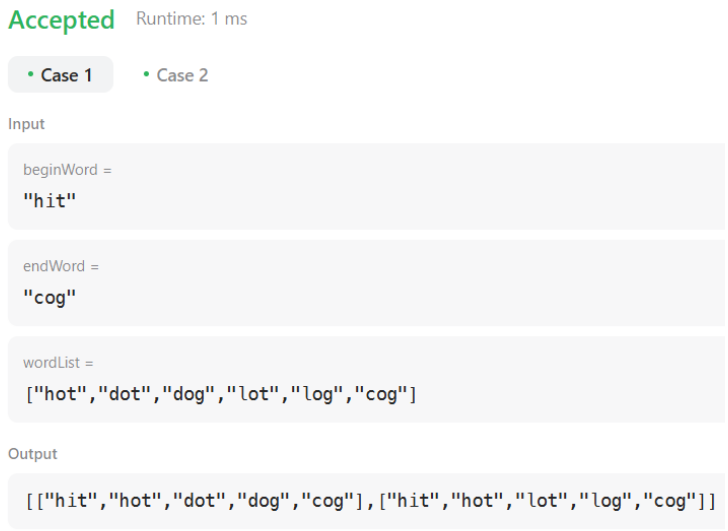
Output: true

Explanation: There are a total of 2 courses to take.

To take course 1 you should have finished course 0. So it is possible.

Code:

```
class Solution {
    public List<List<String>> findLadders(String beginWord, String endWord, List<String>
wordList) {
        Map<String,Integer> hm = new HashMap<>();
        List<List<String>> res = new ArrayList<>();
        Queue<String> q = new LinkedList<>();
        q.add(beginWord);
        hm.put(beginWord,1);
        HashSet<String> hs = new HashSet<>();
        for(String w : wordList) hs.add(w);
        hs.remove(beginWord);
        while(!q.isEmpty()){
            String word = q.poll();
            if(word.equals(endWord)){
                break;
            }
            for(int i=0;i<word.length();i++){
                int level = hm.get(word);
                for(char ch='a';ch<='z';ch++){
                    char[] replaceChars = word.toCharArray();
                    replaceChars[i] = ch;
                    String replaceString = new String(replaceChars);
                    if(hs.contains(replaceString)){
                        q.add(replaceString);
                        hm.put(replaceString,level+1);
                        hs.remove(replaceString);
                    }
                }
            }
        }
        if(hm.containsKey(endWord) == true){
            List<String> seq = new ArrayList<>();
            seq.add(endWord);
            dfs(endWord,seq,res,beginWord,hm);
        }
        return res;
    }
    public void dfs(String word,List<String> seq,List<List<String>> res,String
beginWord,Map<String,Integer> hm){
        if(word.equals(beginWord)){
            List<String> ref = new ArrayList<>(seq);
            Collections.reverse(ref);
            res.add(ref);
            return;
        }
        int level = hm.get(word);
        for(int i=0;i<word.length();i++){
            for(char ch ='a';ch<='z';ch++){
                char replaceChars[] = word.toCharArray();
                replaceChars[i] = ch;
                String replaceStr = new String(replaceChars);
                if(hm.containsKey(replaceStr) && hm.get(replaceStr) == level-1){
                    seq.add(replaceStr);
                    dfs(replaceStr,seq,res,beginWord,hm);
                    seq.remove(seq.size()-1);
                }
            }
        }
    }
}
```



Accepted Runtime: 1 ms

Input

beginWord =
"hit"

endWord =
"cog"

wordList =
["hot","dot","dog","lot","log","cog"]

Output

```
[["hit","hot","dot","dog","cog"],["hit","hot","lot","log","cog"]]
```

Time Complexity:O(N*L + P*L)

9. **Course Schedule:**

There are a total of numCourses courses you have to take, labeled from 0 to numCourses - 1. You are given an array prerequisites where prerequisites[i] = [a_i, b_i] indicates that you **must** take course b_i first if you want to take course a_i.

For example, the pair [0, 1], indicates that to take course 0 you have to first take course 1.

Return true if you can finish all courses. Otherwise, return false.

Example 1:

Input: numCourses = 2, prerequisites = [[1,0]]

Output: true

Explanation: There are a total of 2 courses to take.

To take course 1 you should have finished course 0. So it is possible.

Code:

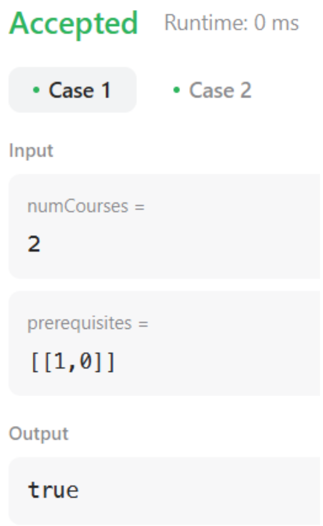
```
class Solution {
    public boolean canFinish(int n, int[][] prerequisites) {
        List<Integer>[] adj = new List[n];
        int[] indegree = new int[n];
        List<Integer> ans = new ArrayList<>();

        for (int[] pair : prerequisites) {
            int course = pair[0];
            int prerequisite = pair[1];
            if (adj[prerequisite] == null) {
                adj[prerequisite] = new ArrayList<>();
            }
            adj[prerequisite].add(course);
            indegree[course]++;
        }

        Queue<Integer> queue = new LinkedList<>();
        for (int i = 0; i < n; i++) {
            if (indegree[i] == 0) {
                queue.offer(i);
            }
        }

        while (!queue.isEmpty()) {
            int current = queue.poll();
            ans.add(current);

            if (adj[current] != null) {
                for (int next : adj[current]) {
                    indegree[next]--;
                    if (indegree[next] == 0) {
                        queue.offer(next);
                    }
                }
            }
        }
        return ans.size() == n;
    }
}
```



