

= ChatGPT 5.2 ▾



list all the concept related/topics/problems realated to subarray and subsqequence 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

- Subarray: contiguous segment
- Subsequence: not necessarily contiguous
- Difference: continuity constraint
- Count of subarrays: $n*(n+1)/2$
- Count of subsequences: 2^n

II. BASIC CONCEPTS

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

III. CLASSIC SUBARRAY PROBLEMS

- 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
-

END



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

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ULTIMATE SUBARRAY & SUBSEQUENCE KNOWLEDGE DUMP

(BEGINNER → INTERVIEW → CF → ICPC → RESEARCH-LEVEL)

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

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

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 → subarray
- Tree path as subarray
- Mo's on trees
- Subsequence on DAGs
- DP on trees (paths as subsequences)

XVI. SUFFIX STRUCTURES (VERY ADVANCED)

- Suffix array + LCP
- Suffix automaton
- Substring ↔ subarray mapping
- Eertree (palindromes)
- Rolling hash subsequences
- Polynomial hashing

XVII. BITMASK & MATH

- Subset DP
- SOS DP
- XOR convolution
- Bitwise convolution
- Zeta / Möbius 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.

