

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

Consistency • Deep Understanding • Confidence

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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