

# CP- EITC

## Lecture 0

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# Introduction to Competitive Programming

November, 2024



## 1 Introduction

## 2 Overview

## 3 CP Preparation

## 4 Create Your Account

# SESSION PLAN



**Indtroduction & CP Lead 23/24**  
El Abidi & Ghacham



**Q&A**  
Mr. Assali



**Overview**  
Louzi



**CP Lead 22/23**  
Ba-mohammed & Hassani

**CP Preparation**  
El Abidi

**Open Talk**  
All special guests



**EITC**  
ENSIAS IT CLUB

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# What is Competitive Programming?

## Definition:

Competitive Programming is a **mental sport** that challenges you to solve coding problems within specific constraints. It's an excellent way to refine your **analytical and logical thinking** while improving your **coding skills**. Participants compete to solve problems efficiently, often within tight time and memory limits.



# What is Competitive Programming?

## Definition:

Competitive programming combines two topics: the design of algorithms and the implementation of algorithms.

- **The design of algorithms :** Involves solving problems creatively and efficiently, using mathematical or logical thinking and established techniques. Typically, a solution to a problem is a combination of well-known techniques and new insights.
- **The implementation of algorithms :** requires good programming skills. In competitive programming, the solutions are graded by testing an implemented algorithm using a set of test cases. Thus, it is not enough that the idea of the algorithm is correct, but the implementation also has to be correct.

## Programming languages :

Currently, C++, Python, and Java are the most popular programming languages in contests. For instance, in Google Code Jam 2017, 79% of the top 3,000 participants used C++, 16% used Python, and 8% used Java, with some participants using multiple languages. C++ is often considered the best choice for competitive programming due to its efficiency and the extensive collection of data structures and algorithms available in its standard library.

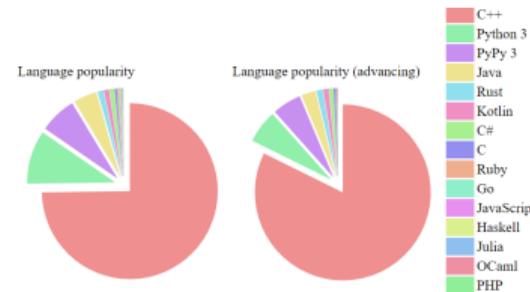


Figure 1: Google Code Jam - Round 2 2022 language statistics

## Programming languages :

Language	Strengths	Weaknesses
C	Fast, fine control over memory management (e.g., pointers, dynamic allocation), lightweight	No built-in data structures, verbose, error-prone manual memory management
C++	Fast, STL provides powerful data structures, Object-oriented and generic programming, Wide community support	Manual memory management, Longer learning curve
Java	Strong libraries, cross-platform, Automatic memory management (garbage collection), strong typing	Slower than C/C++, verbose, higher memory consumption
Python	Easy to learn, rich libraries, dynamic typing, rapid development	Slow execution, higher memory usage, lacks fine control over memory

# Why Should You Do Competitive Programming?

## Advantages of Competitive Programming :

- **Mental Agility and Quick Thinking :**

By practicing CP, you start thinking quickly and within the given timeframe and this improves your mental agility and helps enhance your thinking ability.

- **Learning Opportunity :**

In Competitive programming, we get a wide range of variety of problems and various arithmetic concepts, data structures and algorithms.

- **Personal Growth as a Programmer :**

It helps you get a command over problem-solving, as you have to solve challenging problems within a time limit.

- **Networking :**

Participating in various coding contests gives you a chance to be a part of communities with like-minded people.

# Why Should You Do Competitive Programming?

## Career Prospect :

Competitive programming is very important when it comes to technical interviews for software engineering-related jobs. Many tech giants use competitive programming contests as a medium of recruitment. Companies like Google, Oracle, Meta, etc. have technical interviews based on competitive programming problems.



Figure 2: Top companies that hire Interns through CP

A presentation slide with a dark blue background. On the left, there is a circular portrait of a man with a beard, wearing a black t-shirt, set against a glowing blue circular background. Below the portrait is a white rectangular box with a thin border, containing the text "EL MEHDI ASSALI" in a bold, black, sans-serif font. To the right of the portrait, the letters "Q&A" are displayed in a large, stylized, glowing white font. The letters are partially obscured by several large, semi-transparent question marks that appear to be floating around them. The overall aesthetic is modern and professional.

