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Problem solving using Data Structures and Algorithms

Module 1: Introduction to Programming

- Understanding the fundamentals of programming
- Overview of problem-solving approaches
- Importance of Data Structures and Algorithms in programming

Module 2: Java Fundamentals for Data Structures

- Comprehensive coverage of Java concepts essential for Data Structures
- Object-oriented programming principles
- Collections
- Exception handling and memory management

Module 3: General Problems and Algorithms

- Solving general programming problems
- Introduction to common algorithmic paradigms

Module 4: Bit Manipulation

- Understanding and manipulating bits
- Applications of bit manipulation in algorithms

Module 5: Time and Space Complexity

- Analysing the efficiency of algorithms
- Big O notation and asymptotic analysis
- Space complexity and optimization techniques

Module 6: Arrays

- Working with arrays and their applications
- Array manipulation and common problem-solving techniques
- 2D arrays / Matrices

Module 7: Recursion

- Recursive programming and its applications
- Solving problems using recursive approaches

Module 8: Searching

- Linear search
- Binary search
- Searching in different data structures

Module 9: Hashing

- Introduction to hash functions
- Hash tables
- Hashmaps

Module 10: Sorting

- Introduction to sorting
- Bubble sort
- Insertion sort
- Selection sort
- Merge sort
- Quick sort
- Analysing the efficiency of sorting algorithms

Module 11: Linked Lists

- Singly linked lists
- doubly linked lists
- Operations on linked lists and problem solving

Module 12: Stacks

- Understanding the stack data structure
- Implementing stacks and solving problems using stacks

Module 13: Queues

- Overview of the queue data structure
- Implementing queues and solving problems using queues

Module 14: Binary Trees

- Structure and properties of binary trees
- Binary search trees
- Tree traversal algorithms
    - Inorder
    - Preorder
    - Postorder
    - Level order
    - Spiral order
    - Vertical order

Module 15: Binary Search Trees (BST)

- Properties of BST
- Operations on BST and their applications

Module 16: Dynamic Programming

- Introduction to dynamic programming (Overlapping subproblems, Optimal substructure)
- Memoization
- Tabulation
- Solving optimization problems using dynamic programming

Module 17: Graphs

- Basics of graph theory
- Representing graphs and graph traversal algorithms
- Problem solving using Graphs

Module 18: 3 HackerRank Practice Tests

- Practical application of learned concepts
- Preparation for real-world problem-solving

Note: Each module includes hands-on exercises and real-world applications to reinforce learning.