

Guidelines of the Online Judge System

(Some of the screenshots are from a previous course, but the links are all up to date.)

0. Register Your Account in CodeForces

Access the CodeForces website with URL <https://codeforces.com/enter>.

If you already have a CodeForces account, log in directly. If not, Click “Register” to register an account, then log in.



Fill in the form to login into Codeforces.

You can use [Gmail](#), [Facebook](#) or [ICPC](#) as an alternative way to enter.

Login into Codeforces

Handle/Email

Password

Remember me for a month

[Forgot your password?](#)

[Use Gmail](#) | [Use Facebook](#) | [Use ICPC](#)

[Codeforces](#) (c) Copyright 2010-2020 Mike Mirzayanov
The only programming contests Web 2.0 platform
Server time: Sep/28/2020 02:05:22^{UTC-7} (h1).
Desktop version, switch to [mobile version](#).
[Privacy Policy](#)

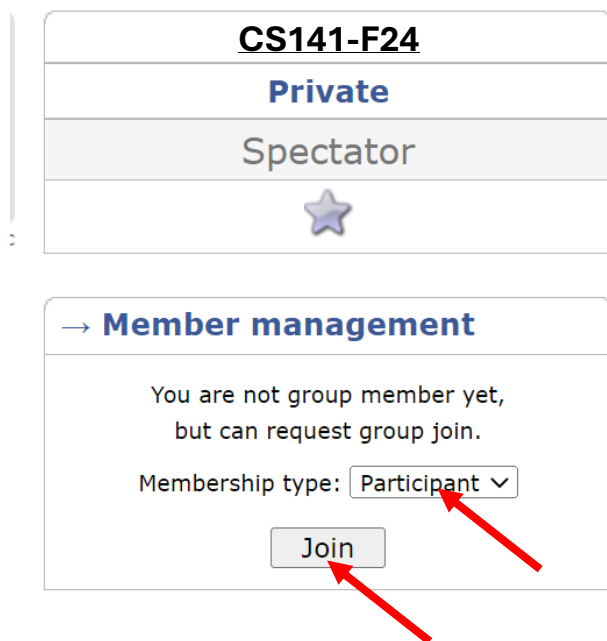
Supported by



1. Join the Group as a Participant

After login, click here to join our group: <https://codeforces.com/group/xerIeu20hB/contests>

Remember to choose “Participant” as Membership type. (The default option is “Spectator”, which will not allow you to submit your code.) Then click **“Join”**.



Then you can see the home page of our group, each programming assignment will be released at the corresponding start time. Usually, this is the time that the corresponding assignment is released.

The rest of the screenshots were taken from other courses/contests as examples. All the steps should be exactly the same.

CONTESTS MEMBERS STATUS

Name	Start	Length	
CS141 Assignment #1	Sep/29/2020 00:00^{UTC-7}	Before start 23:44:55	Prepared by syhlalala Before registration 17:44:55 <small>* Highlighted contests are not public</small>

CS141

Private

Participant

★

→ **Member management**

You are the member of the group

Each programming assignment will be released at the corresponding start time

Supported by



Once it's released, the page will look like this:

CONTESTS MEMBERS STATUS

Name	Start	Length	
CS141 Assignment #1 <input type="button" value="Enter »"/>	Sep/28/2020 00:00^{UTC-7}		Current standings Running 4 weeks Prepared by syhlalala <input type="button" value="Register »"/> x0 Until closing 4 weeks <small>* Highlighted contests are not public</small>

