

# Competitive Programming

Class - 1: Ad-hoc and How to Approach Problems



Time complexity?

# Question - 1

Find time complexity of:

```
for(int i = 0; i < n; i++){  
    for(int j = 0; j < n; j++){  
        // something  
    }  
}
```

## Question - 2

Time complexity?

```
for(int i = 1; i * i <= n; i++){  
    // something 2  
}
```

## Question - 3

```
for (int i = 0; i < n; i++){  
    for(int j = i; j < n; j += i){  
        // something 3  
    }  
}
```

# 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()`



# 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 - 4

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 - 5

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

# Question - 6

Now, you can replace two elements.

## Question - 7 (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 - 8

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 - 9: (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 - 10 (Don't over complicate)

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](#)

# How to improve performance?

- The first 2 problems of CF are mainly ad hoc, so try to apply the mentioned tricks. Same is the case for starting problems of Codechef.
- Give a lot of virtual contests.
- Try atcoder.jp as well.

# Resources

- <https://cses.fi/problemset/>
- <https://earthshakira.github.io/a2oj-clientside/server/>
- <http://www.usaco.org/index.php?page=resources>
- <https://atcoder.jp/>
- <https://cp-algorithms.com/>
- <https://codeforces.com/>
- <https://www.codechef.com/>