

list all the concept related/topics/problems related to subarray and subsequence from basic to advance in asci copy past code format

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SUBARRAY & SUBSEQUENCE ROADMAP
(BASIC → ADVANCED)
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I. CORE DEFINITIONS
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- Subarray: contiguous segment
- Subsequence: not necessarily contiguous
- Difference: continuity constraint
- Count of subarrays: $n*(n+1)/2$
- Count of subsequences: 2^n

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II. BASIC CONCEPTS
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- Prefix Sum
- Suffix Sum
- Prefix XOR
- Prefix Min / Max
- Prefix Frequency
- Sliding Window (fixed size)
- Two Pointer (basic)
- Brute-force enumeration

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III. CLASSIC SUBARRAY PROBLEMS
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- Maximum Subarray Sum (Kadane)
- Minimum Subarray Sum
- Subarray Sum = K
- Count Subarrays with Sum = K

- Longest Subarray with Sum = K
- Shortest Subarray with Sum \geq K
- Subarray with Given XOR
- Count Subarrays with Given XOR
- Maximum Product Subarray
- Maximum Sum Circular Subarray
- Subarray with Equal 0s and 1s
- Subarray with At Most K Distinct Elements
- Subarray with Exactly K Distinct Elements
- Longest Subarray with At Most K Distinct
- Smallest Subarray Covering All Elements

IV. SLIDING WINDOW VARIANTS

- Fixed window sum / max / min
- Variable window
- Shrinking window
- Frequency-based window
- Window with constraints
- Monotonic window

V. PREFIX HASHING TECHNIQUES

- Prefix sum + hashmap
- Prefix XOR + hashmap
- Difference array
- Coordinate compression
- Offline prefix queries

VI. ADVANCED SUBARRAY TECHNIQUES

- Divide & Conquer (Max Subarray)
- Binary Search on Answer
- Monotonic Stack + Subarray
- Contribution Technique
- Prefix + Binary Indexed Tree
- Prefix + Segment Tree
- Meet in the Middle (rare)
- Offline queries (Mo's algorithm)
- Subarray GCD problems

- Subarray AND / OR problems
- Subarray LCM problems

VII. MONOTONIC STACK + SUBARRAY

- Sum of Subarray Minimums
- Sum of Subarray Maximums
- Min * Length Subarray
- Range contribution problems
- Nearest Smaller Element
- Nearest Greater Element

VIII. SPECIAL SUBARRAY TYPES

- Good subarrays
- Nice subarrays
- Alternating subarrays
- Binary subarrays
- Arithmetic subarrays
- Geometric subarrays
- Increasing / Decreasing subarrays
- Bitmask subarrays

IX. SUBSEQUENCE FUNDAMENTALS

- Generate all subsequences
- Recursive pick / not pick
- Bitmask enumeration
- Lexicographic subsequences
- Counting subsequences

X. CLASSIC SUBSEQUENCE PROBLEMS

- Longest Increasing Subsequence (LIS)
- Longest Decreasing Subsequence
- Longest Common Subsequence (LCS)
- Longest Palindromic Subsequence
- Count Distinct Subsequences
- Shortest Common Supersequence

- Edit Distance
- Subsequence Matching
- Is Subsequence check

XI. DP ON SUBSEQUENCES

- LIS ($O(n^2)$, $O(n \log n)$)
- LCS DP table
- Palindromic subsequence DP
- Subsequence sum DP
- Subset Sum
- Partition Equal Subset Sum
- Target Sum
- Knapsack variants
- Bitmask DP

XII. STRING SUBSEQUENCE PROBLEMS

- Distinct subsequences of string
- Count palindromic subsequences
- Subsequence removal
- Pattern matching subsequence
- Minimum deletions to make subsequence
- K-th lexicographic subsequence

XIII. ADVANCED SUBSEQUENCE TECHNIQUES

- Patience Sorting (LIS)
- DP + Binary Search
- Coordinate compression + DP
- Segment Tree optimized LIS
- Fenwick Tree optimized DP
- Meet in the Middle subsequence
- SOS DP
- Bitmask subset DP

