1   CheatSheet: LeetCode Common Templates & Common Code Problems INTERVIEW

- PDF Link: cheatsheet-leetcode-A4.pdf, Category: interview

- Blog URL: `https://cheatsheet.dennyzhang.com/cheatsheet-leetcode-A4`

- Related posts: CheatSheet: System Design For Job Interview, #denny-cheatsheets

File me Issues or star this repo.

1.1   Reference

Name	Summary
Cheatsheet	CheatSheet: Leetcode For Code Interview, CheatSheet: Common Code Problems & Follow-ups
Cheatsheet	CheatSheet: System Design For Job Interview, CheatSheet: SRE/DevOps/Sysadmin
Cheatsheet	CheatSheet: Behavior Questions For Coder Interview

1.2   Top 25 Code Templates

Num	Category/Tag	Example
1	#bfs	Leetcode: Max Area of Island
2	#dfs	LeetCode: Surrounded Regions
3	#binarysearch	LeetCode: Search Insert Position
4	#interval, #mergelist	LeetCode: Interval List Intersections
5	#twopointer, #array	LeetCode: Reverse Words in a String II
6	#twopointer	LeetCode: Two Sum
7	#backtracking, #subset	LeetCode: Subsets II
8	#linkedlist, #presum	LeetCode: Remove Zero Sum Consecutive Nodes from Linked List
9	#unionfind	LeetCode: Accounts Merge
10	#trie	LeetCode: Longest Word in Dictionary
11	#stack	LeetCode: Valid Parentheses
12	#stack	LeetCode: Reverse Substrings Between Each Pair of Parentheses
13	#heap	LeetCode: Top K Frequent Elements
14	#baseconversion	LeetCode: Base 7, LeetCode: Convert to Base -2
15	#interval	LeetCode: Meeting Rooms II, LeetCode: My Calendar I
16	#monotone	LeetCode: Daily Temperatures
17	#knapsack	LeetCode: Coin Change
18	#sortbyfunction	LeetCode: Relative Sort Array
19	#slidingwindow	LeetCode: Longest Substring Without Repeating Characters
20	#editdistance, #dynamicprogramming	LeetCode: Longest Common Subsequence
21	#twopointer, #mergetwolist	LeetCode: Merge Sorted Array
22	#topologicalsort	LeetCode: Course Schedule
23	#bfs, bidirectional bfs	LeetCode: Word Ladder
24	#monotonicfunc, #binarysearch	LeetCode: Kth Smallest Number in Multiplication Table
25	#divideconquer, #recursive	Leetcode: Count of Smaller Numbers After Self
26	#linesweep	Leetcode: Employee Free Time, Leetcode: The Skyline Problem

https://raw.githubusercontent.com/dennyzhang/cheatsheet.dennyzhang.com/master/cheatsheet-leetcode-A4/datastructre.png

1.3   Top 30 Graph Problems

Num	Problem	Summary
1	Graph Connectivity: Count islands in a 2D matrix	LeetCode: Number of Islands, LeetCode: Isla
2	Get the size of the largest island	LeetCode: Max Area of Island
3	Find shortest distance for two nodes in an undirected graph	
4	Cycle detection in a directed graph	LeetCode: Redundant Connection II
5	Detect all cycles in a directed graph	LeetCode: Find Eventual Safe States
6	Whether a graph is a tree	LeetCode: Graph Valid Tree
7	Minimum Spanning Tree(MST) of a weighted graph - Kruskal's algorithm	LeetCode: Connecting Cities With Minimum
8	Find shortest paths in a weighted graph - Floyd-Warshall algorithm	
9	Shortest path for two nodes in a weighted graph - Dijkstra's algorithm	LeetCode: Connecting Cities With Minimum
10	Update a specific region	LeetCode: Flood Fill
11	Update regions for a given rule	LeetCode: Surrounded Regions
12	Number of Distinct Islands	LeetCode: Number of Distinct Islands
13	Mark levels	LeetCode: 01 Matrix
14	Diameter of a tree in graph theory	LeetCode: Tree Diameter
15	Duplicate edges	LeetCode: Reconstruct Itinerary
16	Find a certain node in a graph	LeetCode: Find the Celebrity
17	Coloring graph	LeetCode: Minesweeper
18	Find a certain path from source to destination in a graph	LeetCode: Path With Maximum Minimum V
19	Find the minimum steps from point1 to point2	LeetCode: Word Ladder, LeetCode: Sliding
20	Find all minimum paths from point1 to point2	LeetCode: Word Ladder II
21	All Paths from Source Lead to Destination	LeetCode: All Paths from Source Lead to De
22	Node connectivity problem for a sparse 2D matrix	LeetCode: Escape a Large Maze
23	Bricks Falling When Hit	LeetCode: Bricks Falling When Hit
24	Bridges in a connected graph - Tarjan's algorithm	LeetCode: Critical Connections in a Network
25	Valid & Invalid moves	LeetCode: Alphabet Board Path
26	Move in different directions: 4 directions, 8 directions	LeetCode: Queens That Can Attack the King
27	String Transforms Into Another String	LeetCode: String Transforms Into Another S