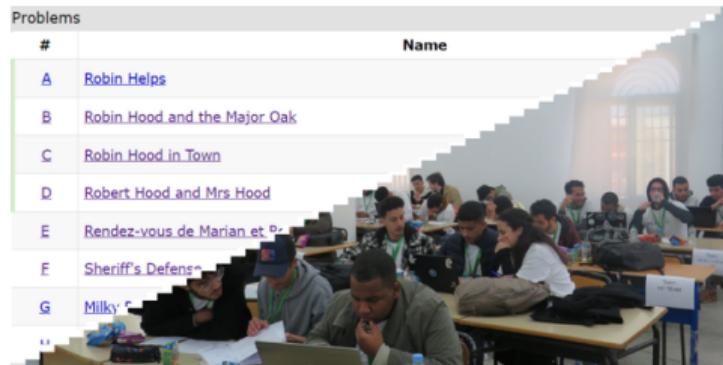
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# Contest



- A contest typically lasts several hours and consists of multiple problems.
- Each problem requires submission of code to a grader after completion.
- The grader checks the program's output against a set of predetermined test cases.
- Each problem has specific time and memory limits that the program must meet.
- Grading varies between contests; sometimes there is partial credit for passing some cases, while other times grading is all-or-nothing.

# CP Problem - LeetCode

The screenshot shows a LeetCode problem page for "1051. Height Checker".

**Problem Description:** A school is trying to take an annual photo of all the students. The students are asked to stand in a single file line in **non-decreasing order** by height. Let this ordering be represented by the integer array `expected` where `expected[i]` is the expected height of the  $i^{\text{th}}$  student in line.

**Problem Description (Continued):** You are given an integer array `heights` representing the **current order** that the students are standing in. Each `heights[i]` is the height of the  $i^{\text{th}}$  student in line (**0-indexed**).

**Return the number of indices where `heights[i] != expected[i]`.**

**Example 1:**

<b>Input:</b> heights = [1,1,4,2,1,3] <b>Output:</b> 3	<b>Example(s) / Notes</b>
---	---------------------------

**Explanation:**  
heights: [1,1,4,2,1,3]  
expected: [1,1,1,2,3,4]  
Indices 2, 4, and 5 do not match.

**Constraints:**

- $1 \leq \text{heights.length} \leq 100$
- $1 \leq \text{heights}[i] \leq 100$

**Code:**

```
C++  Auto
class Solution {
public:
    int heightChecker(vector<int>& heights) {
        int c=0;
        vector<int> v=heights; sort(v.begin(), v.end());
        int n=heights.size();
        for(int i=0;i<n;i++){
            if(heights[i]!=v[i]) c++;
        }
        return c;
    }
};
```

**Your Code / Submit**

**Test Cases**

<b>Accepted</b> Runtime: 0 ms	<b>Test Cases</b>
• Case 1    • Case 2    • Case 3	
<b>Input</b>	
heights = [1,1,4,2,1,3]	
<b>Output</b>	
3	

# CP Problem - CodeForces

## A. Stair, Peak, or Neither?

time limit per test: 1 second

memory limit per test: 256 megabytes

You are given three digits  $a$ ,  $b$ , and  $c$ . Determine whether they form a stair, a peak, or neither.

- A **stair** satisfies the condition  $a < b < c$ .
- A **peak** satisfies the condition  $a < b > c$ .

### Input

The first line contains a single integer  $t$  ( $1 \leq t \leq 1000$ ) — the number of test cases.

The only line of each test case contains three digits  $a$ ,  $b$ ,  $c$  ( $0 \leq a, b, c \leq 9$ ).

### Output

For each test case, output "STAIR" if the digits form a stair, "PEAK" if the digits form a peak, and "NONE" otherwise (output the strings without quotes).

