

LeetCode Solutions

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Part I

LeetCode Top Interview Questions

Chapter 1

Easy

Link: [LeetCode Top Interview Questions: Easy section.](#)

1.1 Arrays

Link: [Arrays](#)

1.1.1 26. Remove Duplicates from Sorted Array

[Link to question](#), [Link to submission](#)

Concepts Two pointer

Algorithm description

- Maintain a read pointer and a write pointer, both starting from zero.
- Advance the write pointer until you see a new value or reach end of array.
- Write value at write location into read location.

- Return read.

1.1.2 122. Best Time to Buy and Sell Stock II

[Link to question](#), [Link to submission](#)

Concepts Greedy

Algorithm description

- Construct a consecutive elements difference array
- Return sum of all positive elements in difference array

1.1.3 189. Rotate Array

[Link to question](#), [Link to submission approach 1](#), [Link to submission approach 2](#)

Concepts Cyclic replacements, Implementation

Approach 1 description

- Maintain a visited array and a pointer initialized to 0
- while pointer + k is not visited, replace arr[pointer + k] with arr[pointer]. Update pointer to pointer + k. Set pointer + k to visited, increment a numberOfChanges variable.
- Increment pointer by 1
- Keep doing this while numberOfChanges less than size of array.

Approach 2 description

- Reverse the entire array
- Reverse from start to start + k
- Reverse from start + k to end

1.1.4 217. Contains Duplicate

[Link to question](#), [Link to submission](#)

Concepts Hash Table, Set

Algorithm description

- Initialize a Set
- For an element in array, if element in Set, return true
- else add element to Set
- If out of loop, return False

1.1.5 136. Single Number

[Link to question](#), [Link to submission](#)

Concepts Bit Manipulation, XOR

Algorithm description

- Initialize an answer variable to 0
- For every element, XOR it to answer. Elements appearing twice get XOR'd out to zero

- Return answer

1.1.6 350. Intersection of Two Arrays II

[Link to question](#), [Link to submission approach 1](#), [Link to submission approach 2](#)

Concepts Hash Table, Two Pointers

Approach 1 description

- Form an element:frequency mapping using map for smaller array (to save space)
- Traverse bigger array
- If frequency of element less than 0, add to answer. Decrement frequency

Approach 2 description

- If arrays are sorted, use two pointers p1 and p2
- If $\text{nums1}[p1] == \text{nums2}[p2]$, add to answer and increment both
- Else if $\text{nums1}[p1]$ is smaller, increment p1. Else increment p2
- Keep doing until reach end of either array

1.1.7 66. Plus One

[Link to question](#), [Link to submission](#)

Concepts Array

Algorithm description

- Initialize a carry variable to 1
- Traverse array from the end.
 $\text{digit}[i] = \text{carry} + \text{digit} \bmod 10$, $\text{carry} = \text{carry} + \text{digit} \text{ div } 10$
- Finally, if carry is not zero, insert carry at start of array

1.1.8 283. Move Zeroes

[Link to question](#), [Link to submission](#)

Concepts Two Pointers

Algorithm description

- Maintain a read and a write pointer, both initialized to 0
- if read end has zero, increment read end
- else, copy read end to write end and increment both
- After read end reaches end, set all numbers from write end to end as 0

1.1.9 1. Two Sum

[Link to question](#), [Link to submission approach 1](#), [Link to submission approach 2](#)

Concepts Hash Table, Two Pointer

Approach 1 description

- Create an element:indices mapping
- Sort the array
- Use two pointers to search for a particular sum
- Once you find the sum, pop index from left pointer, and pop index from right pointer
- Return indices

Approach 2 description

- Create a hashmap of int, int
- Iterate the array with i as looping variable
- If element in hashmap, return (hashmap[element], i)
- Else insert hashmap[target - element] = i

1.1.10 36. Valid Sudoku

[Link to question](#), [Link to submission](#)

Concepts Hash Table, Set

Algorithm description

- Create sets to hold numbers for each row, col and square.
- Traverse the sudoku
- If a number is already in the row, col, square, return False
- Else, come out of loop and return true

1.1.11 48. Rotate Image

[Link to question](#), [Link to submission](#)

Concepts Array, Circular Permutation

Algorithm description

- Do a counterclockwise circular permutation as mentioned in solution
- Pure implementation problem. No algorithmic skill.