https://cdn.dennyzhang.com/images/brain/denny$_{\text{leetcode.png}}$

1.4 Top 20 Binarysearch Problems

Num	Problem	Summary
1	Find whether target in the range	LeetCode: Guess Number Higher or Lower
2	Find the first target with duplicates	LeetCode: First Bad Version
3	Find the last target with duplicates	LeetCode: Longest Repeating Substring
4	Search Insert Position	LeetCode: Search Insert Position, LeetCode: Time Based Key-Value Stor
5	Missing Element in Sorted Array	LeetCode: Missing Element in Sorted Array
6	Find smallest letter greater than target	LeetCode: Find Smallest Letter Greater Than Target
7	Random Point in Non-overlapping Rectangles	LeetCode: Random Point in Non-overlapping Rectangles
8	Binary search on monotonic function	LeetCode: Sqrt(x), LeetCode: Capacity To Ship Packages Within D Day
9	Place k elements to minimize max distance	LeetCode: Minimize Max Distance to Gas Station
10	Kth Smallest Number in Multiplication Table	LeetCode: Kth Smallest Number in Multiplication Table
11	Search for a Range	Leecode: Search for a Range
12	Mountain Array	LeetCode: Peak Index in a Mountain Array
13	Dynamic programming with binary search	LeetCode: Maximum Profit in Job Scheduling
14	Montone stack with binary search	LeetCode: Maximum Width Ramp
15	Find Right Interval	Leecode: Find Right Interval
16	Patient sort	LeetCode: Longest Increasing Subsequence
17	Find Minimum in Rotated Sorted Array	LeetCode: Find Minimum in Rotated Sorted Array
18	Find Minimum in Rotated Sorted Array II	LeetCode: Find Minimum in Rotated Sorted Array II

1.5 Top 25 Dynamic Programming Problems

Num	Problem	Time Complexity	Summary
1	Maximum subarray problem - Kadane's algorithm	O(n)	LeetCode: Maximum Subarray
2	LIS - Longest increasing subsequence	O(n)	LeetCode: Longest Increasing Subsequence
3	LCS - Longest Common Subsequence	O(n*m)	LeetCode: Longest Common Subsequence
4	LPS - Longest Palindromic Subsequence	O(n)	LeetCode: Longest Palindromic Subsequence
5	Longest Palindromic Substring	$O(n^2)$	LeetCode: Longest Palindromic Substring
6	Edit distance of two strings	$O(n^2)$	LeetCode: Edit Distance
7	Maximum profits with certain costs	$O(n^2)$	LeetCode: 4 Keys Keyboard
8	Count of distinct subsequence	O(n)	LeetCode: Distinct Subsequences II
9	Count out of boundary paths in a 2D matrix	O(n*m*N)	LeetCode: Out of Boundary Paths
10	Regular Expression Matching	O(n*m)	LeetCode: Regular Expression Matching
11	Wildcard Matching	O(n*m)	LeetCode: Wildcard Matching
12	Multiple choices for each step	O(n*m)	LeetCode: Filling Bookcase Shelves
13	Knapsack: put array to bag A, B or discard it	O(n*s)	LeetCode: Tallest Billboard
14	Knapsack problem to maximize benefits	O(n*s)	LeetCode: Coin Change
15	Minimum Cost to Merge Stones	$O(n^3)$	LeetCode: Minimum Cost to Merge Stones
16	DP over interval: Minimum-weight triangulation	$O(n^3)$	LeetCode: Minimum Score Triangulation of Poly
17	Burst Balloons	$O(n^3)$	LeetCode: Burst Balloons
18	Remove Boxes	$O(n^4)$	LeetCode: Remove Boxes
19	Largest Sum of Averages	O(k*n*n)	LeetCode: Largest Sum of Averages
20	Uncrossed Lines	O(n*m)	LeetCode: Uncrossed Lines
21	Binary Trees With Factors	$O(n^2)$	LeetCode: Binary Trees With Factors

