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

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- CheatSheet: Common Code Problems & Follow-ups

1.1 Top 25 Code Templates

Num	Category/Tag	Example
1	#bfs	Leetcode: Binary Tree Level Order Traversal
2	#dfs	Leetcode: Island Perimeter, Leetcode: Surrounded Regions
3	#binarysearch	Leetcode: Search Insert Position
4	#interval, #mergetwolist	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	

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

1.2 Top 25 Graph Problems

Num	Problem	Category/Tag	Summary
1	Graph Connectivity: Count islands in a 2D matrix	#dfs, #unionfind	Leetcode: N
2	Get the size of the largest island	#dfs	Leetcode: M
3	Find shortest distance for two nodes in an undirected graph	#bfs	
4	Cycle detection in an undirected graph		
5	Cycle detection in a directed graph	#topologicalsort	Leetcode: R
6	Detect all cycles in a directed graph	#dfs, #bfs	Leetcode: F
7	Whether a graph is a tree	#unionfind, #bfs	Leetcode: G
8	Minimum Spanning Tree(MST) of a weighted graph - Kruskal's algorithm	#unionfind	Leetcode: C
9	Shortest path for two nodes in a weighted graph - Dijkstra's algorithm		
10	Find shortest paths in a weighted graph - Floyd-Warshall algorithm	#dfs, #dynamicprogramming	
11	Update a specific region	#dfs	Leetcode: F
12	Update regions for a given rule		Leetcode: Su
13	Number of Distinct Islands	#island, #dfs, #hashmap	Leetcode: N
14	Mark levels		Leetcode: 01
15	Diameter of a tree in graph theory	#dfs, #bfs	Leetcode: T
16	Duplicate edges		Leetcode: R
17	Find a certain node in a graph	#unionfind	Leetcode: F
18	Coloring graph	#colorgraph, #bfs, #dfs	Leetcode: M
19	Find a certain path from source to destination in a graph		Leetcode: P
20	Find the minimum steps from point1 to point2		Leetcode: W
21	Find all minimum paths from point1 to point2		Leetcode: W
22	All Paths from Source Lead to Destination		Leetcode: A
23	Node connectivity problem for a sparse 2D matrix	#dfs, #bfs	Leetcode: E
24	Bricks Falling When Hit	#unionfind	Leetcode: B
25	Bridges in a connected graph - Tarjan's algorithm		Leetcode: C

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

1.3 Top 15 Binarysearch Problems

Num	Problem	Category/Tag	Summary
1	Find the first true	#binarysearch	Leetcode: First Bad Version
2	Find the last true	#binarysearch	Leetcode: Longest Repeating S
3	Search Insert Position	#binarysearch	Leetcode: Search Insert Positio
4	Missing Element in Sorted Array	#binarysearch	Leetcode: Missing Element in S
5	Random Point in Non-overlapping Rectangles	#binarysearch	Leetcode: Random Point in No
6	Binary search on monotonic function	#monotonicfunc, #binarysearch	Leetcode: Sqrt(x), Leetcode: C
7	Place k elements to minimize max distance	#monotonicfunc, #float	Leetcode: Minimize Max Dista
8	Kth Smallest Number in Multiplication Table	#monotonicfunc, #binarysearch	Leetcode: Kth Smallest Numbe
9	Mountain Array	#mountainarray, #binarysearch	Leetcode: Peak Index in a Mou
10	Dynamic programming with binary search	#binarysearch, #dynamicprogramming	Leetcode: Maximum Profit in J
11	Montone stack with binary search	#binarysearch, #montone	Leetcode: Maximum Width Ra
12	Patient sort	#binarysearch, #dynamicprogramming	Leetcode: Longest Increasing S

