

Placement/Internship

Class - 1: STL, Greedy, Ad hoc and Implementation



Standard Template Library

Why is it used?

The Standard Template Library (STL) is a set of C++ template classes to provide common programming data structures and functions such as lists, stacks, arrays, etc. It is a library of container classes, algorithms, and iterators.

Components of STL

STL has 3 components:

1. Algorithms
2. Containers
3. Iterators

Algorithms

1. Sorting - `std::sort()`, `std::qsort()`
2. Searching - `std::binary_search()`
3. Other - `reverse(first_iterator, last_iterator)`, `*max_element (first_iterator, last_iterator)`, `*min_element (first_iterator, last_iterator)`, `accumulate(first_iterator, last_iterator, initial value of sum)`, `next_permutation()`, `prev_permutation()`

Containers

1. Sequence containers - vector,list,deque,arrays,forward list
2. Container Adaptors - queue, priority_queue,stack
3. Associative containers - set, multiset,map
4. Unordered Associative containers -
unordered_set,unordered_map,unordered_multiset.

Iterators

Iterators are used to point at the memory addresses of STL containers. They are primarily used in sequences of numbers, characters etc.

1. `begin()`
2. `end()`
3. `next()`
4. `prev()`
5. `advance()`

Greedy Algorithms

Greedy is an algorithmic paradigm that builds up a solution piece by piece, always choosing the next piece that offers the most obvious and immediate benefit. So the problems where choosing locally optimal also leads to global solution are the best fit for Greedy.

Fractional Knapsack (Example)



Ad hoc: Tricks

1. Draw lots of small cases to gain a better understanding of the problem.
2. Try to break the given problem into smaller ones.
3. Draw a visual representation of the problem.

Question - 1 (Asked in DE Shaw)

A dice is rolled n times, find the number of ways of getting exactly k 1s.

Tip: Revise P and C.

Trick: Always think about sorting the array

Question - 2

Given an array A , you can replace any one number with any other number.
Minimize the maximum value of $|A[i] - A[j]|$.

Question - 3

Now, you can replace two elements.

Question - 4 (Asked in CodeAgon)

Given an array A , you construct another array B which contains values $|A[i] - A[j]|$ (for $0 \leq i < j \leq n$). Now, you can replace any two elements of A , by any other number. Minimize the sum of $\max_value(B) + \min_value(B)$

Trick: Break problem into smaller parts

Question - 5

Given an array, you can perform the following operations any number of time:

1. Choose an odd length subarray and reverse it.

Find if you can sort the array?

Question - 6: (Same trick)

Given an array, you can perform the following operations any number of time:

1. Choose an even length subarray and add x ($-\infty \leq x \leq \infty$) to it.

Find if you can reduce the array to an array of zeros.

Question - 7 (Don't over complicate things)

Let's consider all integers in the range from 1 to n (inclusive).

Among all pairs of distinct integers in this range, find the maximum possible greatest common divisor of integers in pair. Formally, find the maximum value of $\gcd(a,b)$, where $1 \leq a < b \leq n$.

[Problem - 1370A - Codeforces](#)

Greedy?

Question 8 - Asked in Microsoft

1. Given an array of numbers ranging from 1-6 you have to merge add K elements[in the range 1-6] in the array such that the mean of the array after adding elements become F, we need to return an array of K elements if it was not possible we need to return an empty array.

Question 9: (Standard problem)

You are given a 0-indexed array of integers `nums` of length `n`. You are initially positioned at `nums[0]`.

Each element `nums[i]` represents the maximum length of a forward jump from index `i`. In other words, if you are at `nums[i]`, you can jump to any `nums[i + j]` where:

$0 \leq j \leq \text{nums}[i]$ and

$i + j < n$

Return the minimum number of jumps to reach `nums[n - 1]`. It is guaranteed that you can reach `nums[n - 1]`.

Question 10: (Standard problem, Asked in Arcesium interview)

Given an array of positive integers. Find the minimum positive integer which cannot be obtained by summing a subsequence of the array.

[Smallest Positive Integer that can not be represented as Sum | Practice | GeeksforGeeks](#)

Try out all standard problems from here:

[Greedy Algorithm - InterviewBit](#)

Less than 6 months are remaining, so what needs to be done?

- Start giving contests, if you haven't done yet. Platform: Leetcode
- Would recommend codeforces div-2 A and B to improve your thinking ability.
- While giving contests on leetcode and dailies, write your code on the editor provided by Leetcode itself, in order to get an experience of OA.
- Learn all basic data structures and algorithms with their implementation.
- Learn OOPs in the language in which you code.
- Practice a lot.
- Attend CC classes...