

Advanced Pattern Mastery Track

Purpose: Strengthen optimization thinking, multi-step reasoning, and pattern recognition beyond the standard placement set.

Phase 1 — Advanced Syntax & Fluency (Optimization Thinking)

Focus

- Bit manipulation basics
- Mathematical optimizations
- Efficient brute-force pruning
- Time complexity improvement ($O(n^2) \rightarrow O(n \log n) \rightarrow O(n)$)

Outcome:

Students begin thinking about **performance while coding**, not just correctness.

Phase 2 — Advanced Counting & Hash Optimization

Focus

- Prefix-sum with hashmap optimizations
- Frequency compression
- Counting pairs/triples efficiently
- Hash collision thinking
- Rolling frequency windows

Outcome:

Students solve **counting problems in $O(n)$** using memory optimization.

Phase 3 — Pattern Mastery in Core Algorithms

Focus

- Advanced sliding window
- Binary search on answer
- Advanced greedy decision proof
- Recursion pruning techniques
- Sorting-based optimization problems

Outcome:

Students begin solving **medium–hard pattern problems systematically**.

Phase 4 — Advanced Linear DS Patterns

Focus

- Monotonic stack deep patterns
- Heap optimization problems
- Stack/queue design problems
- Linked list multi-pointer problems
- Priority-queue greedy hybrids

Outcome:

Students gain **interview-level DS pattern fluency**.

Phase 5 — Advanced Tree & Graph Thinking

Focus

- Tree DP introduction
- DFS/BFS state problems
- Graph connectivity optimization
- Trie advanced usage
- Tree traversal pattern combinations

Outcome:

Students solve **recursive structural problems confidently**.

Phase 6 — Advanced Algorithmic Mastery

Focus

- DP pattern classification
- Backtracking pruning optimization
- Divide-and-conquer pattern recognition
- Advanced graph shortest-path variants
- Advanced string pattern problems

Outcome:

Students reach **strong medium–hard interview readiness**.