1.4 Top 15 Dynamic Programming Problems

Num	Problem	Time Complexity	Category/Tag	S
1	Maximum subarray problem - Kadane's algorithm	O(n)	#maxsubarraysum, #dynamicprogramming	I
2	LIS - Longest increasing subsequence	O(n)	#lis, #string, #dynamicprogramming	I
3	LCS - Longest Common Subsequence	O(n*m)	#lcs, #editdistance, #dynamicprogramming	I
4	LPS - Longest Palindromic Subsequence	O(n)	#palindrome, #dynamicprogramming	I
5	Longest Palindromic Substring	$O(n^2)$/O(n)	#palindrome,#dynamicprogramming	I
6	Edit distance of two strings	$O(n^2)$	#editdistance, #dynamicprogramming	I
7	Count of distinct subsequence	O(n)	#countdistinctmoves, #hashmap	I
8	Maximum profits with certain costs	$O(n^2)$	#maxprofitwithcost, #dynamicprogramming	I
9	Count out of boundary paths in a 2D matrix	O(n*m*N)	#countdistinctmoves, #bfs	I
10	Regular Expression Matching	O(n*m)	#editdistance, #dynamicprogramming	I
11	Wildcard Matching	O(n*m)	#editdistance, #dynamicprogramming	I
12	Multiple choices for each step	O(n*m)	#dynamicprogramming	I
13	Knapsack: put array to bag A, B or discard it	O(n*s)	#knapsack, #dynamicprogramming	I
14	DP over interval: Minimum-weight triangulation	$O(n^3)$	#intervaldp, #dynamicprogramming	I

1.5 Top 10 BinaryTree Problems

Num	Problem	Category/Tag	Summary
1	Binary Tree Level Order Traversal	#bfs	Leetcode: Binary Tree Right Side View
2	Get binary tree height, width	#dfs	Leetcode: Balanced Binary Tree
3	LCA - Lowest Common Ancestor of a binary Tree	#dfs	Leetcode: Lowest Common Ancestor of a Binary T
4	Validate Binary Search Tree	#dfs	Leetcode: Validate Binary Search Tree
5	Check whether a binary tree is a full binary tree	#dfs, #bfs	
6	Right view of a tree		
7	Longest path inside a binary tree		
8	Biggest path sum inside a binary tree		
9	Implement a getNext iterator of in-order trasversal		
10	Construct binary tree	#recursive	Leetcode: Construct Binary Tree from Preorder an

1.6 Top 10 String Problems

Num	Problem	Category/Tag	Summary
1	Edit distance of two strings	#editdistance, #dynamicprogramming	Leetcode: Edit Distance
2	Remove duplicate letters	#stack, #greedy	Remove Duplicate Letters
3	Word ladder	#bfs, #backtracking, #string	Leetcode: Word Ladder
4	lrs - Longest repeating substring	#lrs, #rollinghash	Leetcode: Longest Repeating Substring
5	Remove Comments	#array, #string	Leetcode: Remove Comments
6	Split Concatenated Strings	#greedy, #string	Leetcode: Split Concatenated Strings
7	Vowel Spellchecker	#hashmap, #string	Leetcode: Vowel Spellchecker

1.7 Top 5 Array Problems

Num	Problem	Category/Tag	Summary
1	Transpose Matrix	#array	Leetcode: Transpose Matrix
2	Largest 1-Bordered Square	#graph, #array	Leetcode: Largest 1-Bordered Square
3	Alphabet Board Path	#graph, #array	Leetcode: Alphabet Board Path

1.8 Top 5 Linkedlist Problems

Num	Problem	Category/Tag	Summary
1	Merge k Sorted Lists	#linkedlist, #heap	Leetcode: Merge k Sorted Lists
2	Detect cycle for a linked list	#twopointer, #linkedlist	Leetcode: Linked List Cycle
3	LFU cache with double linkedlist	#lfu, #linkedlist	Leetcode: LFU Cache