1.6 Top 15 BinaryTree Problems

Num	Problem	Summary
1	Binary Tree Level Order Traversal	LeetCode: Binary Tree Right Side View
2	Get binary tree height, width	LeetCode: Balanced Binary Tree
3	LCA - Lowest Common Ancestor of a binary Tree	LeetCode: Lowest Common Ancestor of a Binary Tree
4	Validate Binary Search Tree	LeetCode: Validate Binary Search Tree
5	Construct binary tree	LeetCode: Construct Binary Tree from Preorder and Postorder Trav
6	Distribute Coins in Binary Tree	LeetCode: Distribute Coins in Binary Tree
7	Binary Tree Vertical Order Traversal	LeetCode: Binary Tree Vertical Order Traversal
8	Verify Preorder Sequence in Binary Search Tree	LeetCode: Verify Preorder Sequence in Binary Search Tree
9	Recursive + Greedy	LeetCode: Binary Tree Coloring Game
10	Binary tree + greedy	LeetCode: Binary Tree Cameras

1.7 Top 10 String Problems

Num	Problem	Summary
1	Edit distance of two strings	LeetCode: Edit Distance
2	Remove duplicate letters	Remove Duplicate Letters
3	Word ladder	LeetCode: Word Ladder
4	lrs - Longest repeating substring	LeetCode: Longest Repeating Substring
5	Remove Comments	LeetCode: Remove Comments
6	Split Concatenated Strings	LeetCode: Split Concatenated Strings
7	Vowel Spellchecker	LeetCode: Vowel Spellchecker
8	Lexicographically minimal string rotation	LeetCode: Last Substring in Lexicographical Order
9	String Transforms Into Another String	LeetCode: String Transforms Into Another String
10	Find the Closest Palindrome	LeetCode: Find the Closest Palindrome

1.8 Top 5 Array Problems

Num	Problem	Summary
1	Transpose Matrix	LeetCode: Transpose Matrix
2	Largest 1-Bordered Square	LeetCode: Largest 1-Bordered Square
3	Alphabet Board Path	LeetCode: Alphabet Board Path
4	Set Mismatch	LeetCode: Set Mismatch
5	Majority Element	LeetCode: Majority Element

1.9   Top 5 Linkedlist Problems

Num	Problem	Summary
1	Merge k Sorted Lists	LeetCode: Merge k Sorted Lists
2	Detect cycle for a linked list	LeetCode: Linked List Cycle
3	LFU cache with double linkedlist	LeetCode: LFU Cache

1.10   Top 10 Sliding Window Problems

Num	Problem	Summary
1	Sliding window with fixed size	LeetCode: Find All Anagrams in a String
2	Sliding window with non-decreasing size	LeetCode: Max Consecutive Ones III
3	How to initialize the time window?	LeetCode: Minimum Swaps to Group All 1's Together
4	Sliding window with non-decreasing size	LeetCode: Max Consecutive Ones III
5	Move two pointers: two loop vs One loop	LeetCode: Longest Substring Without Repeating Characte
6	Inspiring sliding window problem	LeetCode: Moving Stones Until Consecutive II
7	Sliding window with adjustable size	
8	Move pointer1 to match the other, or the other way around	

1.11   Top 10 Math Problems

Num	Problem	Summary
1	Check prime - Sieve of Eratosthenes	LeetCode: Count Primes
2	Check leap year	LeetCode: Day of the Week
3	GCD	LeetCode: Fraction Addition and Subtraction
4	Overlapping area of two rectangles	LeetCode: Rectangle Area
5	Rotate Array by k steps	LeetCode: Rotate Array
6	Mapping data range of getRand algorithm	LeetCode: Implement Rand10() Using Rand7()
7	Deal with float	LeetCode: Minimize Max Distance to Gas Station
8	Sum of Subsequence Widths	LeetCode: Sum of Subsequence Widths
9	Reduce f(x, y) to g(x)	Leetcode: Maximum of Absolute Value Expression
10	Remove 9	LeetCode: Remove 9
11	Fraction to Recurring Decimal	LeetCode: Fraction to Recurring Decimal
12	Check if two line segments intersect	

