Collections /Data Structures & Algorithms Course Content

❖ **Pre requisite:** Core Java knowledge

This Course is divided into 2 parts

DSA =
Complete Collections workshop + Time /Space complexity/
Algorithms/Sorting/Searching/Dynamic Programming/Pattern
Matching/Matrix/Graph

❖ **Complete Collections workshop - Course Content**
  ➢ **Need for Collection Framework.**
  ➢ **Collection hierarchy**
  ➢ **Collection vs Collections**
  ➢ **Internal Implementation of List**
  ➢ **Internal Implementation of Set**
  ➢ **Internal Implementation of Map**
  ➢ **How to create custom collection**
  ➢ **List**
    ▪ **Array List**
    ▪ **Vector**
    ▪ **Linked List**
    Copy on Write Array List
  ➢ **Set**
    ▪ **Hash Set**
    ▪ **Linked Hash Set**
    ▪ **Copy on write Array Set**
  ➢ **Map**
    ▪ **Hash Map**
    ▪ **Linked Hash Map**
    ▪ **Concurrent hash Map**
    ▪ **How to sort hashmap by values ?**
    ▪ **How to sort hashmap by keys**
    ▪ **Why to over ride equals and hash code method in hashmap ?**

  ➢ **What is iterator and how to use the iterator ?**
  ➢ **What is List Iterator and how to use it ?**
  ➢ **Difference between iterator and List iterator ?**
  ➢ **What is concurrent modification exception and how to resolve it?**
  ➢ **Concurrency vs Synchronization ?**
  ➢ **Copy on write Array list , Copy on write array Set , Concurrent hash map**
  ➢ **How to create Custom collection (Custom Array List) ?**
  ➢ **Linked List**
    ▪ Introduction
    ▪ Insert (Head/Tail/Middle)
    ▪ https://www.hackerrank.com/challenges/insert-a-node-at-the-head-of-a-linked-list/problem
    ▪ https://www.hackerrank.com/challenges/insert-a-node-at-a-specific-position-in-a-linked-list/problem
      https://www.hackerrank.com/challenges/insert-a-node-at-the-tail-of-a-linked-list/problem
    ▪ Delete (Head/Tail/Middle)
    ▪ https://www.hackerrank.com/challenges/delete-a-node-from-a-linked-list/problem
    ▪ Print:
    ▪ https://www.hackerrank.com/challenges/print-the-elements-of-a-linked-list-in-reverse/problem
    ▪ https://www.hackerrank.com/challenges/print-the-elements-of-a-linked-list/problem
    ▪ https://www.hackerrank.com/challenges/get-the-value-of-the-node-at-a-specific-position-from-the-tail/problem
  ➢ **Stack:**
    ▪ What is Stack ?
    ▪ Basic Stack properties (Push, Pop, Peek)
    ▪ https://www.hackerrank.com/challenges/java-stack/problem
    ▪ Stack Implementation using Array
    ▪ Stack Implementation using Linked List

- Stack implementation using Queue
- **Queue:**
  - What is Queue ?
  - Basic Properties of Queue (Peek, poll)
  - What is D Queue, Blocking Queue, Priority Queue ?
  - What are the difference between Linked Blocking Queue verses Array Blocking Queue ?
  - Queue Implementation using Array
  - Queue Implementation using Linked List
  - Queue implementation using Stack
- **Trees**
  - Basic concepts
  - In order traversal: https://www.hackerrank.com/challenges/tree-inorder-traversal/problem
  - Post order traversal: https://www.hackerrank.com/challenges/tree-postorder-traversal
  - Preorder traversal: https://www.hackerrank.com/challenges/tree-preorder-traversal/problem
- **Tree Set**
- **Tree Map**

Time/Space Complexity/Algorithms Topics/ Sorting/ Searching/ Dynamic Programming/Matrix/Graph- Course Content
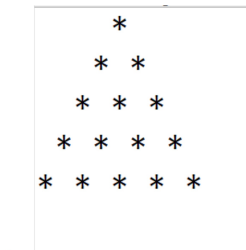
- **What is Time complexity ?**
- **What is space complexity ?**
- **Sorting**
  - **Bubble sort**
    https://www.hackerrank.com/contests/ashok-it-dsa/challenges/bubble-sort-implementation
  - **Insertion sort**
    https://www.hackerrank.com/contests/ashok-it-dsa/challenges/insertion-sort-implementation
    https://www.hackerrank.com/challenges/insertionsort1/problem
    https://www.hackerrank.com/challenges/insertionsort2/problem
    https://www.hackerrank.com/challenges/insertion-sort/problem
  - **Selection sort:**
    https://www.hackerrank.com/contests/ashok-it-dsa/challenges/selection-sort-implementation
  - **Two way Merging/Three way merging**
  - **Merge sort & Merge sorted array: https://leetcode.com/problems/merge-sorted-array/**
  - **Quick Sort** ·
  - **What is Max Heap ?**
  - **What is Min Heap ?**
  - **What is Heap Sort?**
    - Convert the given array into Max Heap ?
    - Convert the given array into Min Heap ?
    - Adding an element to Max Heap or Min Heap ?
- **Graphs**
  - **Basic Concept and How to Construct the Graph in Java ?**
  - **BFS**
  - **DFS**
  - **Shortest Path from source to destination (Dijkstra's algorithm)**