CS141

Private

Participant

★

→ **Member management**

You are the member of the group

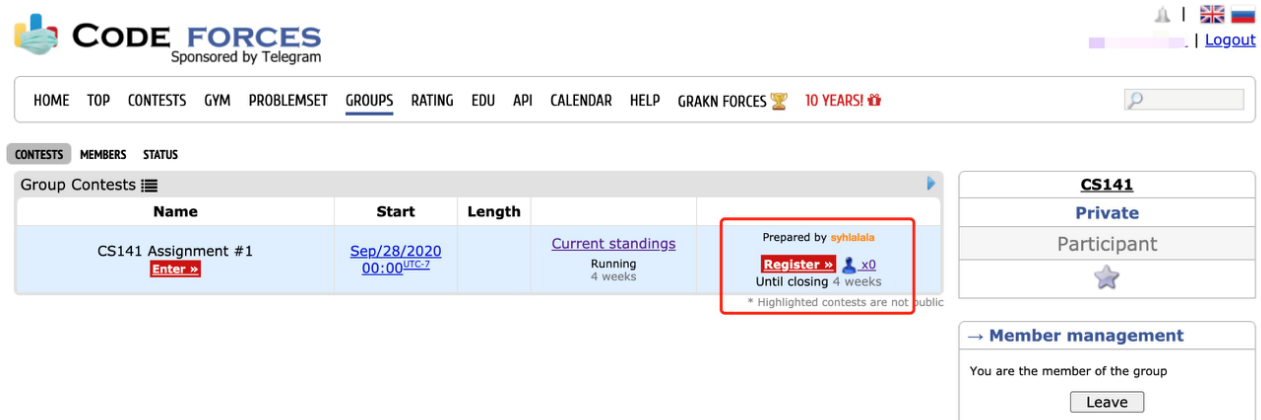
Supported by



2. Registration for the Contests

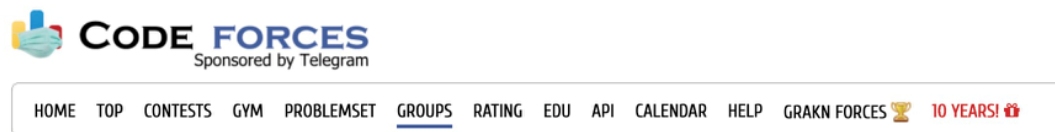
After it's released, you can see the page above.

Click “Register” to register for the contest. You should be registered for the contest to be able to submit.



The screenshot shows the Codeforces website interface. At the top, there is a navigation bar with links for HOME, TOP, CONTESTS, GYM, PROBLEMSSET, GROUPS, RATING, EDU, API, CALENDAR, HELP, GRAKN FORCES, and 10 YEARS! There is also a search bar. Below the navigation bar, there are tabs for CONTESTS, MEMBERS, and STATUS. The main content area displays a table of group contests. The first row is for 'CS141 Assignment #1', which is highlighted. The table columns are Name, Start, Length, and Current standings. The 'Register' button is highlighted with a red box. To the right of the table, there is a sidebar with information about the contest, including 'CS141', 'Private', 'Participant', and a 'Member management' section with a 'Leave' button.

Continue clicking “Register”, then you will receive a message that “You have been successfully registered”.



The screenshot shows the Codeforces website interface. At the top, there is a navigation bar with links for HOME, TOP, CONTESTS, GYM, PROBLEMSSET, GROUPS, RATING, EDU, API, CALENDAR, HELP, GRAKN FORCES, and 10 YEARS! There is also a search bar. Below the navigation bar, there are tabs for CONTESTS, MEMBERS, and STATUS. The main content area displays a registration page for the contest 'CS141 Assignment #1'. The page title is 'Registration for the contest CS141 Assignment #1'. Below the title, there is a 'Terms of agreement:' section with a list of terms. At the bottom, there is a 'Take part:' section with a radio button selected for 'as individual participant' and a 'Register' button.

Registration for the contest CS141 Assignment #1

Terms of agreement:

The registration confirms that you:

- * will not communicate with other participants, share ideas of solutions and hacks;
- * will not use third-party code, except stated in <http://codeforces.com/blog/entry/8790>;
- * will not attempt to deliberately destabilize the testing process and try to hack the contest system in any form;
- * will not use multiple accounts and will take part in the contest using the only and single account.

Take part: as individual participant

Register

3. Start Programming

Before starting programming, make sure you can see "Registration Completed" displayed here, which means you have successfully registered. If not, try to repeat the registration step.

Then, **click "Enter"**.