1.2 Strings

Link: [Strings](#)

1.2.1 344. Reverse String

[Link to question](#), [Link to submission](#)

Concepts Two Pointers

Algorithm description

- Set a left pointer to start of string, right pointer to end
- Swap left and right. Increment left, decrement right
- Do while l less than r

1.2.2 7. Reverse Integer

[Link to question](#), [Link to submission](#)

Concepts Two Pointers

Algorithm description

- Reverse the integer by converting to a string
- Store result in long
- If stored result is outside integer limits, return 0
- Else return the reversed number

1.2.3 387. First Unique Character in a String

[Link to question](#), [Link to submission](#)

Concepts Hash Map

Algorithm description

- Construct element frequency mapping
- Traverse the string from the start, if frequency of a char is 1, return index
- If reach end of string, return -1

1.2.4 242. Valid Anagram

[Link to question](#), [Link to submission](#)

Concepts Hash Map, Counting Sort

Algorithm description

- Traverse through s1, incrementing frequency counts
- Traverse through s2, decrementing frequency counts
- If all counts are zero, return true. Else false.

1.2.5 125. Valid Palindrome

[Link to question](#), [Link to submission](#)

Concepts Two Pointers

Algorithm description

- Maintain a left and a right pointer
- Before comparing the two, ensure left and right both are pointing to an alphanumeric character

1.2.6 28. Implement strStr()

[Link to question](#), [Link to Approach 1](#), [Link to Approach 2](#)

Concepts Two Pointers, Rabin-Karp Algorithm, Rolling Hash

Approach 1 description

- Traverse haystack until you find a character matching with first character of needle
- Once match is found, keep checking for further characters until either there's a mismatch or you reach end of arrays
- Return index accordingly

Approach 2 description - Rabin-Karp

- Hash the needle using a hash function that is easy to be "rolled", that is it is easy to compute hash for next window if hash for previous window is known
- Traverse the haystack using window of length `needle.length()`. Hash the window and compare with needle hash. If matched, return the index of start of window
- See implementation carefully, very interesting. Also see [LeetCode solution article](#).

1.2.7 38. Count and Say

[Link to question](#), [Link to submission](#)

Concepts Recursion, Two Pointers

Algorithm description

- Base case: $n = 1$, return "1"
- Get the answer for $n-1$
- Traverse through answer of $n-1$
- For each consecutive list of same elements, add the count, followed by the element
- Return answer

1.2.8 14. Longest Common Prefix

[Link to question](#), [Link to submission](#)

Concepts Implementation

Algorithm description

- Initialize answer string to ""
- Find length of smallest string
- For i from 0 to $\text{min length} - 1$
- Traverse through all the characters at i th positions
- If different, return answer
- If same, add character to answer

1.3 Linked Lists

Link: [Linked Lists](#)

1.3.1 237. Delete Node in a Linked List

[Link to question](#), [Link to submission](#)

Concepts Trick

Algorithm description

- Copy value of next node into current node
- Set next ptr of current node to next ptr of next node

1.3.2 19. Remove Nth Node From End of List

[Link to question](#), [Link to submission](#)

Concepts Two Pointer

Algorithm description

- To do it in one pass, let a forward pointer advance n steps
- Then, start forwarding a slow pointer as well as the forward pointer one at a time until forward reaches the end
- delete the slow pointer node

1.3.3 206. Reverse Linked List

[Link to question](#), [Link to iterative approach](#), [Link to recursive approach](#)

Concepts Implementation

Approach 1 description

- Initialize a `prev = NULL`, and a `curr = head`
- While head is not NULL, do a cyclic swap between `curr.next`, `prev`, and `curr`.
- Return `prev`

Approach 2 description

- If head is NULL or head.next is NULL return head
- `l = reversed list for head.next`
- `head.next.next = head`, `head.next = NULL`. Return `l`

1.3.4 21. Merge Two Sorted Lists

[Link to question](#), [Link to iterative submission](#), [Link to recursive submission](#)

Concepts Two Pointers

Algorithm description Iterative

- Make a dummy node, and let `tmp = dummynode`
- Keep appending the smaller of the two lists to the dummy node and advance the pointers accordingly
- If one of the lists becomes NULL, append the other list to dummy node
- Return next of `tmp`

Algorithm description Recursive

- If either of lists is NULL, return the other
- if l1 is smaller, get answer to (l1.next, l2) and set it as l1.next. Return l1
- Else get answer to (l1, l2.next) and set it as l2.next. Return l2

1.3.5 234. Palindrome Linked List

[Link to question](#), [Link to submission](#)

Concepts Reverse a linked list, Two Pointers

Algorithm description

- Reverse the second half of the linked list
- Compare nodewise the head of linked list and the head of reversed list to check for palindrome

1.3.6 141. Linked List Cycle

[Link to question](#), [Link to submission](#)

Concepts Hare and Tortoise, Two Pointers

Algorithm description

- Initialize a slow and a fast pointer
- Advance slow by 1, fast by 2
- If slow and fast meet, there's a cycle. Else if fast reaches end, there's no cycle.