1.12   Top 10 Greedy Problems

Num	Problem	Summary
1	Next Permutation	LeetCode: Next Permutation
2	Split Array into Consecutive Subsequences	LeetCode: Split Array into Consecutive Subsequences
3	Remove duplicate letters	Remove Duplicate Letters
4	Bag of Tokens	LeetCode: Bag of Tokens
5	Two City Scheduling	LeetCode: Two City Scheduling
6	Split Concatenated Strings	LeetCode: Split Concatenated Strings
7	Jump Game II	LeetCode: Jump Game II
8	Delete Columns to Make Sorted II	LeetCode: Delete Columns to Make Sorted II

1.13   Top 5 Trie Problems

Num	Problem	Summary
1	Extra datastructure in trie to save caculation	LeetCode: Word Search II
2	Trie for bit manipulation	LeetCode: Maximum XOR of Two Numbers in an Array.
3	Fuzzy match for trie tree	LeetCode: Implement Magic Dictionary

1.14   Top 5 Union Find Problems

Num	Problem	Summary
1	Union find for weighted graph	LeetCode: Evaluate Division
2	Union find: connect groups and merge node count	LeetCode: Bricks Falling When Hit

1.15   Top 5 Heap/Priority Queue Problems

Num	Problem	Summary
1	Meeting Rooms II	LeetCode: Meeting Rooms II
2	Task Scheduler	LeetCode: Task Scheduler
3	Last Stone Weight	LeetCode: Last Stone Weight
4	The Skyline Problem	LeetCode: The Skyline Problem

1.16   Top 5 Montone Stack/Queue Problems

Num	Problem	Summary
1	Monotone stack for consecutive subarrays	LeetCode: Online Stock Span, LeetCode: Sum of Subarray Minimums
2	Shortest Subarray with Sum at Least K	LeetCode: Shortest Subarray with Sum at Least K

1.17   Top 10 Backtracking Problems

Num	Problem	Summary
1	Generate unique permutation	LeetCode: Permutations II
2	Permutation: All elements must take	LeetCode: Pyramid Transition Matrix
3	Combination: All elements can take or don't take	LeetCode: Subsets II
4	Expression Add Operators	LeetCode: Expression Add Operators
5	Permutation vs Combination	LeetCode: Campus Bikes II
6	Define dfs backtracking function	LeetCode: Verbal Arithmetic Puzzle

1.18   Top 20 Object-Oriented Design Problems

Num	Problem	Example
1	Cache	LeetCode: LRU Cache, LeetCode: LFU Cache, LeetCode: All O'one Data Structure
2	Throttling	LeetCode: Design Hit Counter, LeetCode: Logger Rate Limiter
3	Design Log Storage System	LeetCode: Design Log Storage System
4	Linked List with random access	LeetCode: Design Linked List
5	Max Stack	LeetCode: Max Stack
6	Design HashMap	LeetCode: Design HashMap
7	Circular Queue	LeetCode: Design Circular Queue, LeetCode: Design Circular Deque
8	Trie tree	LeetCode: Implement Trie (Prefix Tree), LeetCode: Add and Search Word
9	Get Median	LeetCode: Find Median from Data Stream
10	Range Sum Query	LeetCode: Range Sum Query - Mutable, LeetCode: Range Sum Query - Immutable
11	Design File System	LeetCode: Design File System
12	Tree Iterator	LeetCode: Binary Search Tree Iterator
13	String Iterator	LeetCode: Design Compressed String Iterator
14	ZigZag Iterator	LeetCode: Zigzag Iterator
15	Insert Delete GetRandom O(1)	LeetCode: Insert Delete GetRandom O(1)
16	Insert Delete GetRandom O(1) II	LeetCode: Insert Delete GetRandom O(1) - Duplicates allowed
17	Random Pick with Blacklist	LeetCode: Random Pick with Blacklist