### Example

#### input

```
7
1 2 3
3 2 1
1 5 3
3 4 1
0 0 0
4 1 7
4 5 7
```

Copy

#### output

```
STAIR
NONE
PEAK
PEAK
NONE
NONE
STAIR
```

Copy

# Competitions

## ENSIAS - ITHOLIC :



# Competitions

INPT - JNJD :



# Competitions

## INSEA - GAME OF CODES :



## MNPC



🏆 OVER 50,000DHS IN CASH PRIZES  
AWAIT MNPC2023 VICTORS! 🎉

ALONG WITH BRAGGING RIGHTS, THE WINNERS WILL TAKE HOME  
HEFTY CHEQUE REWARDS :

1ST PLACE      30.000 DHS

2ND PLACE      15.000 DHS

3RD PLACE      9.000 DHS

WHICH AMBITIOUS TEAM WILL CLAIM THE VICTOR'S CHEQUE THIS EDITION?  
THE COUNTDOWN IS ON TO THE EXCITING SHOWDOWN!



# Would You Lose?



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# Where to train and compete online?

 POJ	 ZOJ	 UVALive	 SGU
 URAL	 HUST	 SPOJ	 HDU
 HYSBZ	 UVA	 CodeForces	 Z-Trening
 Aizu	 LightOJ	 UESTC	 NBUT
 FZU	 CSU	 SCU	 ACdream
 CodeChef	 CF::Gym	 OpenJudge	 Kattis
 HihoCoder	 HIT	 HRBUST	 EIJudge
 AtCoder	 HackerRank	 51Nod	 TopCoder
 E-Olymp	 计蒜客	 LibreOJ	 UniversalOJ
 黑暗爆炸	 CSG	 DMOJ	 Toph
 洛谷	 Baekjoon	 QOJ	 CSES



## Some Resources:

- USACO GUIDE
- Geeks For Geeks
- W3schools
- Competitive Programmer's Handbook (CPH) - Antti Laaksonen
- The CSES problemset (now at 300 problems)
- 200+ Solutions in C++ (superj6)

## Discovering Codeforces :

### History of Codeforces

Codeforces is a website that hosts competitive programming contests. It is maintained by a group of competitive programmers from ITMO University led by Mikhail Mirzayanov.

As of 2018, it has over 600,000 registered users. It is available in Russian and English.



Figure 3: Mikhail Mirzayanov

# Discovering Codeforces :

Rating range	Title	Division
≥ 3000	Legendary Grandmaster	1
2600 — 2999	International Grandmaster	1
2400 — 2599	Grandmaster	1
2300 — 2399	International Master	1
2100 — 2299	Master	1
1900 — 2099	Candidate Master	1/2
1600 — 1899	Expert	2
1400 — 1599	Specialist	2/3
1200 — 1399	Pupil	2/3/4
≤ 1199	Newbie	2/3/4

## Codeforces rating system

**Pupil:**

**Specialist:**

**Expert:**

**Candidate Master:**

**Master:**

**Grandmaster:**

## Problems you need to solve consistently

Div2 A & B

Div2 C

Div2 C & D

Div2 D & E or Div1 A & B

Div1 B & C

Div1 C

Figure 4: Codeforces rating system

## A Code Daily website

acodedaily.com

Prev 800 900 **1000** 1100 1200 1300 1400

1500 1600 1700 Next

Driss146 (newbie) Rating: 1017 (Max: 1017) Solved: 4 Unsolved: 10

Filter Logic: OR

2-sat binary search bitmasks brute force chinese remainder theorem combinatorics constructive algorithms data structures dfs and similar divide and conquer dp dsu expression parsing fft flows games geometry graph matchings graphs greedy hashing implementation interactive math matrices meet-in-the-middle number theory probabilities schedules shortest paths sortings string suffix structures strings ternary search trees two pointers

Index	Problem	Score	Rating	Status
1	Gold Rush	2886243	1000	AC
2	Two Binary Strings		1000	AC
3	Raising Bacteria	2701630	1000	-

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# CodeForces

The screenshot shows the CodeForces registration form titled "Register in Codeforces". The form fields include "Handle" (input: Driss146), "Email" (input: Driss146), "Password" (input: masked), and "Confirm Password" (input: blank). Below the form is a note about handle changes and a "Register" button. At the bottom, there's a link for users who didn't receive confirmation emails.