1.4 Trees

Link: [Trees](#)

1.4.1 104. Maximum Depth of Binary Tree

[Link to question](#), [Link to recursive submission](#), [Link to iterative submission](#)

Concepts Recursion, Stack

Algorithm description Recursive

- If root is null, return 0
- Else return $1 + \max(\text{maxDepth}(\text{left}), \text{maxDepth}(\text{right}))$

Algorithm description Iterative

- If root is null, return 0
- Initialize stack holding pair of TreeNode and depth
- Push {root, 1}
- While stack is not empty, get top of stack
- If top is leaf, compare with maxDepth
- Push children if any with $\text{depth} = 1 + \text{parent depth}$

1.4.2 98. Validate Binary Search Tree

[Link to question](#), [Link to iterative submission](#), [Link to recursive submission](#)

Concepts Top-Down

Algorithm description (for recursive/iterative)

- Approach is a top-down one
- At every node, check if node.val is between a range of [small, large]
- If not, return False
- else check left subtree for range[small, node.val] and check right subtree for range[node.val, large]
- Return the AND of the above two

1.4.3 101. Symmetric Tree

[Link to question](#), [Link to recursive submission](#), [Link to iterative submission](#)

Concepts Top-Down

Algorithm description (for recursive/iterative)

- Top down approach
- Check if leftTree.val == rightTree.val
- If true, check for leftTree.left, rightTree.right and leftTree.right, rightTree.left
- Else, return False

1.4.4 102. Binary Tree Level Order Traversal

[Link to question](#), [Link to submission](#)

Concepts Top-Down, BFS

Algorithm description

- Push root into a queue
- At beginning of an iteration, take size of queue
- Pop out #size items from queue, while adding their children to queue
- Add to level
- Add level to final answer

1.4.5 108. Convert Sorted Array to Binary Search Tree

[Link to question](#), [Link to submission](#)

Concepts Recursion, Preorder

Algorithm description

- call procedure with left = 0, right = arr.size() - 1
- if left greater than right, return NULL
- construct node for middle element
- node.left = procedure(left, middle-1), node.right = procedure(middle+1, right)
- return node

1.5 Sorting and Searching

Link: [Sorting and Searching](#)

1.5.1 88. Merge Sorted Array

[Link to question](#), [Link to submission](#)

Concepts Two Pointers

Algorithm description

- Create a copy array for nums1
- Maintain write pointer for nums1, p1 for nums1copy, p2 for nums2
- Write smaller of p1, p2 into nums1. Advance smaller and write head.
- Once out of the loop, see which array still has elements remaining. Add them to nums1

1.5.2 278. First Bad Version

[Link to question](#), [Link to submission](#)

Concepts Binary Search

Algorithm description

- set left as 0, right as n - 1
- while l less than equal to r
- if mid is bad, right = middle - 1

- else left = middle + 1
- Once you come out of loop, return l

1.6 Dynamic Programming

Link: [Dynamic Programming](#)

1.6.1 70. Climbing Stairs

[Link to question](#), [Link to submission](#)

Concepts Dynamic Programming

Algorithm description

- Ways to reach i th step = ways to reach $i-1$ th step plus ways to reach $i-2$ th step

1.6.2 121. Best Time to Buy and Sell Stock

[Link to question](#), [Link to submission](#)

Concepts Dynamic Programming

Algorithm description

- Maintain a smallest stock price seen yet variable
- Update $\text{maxProfit} = \max(\text{maxProfit}, \text{current price} - \text{maxProfit})$

1.6.3 53. Maximum Subarray

[Link to question](#), [Link to submission](#)

Concepts Dynamic Programming

Algorithm description

- Maintain a current sum variable, denoting the highest sum possible that contains the element at the index
- Maintain a highest sum variable, denoting the highest sum encountered among the current sums

1.6.4 198. House Robber

[Link to question](#), [Link to submission](#), [Link to submission \(space optimized\)](#)

Concepts Dynamic Programming

Algorithm description

- Maintain a dp array with $dp[0] = \text{nums}[0]$, $dp[1] = \max(\text{nums}[0], \text{nums}[1])$. $dp[i]$ denotes maximum amount that can be robbed with first $i+1$ houses
- $dp[i] = \max(dp[i-1], dp[i-2] + \text{nums}[i])$
- Finally return $dp[n-1]$

1.7 Design

Link: [Design](#)

1.7.1 384. Shuffle an Array

[Link to question](#), [Link to submission](#)

