Mid Term

1. Time and space complexity

- Understanding time and space complexity
- Polynomial and logarithmic time complexity

2. Data structure:

Array/STL Vector Class:

Prefix sum

- What is prefix sum?
- Implementation
- Sub array range sum query with mathematical explanation
- Problem discussion

Frequency count

- Solve frequency count with brute force
- Show frequency array
- Solve frequency count with frequency array
- Compare time complexity

2D grid

- Virtual representation of 2D grid
- How do we access them?
- Implementation
- Problem solving

Subarray

- What is a sub array?

Subsequence

- What is a sub sequence?
- Problem discussion

Max & min element in array

- How to find the max and min element of an array

STL String Class

STL string

- What is a string?
- How to input and output strings?
- Implementation

Substring

- What is substring?
- Problem discussion.

Subsequence

- What is the subsequence?
- Problem discussion

Stringstream

- What is stringstream?
- Implementation
- Problem discussion

Substring checking

String Functions

- Show various built-in functions of string in stl and their time complexity
- Problem discussion

Palindrome check

- How to check is a string is palindrome or not
- Different tricks of creating a palindrome
- Problem discussion

Mathematical operation using string

- Using ascii codes.
- How to add, subtract, divide and multiply using bigint
- Implementation

Lexicographical analysis

- What is the lexicographical order?
- Sort by lexicographical order.
- Sort using stl.

STL: Map, Set, Queue(Double ended, Priority), Stack

Functions: sort, reverse, find & Complexity analysis of the above

3. **Number Theory:**
   - Divisibility
   - Primality check and generation
     - Prime Factorization
     - Sieve of Eratosthenes
   - Modular Arithmetic(Bigmod)

Final Term

4. Binary search
- STL functions
- Binary search, lower bound and upper bound with complexity analysis
- Binary search for answer

  * Codeforces EDU [step 1 and 2]

5. Sorting
- STL comparator based sorting
- Bubble sort, insertion sort, selection sort and their complexity analysis
- Merge sort and quick sort and their complexity analysis

  * Problem solving from Leetcode

6. Linked list
- Understanding linked list along with complexities
- Building linked list and operating on it

  * Problem solving from Leetcode

7. Graph
- Basics of graph, Graph representation
- BFS - basic traversal, shortest path
- DFS - Basic Traversal, Topological sort
- Component count, bicoloring, BFS/DFS on 2D grid

  * Problem solving from Leetcode

8. Dynamic Programming
- Recursion to DP - Complexity
- Fibonacci