

# Data Structures & Algorithms

## with C++ (C++17)

A Complete Interview-Oriented Learning Roadmap

**Instructor:** Mahmoud Salem

**Start Date:** February 1, 2026

**Duration:** Approximately 7 Months

**Schedule:** 2 Sessions per Week

**Total Sessions:** 56

**Target:** LeetCode Top 150 Problems

## Welcome Message

Welcome to the **Data Structures & Algorithms with C++** course.

This course is designed to help you move from knowing how to write code to understanding **how to think algorithmically**. You will learn how to analyze problems, break them down, and build correct and efficient solutions.

This is not a crash course. It is a structured, long-term journey that rewards consistency and effort.

## What You Will Gain

By the end of this course, you will be able to:

- Solve **150+ carefully selected LeetCode problems**
- Identify common algorithmic patterns
- Master recursion, trees, graphs, and dynamic programming
- Analyze time and space complexity confidently
- Approach technical interviews with clarity and confidence

## How the Course Is Structured

Each topic is delivered using a proven structure:

- **Concept Sessions** — intuition, mental models, visuals, and core ideas
- **Problem-Solving Sessions** — live solving of interview-level problems
- **Hybrid Sessions** — explanation combined with guided practice

Special emphasis is placed on **recursion**, as it forms the foundation for trees, backtracking, and dynamic programming.

## Student Commitment

To benefit fully from this course, students are expected to:

- Attend sessions regularly (2 sessions per week)
- Review session material after each class
- Attempt problems independently
- Accept struggle as part of the learning process

Progress comes from consistency, not speed.

## Frequently Asked Questions (FAQ)

### Do I need strong C++ knowledge before joining?

Basic familiarity with C++ is enough. The course includes a focused C++ review tailored for problem solving.

### Is this course suitable for beginners?

Yes, if you are committed. The difficulty increases gradually with continuous support.

### Will we really solve all LeetCode Top 150 problems?

Yes. The course roadmap is designed to systematically cover the entire list.

### What if I struggle with problems?

Struggling is expected and encouraged. It is a necessary part of building problem-solving skills.

## Detailed Course Roadmap

### Month 1 — Foundations, Arrays & Strings (February 2026)

S	Type	Topic	LeetCode
1	Concept	Course Overview + C++ Review	—
2	Concept	Time & Space Complexity, STL	—
3	Concept	Array Problem Patterns	—
4	Solve	Two Pointers	1, 26, 27, 88
5	Concept	Sliding Window Technique	—
6	Solve	Sliding Window Problems	121, 209, 643, 3
7	Concept	Strings & Character Handling	—
8	Solve	String Problems	125, 242, 49, 344

### Month 2 — Linked Lists, Stack & Queue (March 2026)

9	Concept	Singly Linked Lists	—
10	Solve	Linked List Problems	206, 21, 83, 141
11	Concept	Fast & Slow Pointer Technique	—
12	Solve	Cycle / Middle Problems	142, 876, 234
13	Concept	Stack Fundamentals	—
14	Solve	Stack Applications	20, 155, 496
15	Concept	Queue & Deque	—
16	Solve	Queue Problems	232, 933

### Month 3 — Recursion & Backtracking (April 2026)

This month is intentionally extended to ensure deep understanding.

17	Concept	Introduction to Recursion	—
18	Concept	Call Stack and Base Cases	—
19	Hybrid	Recursion on Arrays	509, 70
20	Solve	Recursion Practice	344, 206
21	Concept	Backtracking Fundamentals	—
22	Solve	Backtracking Problems	46, 78
23	Hybrid	Recursion Tree Analysis	22
24	Review	Full Recursion Review	Mixed

### Month 4 — Trees & Binary Search Trees (May 2026)

25	Concept	Binary Tree Fundamentals	—
26	Solve	DFS Traversals	94, 144, 145
27	Concept	BFS / Level Order Traversal	—
28	Solve	BFS Problems	102, 199
29	Concept	Tree Properties	—
30	Solve	Height / Diameter	104, 543
31	Concept	Binary Search Trees	—
32	Solve	BST Problems	98, 230

### Month 5 — Heap, Hashing & Sorting (June 2026)

33	Concept	Heap and Priority Queue	—
34	Solve	Heap Problems	215, 347
35	Concept	Hash Tables	—
36	Solve	Hashing Problems	1, 217, 451
37	Concept	Sorting Algorithms	—
38	Solve	Sorting Problems	912, 56
39	Hybrid	Custom Sorting	179
40	Review	Monthly Review	Mixed

### Month 6 — Binary Search & Graphs (July 2026)

41	Concept	Binary Search Fundamentals	—
42	Solve	Binary Search Problems	704, 33
43	Concept	Graph Representation	—
44	Solve	DFS / BFS on Graphs	200, 133
45	Concept	Topological Sorting	—
46	Solve	Topological Problems	207, 210
47	Hybrid	Grid Graph Problems	695

48	Review	Graph Review	Mixed
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## Month 7 — Dynamic Programming & Final Revision (August 2026)

49	Concept	Dynamic Programming Introduction	—
50	Solve	1D Dynamic Programming	70, 198
51	Concept	Knapsack Pattern	—
52	Solve	Knapsack Problems	416
53	Concept	LIS and LCS	—
54	Solve	LIS / LCS Problems	300, 1143
55	Solve	Advanced DP Problems	62, 377
56	Final	Full Course Revision	Top 150

## Final Note

This course is designed for students who want real improvement, not shortcuts.

If you stay consistent and trust the process, your problem-solving skills will improve dramatically.

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