Concepts Fisher-Yates Algorithm, Random Permutation

Algorithm description

- Iterate through the array
- For every iteration, generate an index between [current index, last index]
- Swap elements at current index and generated index
- Return array

1.7.2 155. Min Stack

[Link to question](#), [Link to submission](#)

Concepts Two stacks

Algorithm description

- Use one stack to keep track of all elements, and another minstack to keep track of minimums
- Push(x): push x to stack. Push x to minstack only if x less than or equal to top of minstack or if minstack is empty

- `Pop()`: pop from stack. Pop from minstack if `stack.top() == minstack.top()`
- `getMin()`: return `minstack.top()`

1.8 Math

Link: [Math](#)

1.8.1 412. Fizz Buzz

[Link to question](#), [Link to submission 1](#), [Link to submission 2](#) (Easier to maintain)

Concepts Divisibility

Algorithm description

- Instead of following naive approach of check divisibility by 15 first, then by 3 and 5, use an incremental approach
- Add "Fizz" to answer if divisible by 3
- Add "Buzz" to answer if divisible by 5
- This code is much easier to maintain if more conditions like 7:"Jazz" are added. Also note submission 2, which is even easier to maintain

1.8.2 204. Count Primes

[Link to question](#), [Link to submission](#)

Concepts Number Theory, Math, Primes

Algorithm description

- Let's start with a isPrime function. To determine if a number is prime, we need to check if it is not divisible by any number less than n. The runtime complexity of isPrime function would be $O(n)$ and

hence counting the total prime numbers up to n would be $O(n^2)$.
Could we do better?

- As we know the number must not be divisible by any number greater than $n / 2$, we can immediately cut the total iterations half by dividing only up to $n / 2$. Could we still do better?
- We don't need to go all the way till $n / 2$. Just stopping at \sqrt{n} is enough. Complexity is now $O(n \text{ to the power } 1.5)$
- Notice that if we've tested for the number x being prime, we don't need to test for multiples of x being prime anymore. This is the motivation for the Sieve of Eratosthenes. Take a number, if it is not visited, mark all its multiples excluding itself as visited. Increment number and repeat.
- One optimization is to not start at $2x$ but to start at x times x , as $2x$ had already been marked when marking multiples of two.
- Finally, there is no need to go through all numbers till n . We only need to do the sieve for numbers till root of n .
- Answer is count of unvisited elements in visited array
- Definitely look through the final submission for all the optimizations.
- Complexity - $O(n \log \log n)$

1.8.3 326. Power of Three

[Link to question](#), [Link to submission](#)

Concepts Math

Algorithm description

- Since they're asking for no loops/recursion (which would be the naive approach), the idea is to find the largest power of 3 that fits in 4 byte size

- If (largest number which is power of 3) % num == 0, then number is a power of 3
- Bear in mind that this will only work for powers of x where x is a prime number.
- Do look at editorial for a good discussion on logarithms approach as well.

1.8.4 13. Roman to Integer

[Link to question](#), [Link to submission](#)

Concepts Parsing

Algorithm description

- Maintain two pointers, current and next, initialized to 0 and 1
- If value at curr greater than equal value at next, add value at curr to answer. Increment both pointers
- Else, add value at next to answer, subtract value at curr to answer, increment both pointers by two.
- Once out of loop, if curr less than string.length(), add value at curr to answer
- Return answer
- Note: this is a left to right pass solution. Also see the right to left pass submission shown in the editorial

1.9 Others

Link: [Others](#)

1.9.1 191. Number of 1 Bits

[Link to question](#), [Link to submission](#)

Concepts Bit Manipulation

Algorithm description

- initialize answer to 0
- While number not equal to 0, set number as (number & number-1), increment answer
- return answer

1.9.2 461. Hamming Distance

[Link to question](#), [Link to submission](#)

Concepts Bit Manipulation

Algorithm description

- Let A be xor of x and y (xor returns a 1 if the operands are different)
- Count number of set bits in A

1.9.3 190. Reverse Bits

[Link to question](#), [Link to submission 1 \(naive\)](#), [Link to submission 2 \(constant time\)](#)

Concepts Bit Manipulation

Algorithm description

- Naive solution is clear, compare bits at opposite ends. If different, flip them
- For constant time, first, we break the original 32-bit into 2 blocks of 16 bits, and switch them.
- We then break the 16-bits block into 2 blocks of 8 bits. Similarly, we switch the position of the 8-bits blocks
- We then continue to break the blocks into smaller blocks, until we reach the level with the block of 1 bit.

1.9.4 118. Pascal's Triangle

[Link to question](#), [Link to submission](#)

Concepts Implementation

Algorithm description

- Nothing fancy, just construct row by row as mentioned in the description.