**Fill in the form to register in Codeforces.**  
You can skip this step and login with your [Gmail](#).

**Register in Codeforces**

**Handle**   
This means your username (nickname) on Codeforces. Be careful you will be able to change it only once in the first 7 days after registration.

**Email**  Driss146

**Password**    
Password should contain at least five characters

**Confirm Password**

**Register**

If you have already registered before, but have not received a confirmation email, please click [the link](#).

[Use Gmail](#)

# LeetCode

The screenshot shows the LeetCode homepage with the following layout:

- Navigation Bar:** Explore, **Problems** (highlighted), Contest, Discuss, Interview ▾, Store ▾, and a graduation cap icon.
- Promotional Banners:** "Bring LeetCode to Your School" (ends SEP 23) with a 50% OFF coupon, "LeetCode's Interview Crash Course: System Design for Interviews and Beyond", and "LeetCode's Interview Crash Course: Data Structures and Algorithms".
- Study Plan:** A grid of study paths:
  - Top Interview 150: Must-do List for Interview Prep
  - LeetCode 75: Ace Coding Interview with 75 Qs
  - SQL 50: Crack SQL Interview in 50 Qs
  - Introduction to Pandas: Learn Basic Pandas in 15 Qs
  - 30 Days of JavaScript: Learn JS Basics with 30 Qs
  - Amazon Spring '23 High Frequency: Practice Amazon 25 Recently...
- Calendar:** A weekly calendar for Day 15 (21/09/2023) showing tasks for W1 through W5. One task for W3 is highlighted in orange.
- Trending Companies:** A search bar for "Search for a company..." and a list of trending companies.

# HackerRank

The image shows the HackerRank dashboard under the 'Prepare' tab. The main heading is 'Learn programming skills'. Below it, two sections are displayed: 'Your Preparation' and 'Problem Solving'.

**Your Preparation:**

- Java:** Progress bar at 27% (22 points to next star). Includes a 'Continue Preparation' button and a 'Java' icon with two stars.

**Problem Solving:**

- Problem Solving:** Progress bar at 64% (36.25 points to next star). Includes a 'Continue Preparation' button and a 'Problem Solving' icon with two stars.

# AtCoder

The image shows a screenshot of the AtCoder website's contest page. The top navigation bar includes links for Home, Contest, Ranking, English, and Sendo\_17. A banner at the top right promotes the "WORLD TOUR FINALS" with a live stream on 2024/7/12.

**Contest**

**Permanent Contests**

- Contest Name
  - practice contest
  - AtCoder Library Practice Contest

**Upcoming Contests**

Start Time	Contest Name
9/15(Sun) 11:00	11th Asprova Programming Contest (AtCoder Heuristic Contest 037)
9/21(Sat) 13:00	UNIQUE VISION Programming Contest 2024 Autumn (AtCoder Beginner Contest 372)
9/22(Sun) 13:00	AtCoder Regular Contest 184
9/28(Sat) 13:00	AtCoder Beginner Contest 373
9/29(Sun) 13:00	AtCoder Grand Contest 068
10/4(Fri) 11:00	Toyota Programming Contest 2024#10 (AtCoder Heuristic Contest 038)

**Information**

How to get an account / participate in contests?

AtCoder's Contest Format - AtCoder's Testcases - AtCoder's Rating System

AtCoder Race Ranking: 2024 Algo, 2024 Heuristic

Beware of suspicious websites claiming to be AtCoder. [Click here](#) for more information.

**Restructuring of contests**

We will restructure the contests.

- Admins (From September 2024)
  - The admin of AWTF will be **maroonrk**. (no change)
  - The admin of AGC will be **maroonrk**. (no change)
  - The admin of ARC will be changed from **maroonrk** to **snuke**.
  - The admin of ABC will be **snuke**. (no change)

2024-09-15 (Sun)  
03:07:51 +01:00



Thank you for listening !

Idriss El Abidi  
Souhail Louzi

Special thanks to the former CP leads:  
Hamza BA-MOHAMMED, Hachim Hassani Lahsinui and mohamed ghacham amrani  
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