# Advanced Camp: Schedule
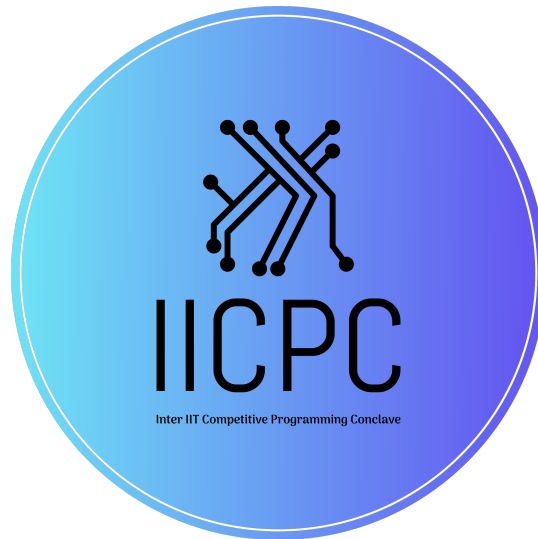
IICPC (Inter IIT competitive Programming Conclave)

June 1, 2024



# Contents

# 1 | Brief Schedule

| Date | Mentor | Topics |
|------|--------|--------|
| 2nd June, 2024 | **Vivek Gupta** | **DP-01**: Introduction |
| | | **DP-02**: Classic problems |
| 6th June, 2024 | **Gaurish Baliga** | **DP-03**: Intermediate Concepts |
| 9th June, 2024 | **Gaurish Baliga** | **DP-04**: Advanced DP problems |
| (14 or 15)th June, 2024 | **Mohit Agrawal** | **Graph-01**: Graph Representation |
| | | **Graph-02**: Graph Traversal Algorithm |
| 16th June, 2024 | **Chahel Singh** | **Graph-03**: Shortest path algorithm |
| 23rd June, 2024 | **Mohit Agrawal** | **Graph-04**: Minimum Spanning Tree |
| 27th June, 2024 | To Be Decided | **Graph-05**: Advanced Graph Algorithms |
| 30th June, 2024 | **Mridul Ahi** | **Graph-06**: Flows, Articulation |
| 5th July, 2024 | **Shivang Tiwari** | **Tree-01**: Basics |
| 7th July, 2024 | **Raghav Goel** | **Tree-02**: Rerooting DP |
| 12th July, 2024 | To Be Decided | **Tree-03**: Euler Tour |
| 14th July, 2024 | **Apoorv Kumar** | Range Queries #1 |
| 18th July, 2024 | **Apoorv Kumar** | Range Queries #2 |
| 21st July, 2024 | **Aryan Agrawal** | Mo's Algorithm |
| 25th July, 2024 | **Abhinav R** | Lazy Propagation |
| 28th July, 2024 | To Be Decided | String Algorithms |
| To Be Decided | **Satyam Kumar Roy** | Heavy-Light Decomposition |
| | | Centroid Decomposition |
| To Be Decided | **Kishore Kumar** | **DP-05**: Divide and Conquer |

The exact times of the lectures will be notified on our Discord Server: `https://discord.gg/fNtMmvWZcP`.

Please fill out the Google form to provide us with your Codeforces (and/or Codechef) handles so that we can invite you to the Codeforces group where every contest will be held.

**Form:** `https://forms.gle/6bBcZ4qATFxBEo1K6`.

# 2 | Detailed Syllabus

## 2.1 • *Dynamic Programming*

· **Introduction to Dynamic Programming**:

– Basic Concepts: Overlapping sub-problems and optimal sub-structure
– Top-down vs. Bottom-up Approaches

· **Classic DP Problems**:

– Fibonacci Sequence
– Coin Change Problem
– Knapsack Problem (0/1 and Unbounded)

· **Intermediate DP Concepts**:

– Longest Common Subsequence

- Longest Increasing Subsequence
- Edit Distance

- **Advanced DP Problems**:

  - Palindromic Substrings/Partitions
  - Digit and Bitmask DP

- **Optimization Techniques**:

  - SOS DP
  - Convex Hull Trick
  - Divide & Conquer

## 2.2 • *Graphs*

- **Graph Representation**:

  - Adjacency Matrix vs. Adjacency List
  - Edge List

- **Graph Traversal Algorithms**: Depth-First Search (DFS) and Breadth-First Search (BFS)

- **Shortest Path Algorithms**: Dijkstra's, Bellman-Ford and Floyd-Warshall Algorithms

- **Minimum Spanning Tree**: Kruskal's and Prim's Algorithms

- **Advanced Graph Algorithms**:

  - Topological Sorting
  - Strongly Connected Components (Tarjan's Algorithm, Kosaraju's Algorithm)

- **Flows, Articulation points and Bridges**:

  - Network Flow (Ford-Fulkerson, Edmonds-Karp)
  - Articulation Points
  - Bridges

## 2.3 • *Trees*

- **Basic Tree Concepts**:

  - Tree Traversal Techniques (Inorder, Preorder, Postorder)
  - Binary Trees and Binary Search Trees (BST)
  - Lowest Common Ancestor (LCA)

- **DP on Trees**: Rerouting DP and Counting problems

- **Euler Tour**: Subtree queries, Route to path queries and Small to large merging

## 2.4 • *Range Queries*

- **Segment Trees**: Range sum query, Range minimum query and variants
- **Fenwick Tree**: Point updates, range queries and 2D Fenwick trees
- **Sparse Table**: Range minimum query and other range queries
- **Mo's Algorithm**: Query ordering for offline queries and applications
- **Lazy Propagation**:
    - Lazy Propagation for Range Updates
    - Merge sort tree
    - Ordered set

## 2.5 • *String Algorithms*

- **String Hashing & Suffix Automaton**:
    - Polynomial Rolling Hash
    - Applications of Hashing in Strings
    - Suffix automation

# 3 | Contact

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# 4 | About Us

The Inter IIT Competitive Programming Conclave (IICPC) unites elite competitive programmers and developers from over 40+ IITs, IIITs, NITs, BITS, and numerous other universities. Our aim is to cultivate passion and interest in competitive programming while offering assistance to beginners. The IICPC Summer Camp represents our inaugural public initiative toward achieving this objective.

We thank our sponsors **0xPPL** and **Algozenith** for making this possible.
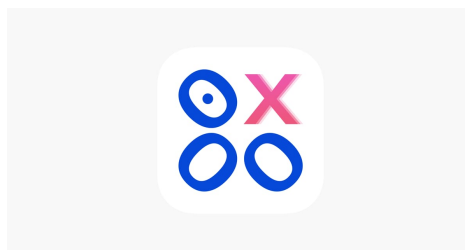


(a) Algozenith        (b) 0xPPL

Figure 1: Sponsors