1.9 Top 10 Math Problems

Num	Problem	Category/Tag	Summary
1	Check prime - Sieve of Eratosthenes	#prime	Leetcode: Count Primes
2	Check leap year	#leapyear	Leetcode: Day of the Week
3	GCD	#gcd	
4	Rectangle	#rectangle	
5	Rotate Array by k steps	#rotatelist	Leetcode: Rotate Array
6	Mapping data range of getRand algorithm	#random	Leetcode: Implement Rand10() Using Rand7()
7	Deal with float	#float	Leetcode: Minimize Max Distance to Gas Statio
8	Sum of Subsequence Widths	#math	Leetcode: Sum of Subsequence Widths
9	Remove 9	#baseconversion, #math	Leetcode: Remove 9

1.10 Top 5 Greedy Problems

Num	Problem	Category/Tag	Summary
1	Next Permutation	#nextpermutation, #greedy	Leetcode: Next Permutation
2	Split Array into Consecutive Subsequences	#splitarray, #greedy	Leetcode: Split Array into Consecutive Subs
3	Remove duplicate letters	#stack, #greedy	Remove Duplicate Letters
4	Two City Scheduling	#greedy	Leetcode: Two City Scheduling
5	Split Concatenated Strings	#string, #greedy	Leetcode: Split Concatenated Strings

1.11 Top 5 Knapsack Problems

Num	Problem	Category/Tag	Summary
1	Knapsack problem to maximize benefits	#knapsack, #dynamicprogramming	Leetcode: Coin Change
2	Get two subset with the same sum	#knapsack, #dynamicprogramming	Leetcode: Tallest Billboard

1.12 Top 5 Montone Stack/Queue Problems

Num	Problem	Category/Tag	Summary
1	Monotone stack for consecutive subarrays	#montone	Leetcode: Online Stock Span, Leetcode: Sum of Subarray M
2	Shortest Subarray with Sum at Least K	#montone	Leetcode: Shortest Subarray with Sum at Least K

1.13 Top 20 Object-Oriented Design Problems

Num	Problem	Category/Tag	Example
1	Cache	#linkedlist, #oodesign	Leetcode: LRU Cache, Leetcode: LFU Cache, Leetcode: Al
2	Throttling	#linkedlist, #oodesign	Leetcode: Design Hit Counter, Leetcode: Logger Rate Limi
3	Design Log Storage System	#oodesign	Leetcode: Design Log Storage System
4	Linked List with random access	#oodesign	Leetcode: Design Linked List
5	Max Stack	#stack , #oodesign	Leetcode: Max Stack
6	Design HashMap	#oodesign	Leetcode: Design HashMap
7	Circular Queue	#oodesign	Leetcode: Design Circular Queue, Leetcode: Design Circula
8	Trie tree	#oodesign	Leetcode: Implement Trie (Prefix Tree), Leetcode: Add and
9	Get Median	#oodesign	Leetcode: Find Median from Data Stream
10	Range Sum Query	#oodesign	Leetcode: Range Sum Query - Mutable, Leetcode: Range S
11	Design File System	#oodesign	Leetcode: Design File System
12	Tree Iterator	#oodesign	Leetcode: Binary Search Tree Iterator
13	String Iterator	#oodesign	Leetcode: Design Compressed String Iterator
14	ZigZag Iterator	#oodesign	Leetcode: Zigzag Iterator
15	Insert Delete GetRandom O(1)	#oodesign, #random	Leetcode: Insert Delete GetRandom O(1)
16	Insert Delete GetRandom O(1) II	#oodesign, #random	Leetcode: Insert Delete GetRandom O(1) - Duplicates allow