- **Dynamic Programming**
  - **Fundamental OF DP**
  - **Fibonaci Series Problem**
  - **Recurrsion verses Dynamic Programming**
  - **Coin Change Problem**

- **Matrix:**
  - **Matrix Representation**
  - **Addition of 2 matrix**
  - **Multiplication of 2 matrix**
  - **Check whether the given matrix is symmetric or not ?**
  - **Printing the Matrix**
  - **Transpose of a Matrix**

➢ **Pattern Printing**
https://www.hackerrank.com/challenges/staircase/problem?isFullScreen=true
Triangle Pattern

- **Pattern Programs for the below patterns**

-
```
★
★ ★
★ ★ ★
★ ★ ★ ★
★ ★ ★ ★ ★
```

Pattern 2

-
```
★ ★ ★ ★ ★
★ ★ ★ ★
★ ★ ★
★ ★
★
```

-
```
    *
   * *
  * * *
 * * * *
* * * * *
```

Pattern 3

-
```
★
★ ★
★ ★ ★
★ ★ ★ ★
★ ★ ★ ★ ★
★ ★ ★ ★
★ ★ ★
★ ★
★
```

➢ **Programmatic Questions**

- ➢ Fundamentals of Array
- ➢ Min and Max element in the array
- ➢ Unique Elements of an array
- ➢ Use Recursion to reverse the array
- ➢ Duplicate elements of an array
- ➢ Search for the missing number
- ➢ Factorial of a number
- ➢ Nth Fibonacci number
- ➢ Prime or not:
- ➢ Basic Implementation
- ➢ https://www.hackerrank.com/challenges/simple-array-sum/problem
- ➢ Reverse of an Array: https://www.hackerrank.com/challenges/arrays-ds/problem?isFullScreen=true
- ➢ LCM of N numbers: https://www.hackerrank.com/contests/crescent-contest/challenges/find-the-lcm
- ➢ Simple Array Sum: https://www.hackerrank.com/challenges/simple-array-sum/problem
- ➢ Sum of N numbers: https://www.hackerrank.com/contests/placement-prep-testing/challenges/sum-of-n-numbers
- ➢ What is the simplest way to identify the array is in sorted manner with less complexity ?
- ➢ Write a program to reverse the array without using extra memory ?
- ➢ Swap two numbers without using the third variable?
- ➢ Pair difference: www.interviewbit.com/problems/diffk/
- ➢ Linear & Binary Search: https://leetcode.com/problems/two-sum/
- ➢ Square Root: https://www.hackerrank.com/contests/ashok-it-dsa/challenges/square-root-10
- ➢ Compare two Linked list :
  - ▪ https://www.hackerrank.com/challenges/compare-two-linked-lists/problem
- ➢ Merge 2 sorted Linked List
  https://www.hackerrank.com/challenges/merge-two-sorted-linked-lists/problem

- Cyclic detection
  https://www.hackerrank.com/challenges/detect-whether-a-linked-list-contains-a-cycle/problem
- Open and close bracket problem using Stack:
  https://www.hackerrank.com/challenges/java-stack/problem
- Min and Max Element Present in a Binary Search Tree ?
- Print all leaves of a binary search tree?
- Height of A Tree: https://www.hackerrank.com/challenges/tree-height-of-a-binary-tree/problem
- Fill Depth: https://www.hackerrank.com/contests/ashok-it-dsa/challenges/find-depth
  Sum OF all the Elements Present in a Tree
- Level order traversal : https://www.hackerrank.com/challenges/30-binary-trees/problem
- Vertical order traversal : https://leetcode.com/problems/vertical-order-traversal-of-a-binary-tree/
- Distance Between 2 Nodes in BST : https://leetcode.com/problems/minimum-distance-between-bst-nodes/
- Left-View of A Tree : https://www.hackerrank.com/contests/ashok-it-dsa/challenges/left-view-of-tree-1
- Check Whether the given tree is BST or not ?123123
- Write a program to print the mirror image of a Tree ?
  https://www.codingninjas.com/studio/problems/second-largest-element-in-the-array_873375
  https://practice.geeksforgeeks.org/problems/merge-two-sorted-arrays-1587115620/1