1.19   Top 50 General Problems

Num	Problem	Example
1	Longest substring with at most K distinct characters	LeetCode: Longest Substring with At Most K Distinct Characters
2	Longest subarray with maximum K 0s	LeetCode: Max Consecutive Ones III
3	Seperate a list into several groups	LeetCode: Summary Ranges
4	Split string	LeetCode: License Key Formatting
5	TopK problem	LeetCode: Top K Frequent Elements, LeetCode: Find K Pairs w
6	Longest Palindromic Subsequence	LeetCode: Longest Palindromic Subsequence
7	Sort one array based on another array	LeetCode: Relative Sort Array
8	Range update with lazy propagation	LeetCode: Corporate Flight Bookings
9	Get all possibilities of subsets	LeetCode: Subsets II, LeetCode: Subsets
10	Choose k numbers from a list	LeetCode: Combination Sum II
11	Combination from multiple segments	LeetCode: Letter Combinations of a Phone Number
12	Remove nodes from linked list	LeetCode: Remove Zero Sum Consecutive Nodes from Linked List
13	Two pointers	LeetCode: Two Sum
14	Buy stock for maximum profit list	LeetCode: Best Time to Buy and Sell Stock
15	Prefix search from a list of strings	LeetCode: Longest Word in Dictionary
16	Factor Combinations	LeetCode: Factor Combinations
17	Permutation without duplicates	LeetCode: Palindrome Permutation II
18	Convert a number into negative base representation	LeetCode: Convert to Base -2
19	Network connectivity	LeetCode: Friend Circles
20	Build relationship among different sets	LeetCode: Accounts Merge
21	Find the next greater value	LeetCode: Daily Temperatures
22	Meeting conflict	LeetCode: Meeting Rooms, LeetCode: Course Schedule
23	Minimum conference rooms	LeetCode: Meeting Rooms II
24	Quick slow pointers	LintCode: Middle of Linked List
25	Longest Repeating Character with at most K changes	LeetCode: Longest Repeating Character Replacement
26	Prefix and Suffix Search	LeetCode: Prefix and Suffix Search
27	Remove duplicate letters	LeetCode: Remove Duplicate Letters
28	Beautiful array	LeetCode: Beautiful Array
29	Whether 132 pattern exists in array	LeetCode: 132 Pattern
30	Detect conflicts of intervals	LeetCode: Non-overlapping Intervals
31	Segment tree: solves range query problems quickly	LeetCode: Range Sum Query - Mutable
32	Find best meeting points for a list of nodes	LeetCode: Best Meeting Point
33	Find the size of longest wiggle subsequence	LeetCode: Wiggle Subsequence
34	Sequence reconstruction	LeetCode: Sequence Reconstruction
35	Construct Binary Tree from String	Construct Binary Tree from String
36	Use more space to save time	LeetCode: Min Stack
37	Min max game problems	LeetCode: Predict the Winner, LeetCode: Stone Game
38	Shortest Subarray with Sum at Least K	LeetCode: Shortest Subarray with Sum at Least K
39	Wiggle sort	LeetCode: Wiggle Sort II
40	Array compressed storage	LeetCode: Design Tic-Tac-Toe
41	Dead lock: the Dining Philosophers	LeetCode: The Dining Philosophers
42	Maintain the order	LeetCode: Building H2O
43	Int to string or string to int	
44	Expression Add Operators	LeetCode: Expression Add Operators
45	Merge k Sorted Lists	LeetCode: Merge k Sorted Lists
46	Trapping Rain Water	LeetCode: Trapping Rain Water

1.20 Basic Thinking Methodologies

Num	Name	Summary
1	Trial and error	
2	Divide and Conquer	
3	Start with naive algorithm, then identify useless steps	

1.21 Tips: Think From The Other Direction

Num	Name	Summary
1	In graph, instead of deleting edges, add edge in reverse	LeetCode: Bricks Falling When Hit
2	Instead of BFS from empty to islands, do the otherwise	LeetCode: As Far from Land as Possible
3	Treat each point as the last item, instead of the first	LeetCode: Burst Balloons
4	Avoid deleting element from hashmaps	