1.9.5 20. Valid Parentheses

[Link to question](#), [Link to submission](#)

Concepts Stack

Algorithm description

- Iterate through string
- If it's an opening bracket, push onto stack
- Else, if it's not a matching bracket, return False
- If matching bracket, pop from stack
- When you come out of loop, if stack is empty return true
- Return false

1.9.6 268. Missing Number

[Link to question](#), [Link to submission](#)

Concepts Bit Manipulation

Algorithm description

- XOR all numbers in the range $[0, n]$ into a variable answer
- Iterate through the array, XORing every element into the answer variable
- Return answer. All elements will have appeared twice, except the missing number which appeared once, and hence is stored in answer variable

Chapter 2

Medium

Link: [LeetCode Top Interview Questions: Medium section](#).

2.1 Array and Strings

Link: [Array and Strings](#)

2.1.1 15. 3Sum

[Link to question](#), [Link to submission](#)

Concepts Two Pointer, Sorting

Algorithm description

- Sort the array
- Traverse from left. For each iteration, fix target as $-1 * \text{nums}[i]$
- Maintain left ptr as $i+1$, and right ptr as end of arrays
- Search if sum of values at left and right equals target

- If so, add triplet to answer. Move left and right pointers along accordingly
- Take care to write loops to skip over duplicate values at left, right and i. Avoids TLE.

2.1.2 73. Set Matrix Zeroes

[Link to question](#), [Link to submission](#)

Concepts Space Optimization, In Place

Algorithm description

- Set boolean variables to decide if first row and first column need setting to zero
- Traverse matrix (excluding first row and first column)
- Wherever $\text{arr}[i][j] == 0$, set $\text{arr}[i][0]$ and $\text{arr}[0][j]$ as 0
- Traverse matrix (excluding first row and first column). If $\text{arr}[i][0] == 0$ or $\text{arr}[0][j] == 0$, set $\text{arr}[i][j] = 0$
- Finally, set first row and first column as zero if needed, as decided in first step

2.1.3 49. Group Anagrams

[Link to question](#), [Link to submission](#)

Concepts Sorting, Hashtable

Algorithm description

- Set up a map of string, vector;string;
- Traverse array
- For a string, sort it, and append original string to vector at hashed value of sorted string
- Finally, append all vectors to an answer array and return the array

2.1.4 3. Longest Substring Without Repeating Characters

[Link to question](#), [Link to submission](#)

Concepts Sliding Window, HashMap, Two Pointer

Algorithm description

- Initialize left and right both at 0
- Advance right as you keep getting characters and store their indexes in a map. Keep updating maxLen as $\max(\text{maxLen}, r - l + 1)$
- The moment you get a repeated character, delete all entries in the map for characters from left ptr to first occurrence of repeated character.
- Then, update position of left to one index after the first occurrence of repeated character, as well as update the first occurrence of repeated character as the right pointer.
- Return maxLen

2.1.5 5. Longest Palindromic Substring

[Link to question](#), [Link to submission](#), [Link to DP submission](#)

Concepts DP, Two Pointer

Approach 1 description

- Start at each of the $2 * \text{len} - 1$ possible centres of the string.
- Keep expanding outside until palindrome.
- Store longest palindrome in answer and return answer

DP description

- $\text{dp}[i][i] = \text{true}$, $\text{dp}[i][i+1] = \text{true}$ if $s[i] == s[i+1]$
- $\text{dp}[i][j] = \text{true}$ if $\text{dp}[i+1][j-1] == \text{true}$ and $s[i] == s[j]$
- Finally return $s.\text{substr}(\text{starting index}, \text{maxLength})$
- Do look at implementation to see how dp array is filled. Order is not top to bottom, left to right. It is filled in a diamond shaped manner. Remember DAA course? That way.

2.1.6 334. Increasing Triplet Subsequence

[Link to question](#), [Link to submission](#)

Concepts If-Else

Algorithm description

- Keep a smallest and a second smallest, both initialized at INT MAX
- Traverse the array
- If number less than equal to smallest, update smallest
- Else if number less than equal to second smallest, update second smallest
- Else return true

2.1.7 163. Missing Ranges

[Link to question](#), [Link to submission](#)

Concepts Arrays, Implementation

Algorithm description

- Create a new long datatype vector out of integers of nums
- Push lower - 1 and upper + 1 to long vector
- Generate a differences array
- If difference $\neq 2$, continue
- If difference equals 2, push back $\text{longarray}[i]+1$ to answer
- Else push back $(\text{longarray}[i]+1)-i-(\text{longarray}[i+1] - 1)$ to answer
- Return answer