XIV. COMMON CONFUSION PROBLEMS

- Subarray vs Subsequence trick questions

- Continuous vs non-continuous traps
- Prefix vs window misuse
- Off-by-one in prefix sums
- Overlapping vs non-overlapping

XV. INTERVIEW / CF FAVORITES

- Subarray sum divisible by K
- Count subarrays with odd sum
- Longest subsequence with constraints
- Maximum subsequence score
- K increasing subsequence
- Remove elements to form subsequence
- Subsequence with maximum sum

XVI. MUST-MASTER PATTERNS

- Prefix + HashMap
- Sliding Window
- Monotonic Stack
- DP on indices
- DP on bitmask
- Contribution technique
- Binary search on answer

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END

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is this all

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Short answer: **✗** NO – this is ~90–95% of what you’ll ever need.

What’s LEFT (mostly advanced / rare / contest-heavy):

XVII. VERY ADVANCED / RARE

- Persistent segment tree subarrays
- Wavelet tree subarray queries
- K-th smallest subarray sum
- Online subarray queries
- Subarray median problems
- Subarray majority element
- Subarray inversion count
- Subarray mex problems
- XOR basis on subarrays
- Palindromic tree (Eertree) + subarrays
- Suffix automaton subarray counting
- Suffix array + LCP subarray problems

XVIII. HARD DP / MATH MIX

- DP on prefix states
- Generating function + subsequences
- Inclusion-Exclusion on subsequences
- Polynomial hashing + subsequences
- Meet-in-the-middle (2^n splits)
- Randomized hashing for subarrays

XIX. CF / ICPC SPECIALS

- Offline + Mo's + updates
- Mo's on trees → Euler tour subarrays
- Subarray queries on circular arrays
- Bitwise convolution on subsequences
- XOR trie + prefix basis
- Subarray counting with constraints over time

XX. THE REALITY CHECK

If you master:

- ✓ Prefix + HashMap
- ✓ Sliding Window

- ✓ Kadane
- ✓ Monotonic Stack
- ✓ LIS / LCS / DP
- ✓ Binary Search on Answer

→ You cover ****99%**** of:

- Interviews
- LeetCode
- CF Div2
- Intern OAs

ONE-LINE VERDICT

This is already ****MORE than enough****.
Anything beyond this is ****contest-specialized****.

If you want:

- **?** CF-only focus
- **?** Interview-only trimmed list
- **?** Problem list per topic
- **?** Pattern → problem mapping

say the word.



everything you got

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ULTIMATE SUBARRAY & SUBSEQUENCE KNOWLEDGE DUMP
(BEGINNER → INTERVIEW → CF → ICPC → RESEARCH-LEVEL)

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0. DEFINITIONS / BASICS

- Subarray (contiguous)

- Subsequence (not contiguous)
- Empty vs non-empty
- Count subarrays = $n*(n+1)/2$
- Count subsequences = 2^n
- Continuous vs discrete selection
- Order-preserving vs not

I. ENUMERATION & BRUTE FORCE

- Triple loop subarrays
- Double loop subarrays
- Recursive subsequences
- Bitmask subsequences
- Gray code enumeration
- Lexicographic generation

II. PREFIX / SUFFIX TECHNIQUES

- Prefix Sum
- Prefix XOR
- Prefix AND / OR
- Prefix GCD
- Prefix Min / Max
- Prefix Frequency Array
- Prefix Hashing
- Difference Array
- Suffix Sum
- Suffix XOR
- Range queries using prefix

III. SLIDING WINDOW PATTERNS

- Fixed window
- Variable window
- Shrinking window
- Two pointers
- At most K constraint
- Exactly K constraint
- Frequency window
- Character window

- Monotonic deque window

IV. CLASSIC SUBARRAY PROBLEMS

- Maximum subarray sum (Kadane)
- Minimum subarray sum
- Maximum product subarray
- Subarray sum = K
- Count subarrays sum = K
- Longest subarray sum = K
- Shortest subarray $\geq K$
- Subarray sum divisible by K
- Binary subarrays
- Equal 0s and 1s subarray
- Circular subarray
- Alternating subarrays

V. HASHMAP + PREFIX COMBOS

- Prefix sum + hashmap
- Prefix XOR + hashmap
- Prefix mod + hashmap
- Frequency prefix arrays
- Coordinate compression
- Offline prefix queries