The screenshot shows the Codeforces website interface. At the top, there is a navigation bar with links like HOME, TOP, CONTESTS, GYM, PROBLEMSSET, GROUPS, RATING, EDU, API, CALENDAR, HELP, GRAKN FORCES, and 10 YEARS!. Below this, there are tabs for CONTESTS, MEMBERS, and STATUS. The main content area displays a table of group contests. The first row is for 'CS141 Assignment #1', which is highlighted in blue. In this row, the 'Enter' button is circled in red, and the text 'Registration completed' is highlighted with a red box. To the right of the table, there is a sidebar for the contest 'CS141', showing it is 'Private' and the user is a 'Participant'. Below this, there is a 'Member management' section with a 'Leave' button.

You will see the programming problems for this assignment.

The screenshot shows the Codeforces website interface for the 'Problems' section of the 'CS141 Assignment #1' contest. The navigation bar is the same as in the previous screenshot. Below it, there are tabs for PROBLEMS, SUBMIT CODE, MY SUBMISSIONS, STATUS, STANDINGS, and CUSTOM INVOCATION. The main content area displays a table of problems. The first row is for 'Merge Them!', which is highlighted with a red box. To the right of the table, there is a sidebar for the contest 'CS141', showing it is 'Private' and the user is a 'Participant'. Below this, there is a section for 'CS141 Assignment #1' showing 'Contest is running' for '4 weeks' and the user is a 'Contestant'.

Click on the name to enter. Then you can see the whole problem.

1. Merge Them!

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

It's not easy to be a teacher - because you need to make all students happy. Yihan is asked to order a list of students by their exam score (from lowest to highest). Now all the students stands in a row in front of her. She has learned the merge sort algorithm, so that's exactly how she plans to do: she will divide the students into the left half and the right half, sort each of them respectively, and then merge them into a sorted row.

The core part in merge sort is to merge two sorted arrays (subset of students) into one. However, students are incoordinated because some of them are unhappy to be sorted. Generally, anytime two subsets of students A and B are merged, the student with the lowest score in $A \cup B$, let's call the student X , will be very unhappy because now everyone knows that he or she didn't do well in the exam. Yihan has to give X some candies to make X happy again. In particular, the number of candies X needs is the difference between X 's score and the highest score in the merged result $A \cup B$. If there are multiple such students (i.e., with the same lowest score), they all need the same number of candies.

Yihan knows the initial order of the students and their scores. She wants to know how many candies she needs to prepare to finish the task of merge-sorting all the students's score, while keeping everyone happy.

Input

The first line is a single integer n ($1 \leq n \leq 10^6$). Assume n is a power of 2 so that in merge sort we can always divide it into exactly halves.

In each of the next n lines, there is an integer that is the score s_i of the i -th student $0 < s_i \leq 2^{31}$.

Output

The first line contains the number of candies that Yihan has to prepare.

The next n lines each contains a positive integer, which is the sorted result of the input scores.

The output value is guaranteed to be within $2^{31} - 1$.

CS141
Private
Participant
★

CS141 Assignment #1
Contest is running
4 weeks
Contestant
★

→ **Submit?**
Language: GNU G++17 7.3.0
Choose file: Choose File No file chosen
Submit

To submit your code, **click "Submit Code". Don't forget to choose your language.**

Submit solution CS141 Assignment #1

Problem: 1 - Merge Them!
standard input/output 1 s, 256 MB

Language: GNU G++17 7.3.0

Source code:

Switch off editor Tab size: 4

Or choose file: Choose File No file chosen

Submit

Choose your language

After finishing your code, click the "Submit" button to submit your answer.

Then you can see whether your answer is correct. If all test cases are passed, it will be judged as “**Perfect result – x points**” (x is the total number of points of that problem). If not, means you failed in some test cases, and it will show your score based on the number of tests you passed.