Accepted Runtime: 0 ms

• Case 1 • Case 2

Input

numCourses =

```
2
```

prerequisites =

```
[[1,0]]
```

Output

```
true
```

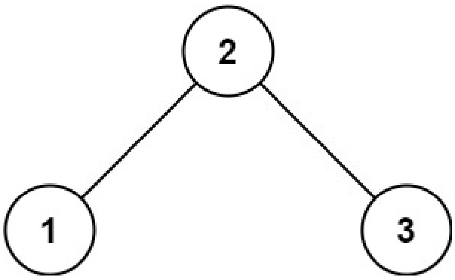
Time Complexity:O(V+E)

10.Validate binary Search tree:

Given the root of a binary tree, *determine if it is a valid binary search tree (BST)*.

A **valid BST** is defined as follows:

- The left subtree of a node contains only nodes with keys **less than** the node's key.
- The right subtree of a node contains only nodes with keys **greater than** the node's key.
- Both the left and right subtrees must also be binary search trees.

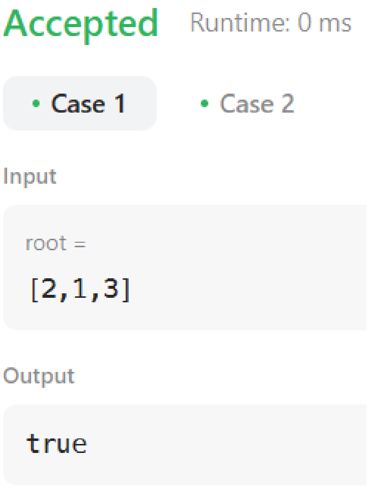


Input: root = [2,1,3] **Output:** true

Code:

```
class Solution {
    public boolean isValidBST(TreeNode root) {
        return valid(root, Long.MIN_VALUE, Long.MAX_VALUE);
    }
    private boolean valid(TreeNode node, long minimum, long maximum) {
        if (node == null) return true;
        if (!(node.val > minimum && node.val < maximum)) return false;
        return valid(node.left, minimum, node.val) && valid(node.right, node.val,
maximum);
```

```
  }
}
```



Accepted Runtime: 0 ms

• Case 1 • Case 2

Input

```
root =
[2,1,3]
```

Output

```
true
```

Time Complexity:o(n)

11.Design tic tac toe:

Code:

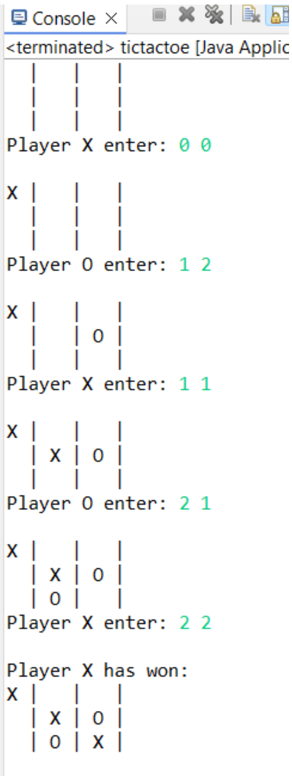
```
import java.util.Scanner;
class tictactoe {
 public static void main(String[] args) {
  char[][] board = new char[3][3];
  for (int row = 0; row < board.length; row++) {
   for (int col = 0; col < board[row].length; col++) {
    board[row][col] = ' ';
   }
  }
  char player = 'X';
  boolean gameOver = false;
  Scanner scanner = new Scanner(System.in);
  while (!gameOver) {
   printBoard(board);
   System.out.print("Player " + player + " enter: ");
   int row = scanner.nextInt();
   int col = scanner.nextInt();
   System.out.println();
   if (board[row][col] == ' ') {
    board[row][col] = player; // place the element
    gameOver = haveWon(board, player);
    if (gameOver) {
     System.out.println("Player " + player + " has won: ");
    } else {
     player = (player == 'X') ? 'O' : 'X';
```

```
        }
      } else {
        System.out.println("Invalid move. Try again!");
      }
    }
    printBoard(board);
  }

  public static boolean haveWon(char[][] board, char player) {
    // check the rows
    for (int row = 0; row < board.length; row++) {
      if (board[row][0] == player && board[row][1] == player && board[row][2] ==
player) {
        return true;
      }
    }
    for (int col = 0; col < board[0].length; col++) {
      if (board[0][col] == player && board[1][col] == player && board[2][col] == player) {
        return true;
      }
    }

    // diagonal
    if (board[0][0] == player && board[1][1] == player && board[2][2] == player) {
      return true;
    }

    if (board[0][2] == player && board[1][1] == player && board[2][0] == player) {
      return true;
    }
    return false;
  }
  public static void printBoard(char[][] board) {
    for (int row = 0; row < board.length; row++) {
      for (int col = 0; col < board[row].length; col++) {
        System.out.print(board[row][col] + " | ");
      }
      System.out.println();
    }
  }
}
```



```
<terminated> tictactoe [Java Applic
  |   |   |
  |   |   |
  |   |   |
Player X enter: 0 0

X |   |   |
  |   |   |
  |   |   |
Player O enter: 1 2

X |   |   |
  |   | O |
  |   |   |
Player X enter: 1 1

X |   |   |
  | X | O |
  |   |   |
Player O enter: 2 1

X |   |   |
  | X | O |
  | O |   |
Player X enter: 2 2

Player X has won:
X |   |   |
  | X | O |
  | O | X |
```

Time Complexity: O(1)