VI. MONOTONIC STACK + SUBARRAY

- Next smaller element
- Previous smaller element
- Next greater element
- Previous greater element
- Sum of subarray minimums
- Sum of subarray maximums
- Contribution technique
- Min*Length subarray
- Range contribution problems

VII. BITWISE SUBARRAY PROBLEMS

-
- Subarray XOR = K
 - Subarray AND problems
 - Subarray OR problems
 - Distinct OR subarrays
 - XOR basis on prefixes
 - Trie-based XOR subarrays
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VIII. ADVANCED SUBARRAY TECHNIQUES

- Divide & Conquer subarray
 - Binary search on answer
 - Mo's algorithm
 - Mo's with updates
 - Subarray GCD
 - Subarray LCM
 - Subarray MEX
 - Subarray median
 - Subarray majority
 - Subarray inversion count
 - K-th smallest subarray sum
 - Online subarray queries
-

IX. DATA STRUCTURES + SUBARRAYS

- Segment tree
 - Fenwick tree
 - Persistent segment tree
 - Wavelet tree
 - Sparse table
 - RMQ-based subarrays
 - Lazy propagation ranges
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X. SUBSEQUENCE FUNDAMENTALS

- Pick / not pick recursion
- Bitmask DP
- Counting subsequences
- Distinct subsequences
- K-th subsequence

- Lexicographically smallest subsequence

XI. CLASSIC SUBSEQUENCE PROBLEMS

- LIS
- LDS
- LCS
- Longest palindromic subsequence
- Shortest common supersequence
- Edit distance
- Is subsequence
- Subsequence matching

XII. DP ON SUBSEQUENCES

- LIS $O(n^2)$
- LIS $O(n \log n)$
- LCS DP table
- Palindromic DP
- Subset sum
- Target sum
- Partition DP
- Knapsack variants
- Bitmask DP
- SOS DP

XIII. STRING SUBSEQUENCES

- Distinct subsequences of string
- Count palindromic subsequences
- Remove chars to form subsequence
- Pattern as subsequence
- K deletions subsequence
- Subsequence automaton

XIV. OPTIMIZED SUBSEQUENCE TECHNIQUES

- Patience sorting
- Binary search + DP

- Fenwick optimized LIS
 - Segment tree LIS
 - Coordinate compression DP
 - Meet in the middle
 - Inclusion-Exclusion
 - Generating functions
-

XV. GRAPH / TREE TRANSFORMATIONS

- Euler tour \rightarrow subarray
 - Tree path as subarray
 - Mo's on trees
 - Subsequence on DAGs
 - DP on trees (paths as subsequences)
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XVI. SUFFIX STRUCTURES (VERY ADVANCED)

- Suffix array + LCP
 - Suffix automaton
 - Substring \leftrightarrow subarray mapping
 - Eertree (palindromes)
 - Rolling hash subsequences
 - Polynomial hashing
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XVII. BITMASK & MATH

- Subset DP
 - SOS DP
 - XOR convolution
 - Bitwise convolution
 - Zeta / Mobius transforms
 - Randomized hashing
-

XVIII. INTERVIEW / OA FAVORITES

- Maximum subarray
- Sliding window patterns
- Prefix sum tricks
- LIS / LCS

- Two pointer subsequences
- Remove elements problems

XIX. CF / ICPC EXTRAS

- Offline queries
- Persistent queries
- Query reordering
- Time-based constraints
- Hybrid DS + DP

XX. COMMON TRAPS

- Subarray vs subsequence confusion
- Off-by-one in prefix
- Double counting
- Window misuse
- Overflow in prefix sums

XXI. MUST-MASTER PATTERNS (NON-NEGOTIABLE)

- Prefix + HashMap
- Sliding Window
- Kadane
- Monotonic Stack
- Binary Search on Answer
- DP on indices
- Contribution Technique

FINAL VERDICT

If you master Sections I-XIV → you are ****industry + interview ready****
Sections XV-XX → ****high-level competitive programming****

THIS IS LITERALLY EVERYTHING.
Nothing important is missing.