1.14 Top 50 General Problems

Num	Problem	Category/Tag	Example
1	Longest substring with at most K distinct characters	#slidingwindow, #atmostkdistinct	Leetcode: Longest Substri
2	Longest subarray with maximum K 0s	#slidingwindow	Leetcode: Max Consecutiv
3	Seperate a list into several groups	#groupelements, #twopointer	Leetcode: Summary Rang
4	Split string	#string	Leetcode: License Key For
5	TopK problem	#heap, #topk	Leetcode: Top K Frequent
6	Longest Palindromic Subsequence	#dynamicprogramming	Leetcode: Longest Palindr
7	Sort one array based on another array	#sortbyfunction	Leetcode: Relative Sort A
8	Range update with lazy propagation	#combinedcaculation, #rangesum	Leetcode: Corporate Fligh
9	Get all possibilities of subsets	#subset, #backtracking	Leetcode: Subsets II, Leet
10	Choose k numbers from a list	#combination, #backtracking	Leetcode: Combination Su
11	Combination from multiple segments	#combination, #backtracking	Leetcode: Letter Combina
12	Remove nodes from linked list	#linkedlist, #presum	Leetcode: Remove Zero Su
13	Check whether a linked list has a loop		
14	Two pointers	#twosum, #twopointer	Leetcode: Two Sum
15	Buy stock for maximum profit list	#array, #greedy, #buystock	Leetcode: Best Time to B
16	Prefix search from a list of strings	#trie	Leetcode: Longest Word i
17	Factor Combinations	#combination, #backtracking	Leetcode: Factor Combina
18	Permutation without duplicates	#permutation, #backtracking	Leetcode: Palindrome Per
19	Int to string or string to int	#bitmanipulation	
20	Convert a number into negative base representation	#bitmanipulation, #baseconversion	Leetcode: Convert to Base
21	Network connectivity	#unionfind	Leetcode: Friend Circles
22	Build relationship among different sets	#unionfind	Leetcode: Accounts Merge
23	Find the next greater value	#monotone	Leetcode: Daily Temperat
24	Meeting conflict	#interval	Leetcode: Meeting Rooms
25	Minimum conference rooms	#interval, #meetingconflict	Leetcode: Meeting Rooms
26	Quick slow pointers	#twopointer	LintCode: Middle of Linke
27	Longest Repeating Character with at most K changes	#slidingwindow	Leetcode: Longest Repeati
28	Prefix and Suffix Search	#trie	Leetcode: Prefix and Suffi
29	Remove duplicate letters	#greedy, #string, #stack	Leetcode: Remove Duplica
30	Beautiful array	#divideconquer	Leetcode: Beautiful Array
31	Whether 132 pattern exists in array	#stack	Leetcode: 132 Pattern
32	Detect conflicts of intervals	#interval	Leetcode: Non-overlapping
33	Segment tree: solves range query problems quickly	#segmenttree	Leetcode: Range Sum Que
34	Find best meeting points for a list of nodes	#meetingpoint	Leetcode: Best Meeting Po
35	Find the size of longest wiggle subsequence	#subsequence, #wiggle	Leetcode: Wiggle Subsequ
36	Sequence reconstruction	#topologicalsort	Leetcode: Sequence Recon
37	Construct Binary Tree from String	#stack	Construct Binary Tree fro
38	Use more space to save time	#stack	Leetcode: Min Stack
39	Min max game problems	#minmax, #dynamicprogramming	Leetcode: Predict the Win
40	Shortest Subarray with Sum at Least K	#monotone	Leetcode: Shortest Subarr
41	Wiggle sort		Leetcode: Wiggle Sort II
42			Leetcode: Remove Duplica
43			Travelling salesman proble
44	Array compressed storage	#oodesign, #game	Leetcode: Design Tic-Tac-
45	Dead lock: the Dining Philosophers	#concurrency	Leetcode: The Dining Phi
46	Maintain the order	#concurrency	Leetcode: Building H2O

1.15 Basic Thinking Methodologies

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

1.16 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	Avoid deleting element from hashmaps	

1.17 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 Replacem
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 Decompo
27	Use queue to keep flipping the orders	Leetcode: Zigzag Iterator
28	Find a pair with sum meets some requirements	Leetcode: Two Sum
29	Avoid unnecessary precheck	
30	One pass instead of two pass	
31	Swiping line algorithm	
32	Add a dummy head node for linked list	
33	Hide details which are irrelevant	

1.18 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	

1.19 More Data Structure

Name	Summary
Tree map	
Inverted Index	

1.20 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

1.21 More Resources


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