1.22 Common Tips For Clean Code

Num	Name	Summary
1	Calculate sum of a range quickly	#presum,LeetCode: Maximum Subarray
2	Move in four directions for a matrix	LeetCode: Sliding Puzzle
3	Split string by multiple separators	LeetCode: Brace Expansion
4	Add a dummy tailing element to simplify code	LeetCode: Brace Expansion
5	Fast slow pointers	LintCode: Middle of Linked List
6	Deep copy an array	LeetCode: Combination Sum
7	Use arrays instead of hashmaps, if possible	LeetCode: Number of Days in a Month
8	Control the order of dfs	LeetCode: Subsets II
9	Avoid inserting into the head of an array	LeetCode: Path In Zigzag Labelled Binary Tree
10	From right to left, instead of left to right	LeetCode: Merge Sorted Array
11	Think the other way around	`Add Items` vs `Remove Items`, `Increase Counter`
12	Avoid unnecessary if. . . else. . .	res[i] = (diff/2 <= k), LeetCode: Can Make Palin
13	To get the case of K, solve: at most K - at most (K-1)	LeetCode: Subarrays with K Different Integers
14	Instead of deleting entry from hashmap, decrease counter	LeetCode: Longest Substring with At Most K Dis
15	Find the max/min; If not found, return 0	LeetCode: Minimum Area Rectangle
16	With helper function vs without helper function	LeetCode: Longest Repeating Character Replacer
17	Instead of adding a character, try to delete one	LeetCode: Longest String Chain
18	#roudtrippass: from left to right, then right to left	LeetCode: Shortest Distance to a Character
19	Delayed calculation to simplify the code	LeetCode: Interval List Intersections
20	Instead of removing, add padding elements	LeetCode: Duplicate Zeros
21	Initialize array with n+1 length to simplify code	LeetCode: Range Addition
22	Look for off-by-one errors, sometimes use i+1<len(l) vs i<len(l)	LeetCode: Previous Permutation With One Swap
23	Hashmap can reduce calculation, but may complicate things too	LeetCode: Maximum Frequency Stack
24	Sliding window to get the longest size of subarray	LeetCode: Max Consecutive Ones III
25	In matrix dfs, change cell to impossible value to avoid state hashmap	LeetCode: Word Search II
26	For palindrome check, check the whole string, instead of left half	LeetCode: Longest Chunked Palindrome Decomp
27	Use queue to keep flipping the orders	LeetCode: Zigzag Iterator
28	Find a pair with sum meets some requirements	LeetCode: Two Sum
29	Add a dummy head node for linked list	LeetCode: Reverse Linked List
30	Hide details which are irrelevant	
31	One pass instead of two pass	
32	Avoid unnecessary precheck	

1.23 Whiteboard Tips

Name	Summary
Focus on your key motivations or thinkings	Pivot quickly from interviewers' feedback
Brute force algorithm add values	Intuitive algorithms are usually the starting points of optimal ones
Work through specific test case clearly	Reduce bugs, and help to obtain interviewers' feedback early
Naming variables could be tricky	Settle down a set of variables per your preference
You don't have to crack all problems/optimal algorithms	

1.24 More Data Structure

Name	Summary
Tree map	
Inverted Index	

1.25   Resource For Code Problems

Name	Summary
Leetcode summary	Link: Top Google Questions, Link: Top 100 Liked Questions, Link: Top Interview Questions
Leetcode summary	GitHub: kdn251/interviews, Github: Algorithms-and-Coding-Interviews
YouTube	How to: Work at Google - Example Coding/Engineering Interview, lee 215, Aoxiang Cui, happygirlzt
Online test websites	hihocoder.com, codeforces.com, spoj.com, Google - codejam, hackerrank.com
Online test websites	hackerrank - hard, poj.org, acm.hdu.edu.cn, acm.zju.edu.cn, acm.timus.ru, uva.onlinejudge.org
visualgo	visualizing data structures and algorithms through animation
Reference	geeksforgeeks.org, Youtube: Abdul Bari - Algorithm
Reference	COS 423 Theory of Algorithms

1.26   More Resources

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```
https://en.wikipedia.org/wiki/Data_structure
https://www.cs.princeton.edu/~rs/AlgsDS07/
https://www.geeksforgeeks.org/top-10-algorithms-in-interview-questions/
```