ACM ICPC Boot Camp

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What is ACM ICPC?

- ICPC stands for Inter-Collegiate Programming Contest, conducted by ACM.
- It is the most prestigious college level programming contest.
- Important Contest Dates :

	Amritapuri	**IIT Kharagpur**	**IIT Kanpur**
Online Date	October 27	October 19	November 2
Onsite Date	December 18-19	December 12-13	December 14-15
Last Reg Date	October 26	September 29	October 26
OI Rd Platform	hackerrank	codechef	codechef

How to Participate?

- Teams of 3.
- Each team should have a coach, who must be a professor.
- The coach registers the team for the online round.
- Typically 4 to 5 teams qualify from the institute in the online(first) round.
- Registration has already started. Check previous slides for details.

A Typical Contest Problem

- Problem
- Input and Output format
- Number of instances
- Variable bounds
- Constraints
  - Time limit
  - Space limit

Input/Output Format

- Input is from STDIN and output is to be made to STDOUT
- For C++: scanf and printf are in general faster than cin and cout, so it is recommended that you use these for i/o handling.
- General Tip: Time for i/o depends on the number of system calls made, so for instance if you have to take as input 'n' numbers, separated by space, it is useful to take the input as a single line and then parse it to get 'n' numbers rather than making 'n' different system calls.
- Make sure that you follow the output format and avoid trivial wrong submissions only because of formatting the output incorrectly.

O-notation

- O-notation :
  f(n) = O(g(n)) if f (n) is asymptotically less than some multiple of g(n).
- Generally helpful to estimate complexity of algorithms.
- For example,
  $f(n) = 2n^2 + 4n^3 = O(n^3)$

Variable Bounds

- A typical CPU is assumed to process 10^8 instructions in a second.
- This assumption will help us deciding the targetted order of the algorithm while inspecting the input variable constraints.
- A brief idea is as follows: Divide 10^8 by the number of test cases and then use the following table to predict order.

Variable Bound * No. Test Cases	**Predicted Order**
10^8	O(n)
10^5	O(nlogn)
10^4	O(n^2)
10^{16}	O($\sqrt{n}$)

Data Ranges

- It is important that you understand which data type to use.
- For this it is necessary to have a feel of the ranges of various data types.
- This avoids loss of time during the competition in figuring out the appropriate data type say long int or just int or long long int.
- The foll. table gives a brief idea about some data types. You can google for other data types.

Data Type	**Range**
short	32,768 to 32,767
int	2,147,483,648 to 2,147,483,647
long long	9,223,372,036,854,775,808 - 9,223,372,036,854,775,807

Types of errors

- Compilation Error
- Time Limit Exceeded
- Memory Limit Exceeded
- Wrong Answer
- You should be familiar with these errors before attempting a contest.
- Appropriate penalties are put for every erroneous solution.

Programming Style

- C, C++, Java is allowed in all contests. So preferably practice in only these.
- Using templates can ease your job during a contest.
- Be aware! Corner cases can get tricky!
- Be careful about the output format; take care in removing stray outputs.

C++ Standard Template Library

- Using STL classes/functions can speed up your work.
- They may be more efficient than your own implementation.
- Some STL classes that help,
  vector, list, queue, set, map, deque, priority queue
- STL functions that help,
  sort, next permutation, etc...

C++ Algorithms Library

- Algorithms library is a very important library with many predefined functions which can be used directly and inturn save time.
- Some important functions are:
  - Merge
  - Sort
  - Min/Max
  - Lexographical Compare
  - Make Binary Heap
  - Modifying/Nonmodifying Sequence Operations

Where and How to Practice?

- TopCoder Tutorials, Start from Div2 problems which are basic and then proceed as per your speed. Try participating in SRM's.
- Hackerrank is a new platform with a good interface and problems escalating from simple to difficult.
- Codechef cookoff (monthly contest) and long contests should be tried.
- SPOJ solutions are not easy to find so you might want to give a try to other available resources before attempting these.
- We will mail you the important tutorials from topcoder which you should definitely read apart from others.

Success is team work

- Knowing who does what best can help in planning.
- Try forming a team with people having different strengths.
- Cross check your teammates solution for higher accuracy before submitting.
- Ensure that all three are not stuck on the same problem. Start attacking different problems.
- Stay cool! Dont panic! :)

Thank You!