ICPC ECNA Introductory Session

01

What is the ICPC?

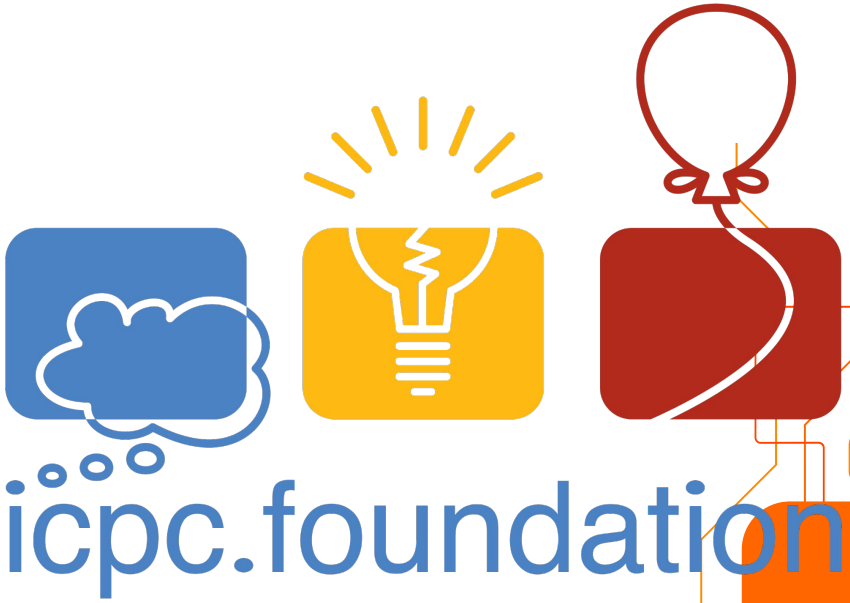
Good Luck :)

ICPC Info

Algorithmic/Mathematical Competition for undergrads

Key points

- Teams of 3 persons
- One computer
- One keyboard
- 9+ problems to solve
- Tiered competition; i.e. ECNA -> NAC -> WORLDS



Why participate?

Benefits

- The only other mathematical challenge for undergrads is the PUTNAM, but the PUTNAM isn't in-person. The ECNA ICPC is hosted in uWindsor for our region! You'll get to meet other highly intelligent problem solvers.
- Informatics problems are very fun.
- It is a big plus on your resume.
- Companies will reach out to you if you do well.

Cons

- None

Solving Problems

Problem Solving

You have to write some program that takes in the expected input and produces the expected output.

How to practice

Solve more problems! The more problems you solve, the better you'll get. Supplement that with regular review of past problems you've solved, and you're golden.

Where

Leetcode if you're mainly focused on interview prep. Otherwise, Codeforces/AtCoder are my favourite platforms.

02

Problems from the ICPC

Good Luck!

Airfare Grants

https://open.kattis.com/problems/airfaregrants

Congratulations! Your team has advanced to the next round of the International Cupcake Production Competition (ICPC)! To participate in the competition, you are going to fly to Cupcake City from your hometown. The competition organizers have just shared good news: generous sponsors will support you with your flight ticket!

AI-generated image of Cupcake City.

Here's how it works. You have already obtained a list of available flights. Among those options, you first report the price of any one potential flight. This determines the *reimbursement limit* of your trip; sponsors would pay you *up to half that price*. Next, you actually purchase your flight ticket. This flight may or may not be the same as the flight you report for the reimbursement limit. Finally, you show the receipt of your purchase, and sponsors will reimburse you the minimum of your actual cost and the reimbursement limit.

Now, you want to figure out your minimum possible *net* cost—the price you pay, minus the amount you get reimbursed. Naturally, you will report the price of the most expensive flight ticket and buy the cheapest flight ticket.

Sample Input 1

```
2
150
250
```

Sample Output 1

```
25
```

Sample Input 2

```
5
200
300
150
400
500
```

Sample Output 2

```
0
```

Garage Door Code

https://open.kattis.com/problems/garagedoorcode

There have been an increasing number of laptop thefts in your area lately. After yours was recently stolen, too, you decided that you had enough and are going to do something about it! After asking around, you heard some rumors about where the stolen laptops have been hidden and you want to get your laptop back!

The rumors led you to a particular garage and you have decided to keep an eye on it to try to figure out how to get in. Over the course of the afternoon, you have seen a handful of people come, enter the garage, and then leave.

There's a security keypad on the door. As you have watched carefully, you have observed different people putting in the code, but they enter different numbers of digits. You figure out that some, maybe all, of them are pretending to intersperse additional key presses just to confuse anyone who might be watching them. You look up the keypad manufacturer's webpage and find that the keypad was designed to use codes with a predetermined length of K digits. Given the set of observations you've made of different individuals "entering" elongated variations of the code (each does contain the correct code), can you determine what the correct code might be? It is guaranteed that there will always be at least one correct code that matches all observations. There may be multiple codes that match; you must find all matching codes.

Sample Input 1

```
4 3
21302749
5230248
21076724
```

Sample Output 1

```
1
2024
```

Sample Input 2

```
5 7
0812734225
162334559
7512334755
1002394561
9321423495
81237425
47126345119
```

Sample Output 2

```
1
12345
```

Sauna

https://open.kattis.com/problems/sauna

Kaisa and her friends are going to the sauna!

Now they have to pick the temperature. Each of them has their own temperature preferences as an inclusive range of acceptable values. Can you help them find the temperatures that everyone is happy with?

Since there might be a large number of possible temperatures, they have asked you to just tell them how many options there are and what the lowest temperature that works for everyone is, as then the sauna will need less time to heat up.

Sample Input 1

```
3
70000 70005
70003 70010
65000 80000
```

Sample Output 1

```
3 70003
```

Sample Input 2

```
2
70000 70500
80000 80100
```

Sample Output 2

```
bad news
```

Rocky Mountain

https://open.kattis.com/problems/rockymountain

The Rocky Mountain Cable (RMC) company is planning to run cables from the top peak of the Rocky Mountains to lower points in the mountain range, so that cable cars can be used to transport tourists to the highest peak. A cable must connect from one of the potential sites to the highest peak in a straight line, but the cable cannot cross any part of the mountain range. However, the cable may coincide with a slope.

In order to serve the most number of tourists, it is desirable to connect the cable from the highest peak to the lowest possible site. Help the company determine the best possible site on the left and the right of the highest peak. If there are ties, choose the leftmost site on the left, and the rightmost site on the right.

The mountain range is specified by N sites (x_i, y_i). One of these sites is the unique highest peak (x_p, y_p) such that $1 < p < N$ and $y_p > y_i$ for all $i \neq p$. Note that the highest peak cannot be the first or the last site. The entire mountain range is described by straight line segments connecting (x_i, y_i) to (x_{i+1}, y_{i+1}) for $1 \leq i < N$, such that $x_i < x_{i+1}$.

Sample Input 1

```
5
10 10
20 20
30 40
40 30
50 0
```

Sample Output 1

```
10 10
40 30
```

Sample Input 2

```
5
10 10
20 20
30 30
40 20
50 10
```

Sample Output 2

```
10 10
50 10
```