PROBLEMS SUBMIT CODE **MY SUBMISSIONS** STATUS STANDINGS ADM. EDIT CUSTOM INVOCATION

#	When	Who	Problem	Lang	Verdict
130314428	Sep/29/2021 20:44 ^{UTC-7}	syhlalala	E - Feeding Friendsy	GNU C++17	Perfect result: 80 points
130314158	Sep/29/2021 20:38 ^{UTC-7}	syhlalala	E - Feeding Friendsy	GNU C++17	Perfect result: 80 points
130313967	Sep/29/2021 20:33 ^{UTC-7}	syhlalala	E - Feeding Friendsy	GNU C++17	Partial result: 75 points
129912417	Sep/26/2021 02:40 ^{UTC-7}	syhlalala	I - Sphere Mongers	GNU C++17	Partial result: 96 points
129911661	Sep/26/2021 02:29 ^{UTC-7}	syhlalala	I - Sphere Mongers	GNU C++17	Partial result: 96 points
129911303	Sep/26/2021 02:24 ^{UTC-7}	syhlalala	I - Sphere Mongers	GNU C++17	Partial result: 18 points

You can submit an arbitrary number of times before the deadline. The highest score for each problem will be counted. If you want to re-submit after debugging, you could just go back to the “Submit Code” page and submit your new version.

Note that you have to pass the first test case (which is usually just the example) to get any points. Otherwise you will see something like:

129737615	Sep/24/2021 00:54 ^{UTC-7}	syhlalala	H - Fetch Quest	GNU C++17	Wrong answer on test 1
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This is, however, a feature of the system. So just make sure you at least pass the example.

If you want to know more about your results, click the “verdict” column for each problem in the table above. You will see a list of your results for each test case. For example:

```

Judgement protocol
#1: Accepted [0 ms, 0 MB, 10 points]
#2: Accepted [0 ms, 0 MB, 10 points]
#3: Accepted [0 ms, 0 MB, 10 points]
#4: Accepted [1684 ms, 0 MB, 10 points]
#5: Accepted [31 ms, 3 MB, 10 points]
#6: Accepted [15 ms, 0 MB, 10 points]
#7: Accepted [15 ms, 3 MB, 10 points]
#8: Time limit exceeded [5000 ms, 3 MB, 0 points]
#9: Time limit exceeded [5000 ms, 0 MB, 0 points]
#10: Time limit exceeded [5000 ms, 3 MB, 0 points]
#11: Accepted [1512 ms, 3 MB, 10 points]
#12: Time limit exceeded [5000 ms, 3 MB, 0 points]
#13: Accepted [0 ms, 0 MB, 10 points]
#14: Time limit exceeded [5000 ms, 3 MB, 0 points]
#15: Time limit exceeded [5000 ms, 3 MB, 0 points]

```

This helps you understand the problems in your code.

With some of the core operations and functions covered above, you can try clicking on other buttons to explore other features that have not been introduced!

4. Other Notes

- **You won't be able to see the test data.** This is also the situation when you are in an interview, or, when you are actually at work in a company. One important skill as a programmer is to design test cases to find bugs in your own code. You need to consider a lot of corner cases to make sure your code is correct and robust.
- Each problem has 10-20 test cases, each with some points, based on the problem. This means that even your algorithm cannot solve the entire problem, if you can solve part of the problem (e.g., only for small inputs or simple inputs), you can get some points. Don't give up!
- For all the problems, we guarantee that a reasonable algorithm implemented in C++ will pass all test cases within the time limit. **Other languages are allowed, but not guaranteed to always satisfy time limit.** We will use time scaling policy to help accommodate this: The system automatically adjusts time limits by the following multipliers for some languages. You can see more details [here](#). However, still, C++ is highly recommended because it is the most efficient in running time.
- Sometimes the input time may be long and it can dominate your running time. To simply make your input time faster, here are some useful material C+, Java and Python (again, even so, it's not guaranteed that python can always pass the largest test case):
 - o C++: <https://www.geeksforgeeks.org/fast-io-for-competitive-programming/>
 - o Java: <https://www.geeksforgeeks.org/fast-io-in-java-in-competitive-programming/>
 - o Python: <https://www.geeksforgeeks.org/python-input-methods-competitive-programming/>

Happy Coding!