

Noctem Virtual

1. You have three hours to complete this contest. There are 7 problems, and you may complete them in any order.
2. Cheating is strictly prohibited. This includes conferring with people that are not on your team or using code written by someone not on your team. Failure to abide by this rule will result in automatic disqualification.
3. As you complete the questions, you should submit your solutions on the grader website. There, you will be able to see how many test cases you got correct for the given question. You may resubmit on the grader as many times as you would like during the three hour period for no penalty. However, only the last submission you make on the grader for a question will be used to calculate your final score.
4. Your final score will be calculated based off of your last submission on each question. Each test case will be worth 1 point, for a total of 10 points per question and 70 points in total. If there is a tie between two teams, the tie will be broken by looking at which team had more of the three hour time window remaining when they submitted for the last time.
5. Last but not least, we wish your team the best of luck!

Problem 1 - Relatively Primes**Problem:**

Given two non-negative integers A and B , determine whether or not they are relatively prime. Two numbers are relatively prime if they share no common factors greater than one.

Input Format (relprimes.in):

The first line contains A ($1 \leq A \leq 10^9$) and B ($1 \leq B \leq 10^9$).

Output Format (relprimes.out):

Output “1” if the numbers are relatively prime, and “0” otherwise.

Sample Input:

8 3

Sample Output:

1

Credits: Concept: Charlotte, Problem: Emma, Edited: Alex Y

Problem 2 - A Shadow Falls On The Chicken Coop**Problem:**

A spectre is lurking in the chicken coop. A new farmer is in town and he will bring the pain. This farmer's name is Steven Tan. He lines all his N chickens up in no particular order. He weighs all the chickens and needs to select exactly five of them for his devious experimentation. However, Farmer Steven can only pick up the chickens if they are all in consecutive order because he is weak. Find the maximum total weight of chickens that Steven can pick up for his plan. They are needed in his experiments...

Input Format (shadow.in):

The first line contains the number of chickens N ($10 \leq N \leq 10^5$). The next N lines each contain an integer with the weight of each chicken W_i ($1 \leq W_i \leq 10^5$).

Output Format (shadow.out):

A single integer containing the maximum total weight of chickens Steven can pick up.

Sample Input:

```
10
4
2
6
4
4
2
7
8
12
8
```

Sample Output:

```
37
```

Credits: Concept: Charlotte, Problem: Marco, Edited: Steven, Chicken Meister: Marco

Problem 3 - NFC (Noctem Fried Chicken)**Problem:**

Some of Colonel Steven's chickens escape from his experiments. The chickens are hungry and find the Noctem Dumpling House, where everyone is forced to eat exactly K dumplings. Unfortunately, according to Chinese filial piety, everyone must take two plates in order to show respect to their elders. One poor chicken has to satisfy the mob, and reaches for the plates himself. Unfortunately, the chef can't count and has put a random number of dumplings on each plate because he is somehow bad at math. There are N plates of dumplings lined up in positions numbered from 1 to N on a table. Each plate contains D_i dumplings. The chicken is lazy and doesn't want to reach very far for the dumplings because it is very tired from its escape; thus, it will always try to minimize the sum of the distances it has to reach to get to the two plates. Which two plates should the chicken take to have a total of K dumplings while having to reach the least total distance? The chicken is standing on plate 1. You may assume that there is at least one pair of plates that have a total of K dumplings. In the case of a tie, the pairing containing the closest plate will be counted.

The dumplings taste oddly familiar...

Input Format (nfc.in):

The first line contains the number of plates N ($2 \leq N < 1000$) and the number of dumplings everyone is forced to eat K ($2 \leq K < 10^9$). Next N lines each contain D_i ($0 \leq D_i < 10^9$), signifying the number of dumplings on the i -th plate.

Output Format (nfc.out):

A single line containing the first plate (the closer one) and the second plate (the farther one) the chickens should take. The two numbers should be separated by a space.

Sample Input:

```
10 35
12
42
15
34
54
11
1
20
23
200
```

Sample Output:

```
1 9
```

Credits: Concept: Emma, Problem: Alex Y, Edited: Steven, Chicken Meister: Alex Y

Problem 4 - Gotta Catch em' All**Problem:**

After the dumpling incident, Chickenmon master Steven is on the hunt to reclaim his N lost chickens. They are now spread out along a line each with their own size S_i . However, Steven's experiments are not over, so he's gotta catch them ALL. Steven plans on using the latest developments in trapping technology to catch his chickens - Powerful Over-complicated Grabber of Chickens, Hens, And Malicious Poultry (POGCHAMP). Steven can place M orders of POGCHAMPs (POGs), which are all the same size K . Each POG can trap as many chickens as Steven likes, but can only fit chickens if the sum of their sizes is less than or equal to the size of the POG. As Steven walks across the line of chickens, he will always hurl a POG at the first uncaught chicken he passes, and that POG will catch as many next consecutive chickens as the size of the POG will allow. Since bigger POGCHAMPs cost more and Steven is broke, help him determine the smallest possible K such that he can still catch all the chickens.

Input Format (verybest.in):

The first line contains 2 space separated integers, N ($1 \leq N \leq 10^5$) and M ($1 \leq M \leq 10^5$). The next N lines each contain an integer S_i ($1 \leq S_i \leq 10^9$), signifying the size of the i -th chicken.

Output Format (verybest.out):

A single integer signifying the smallest possible K such that Steven can catch all the chickens.

Note: A 64-bit integer will be needed to store the output due to the size of the numbers.

Sample Input:

```
5 3
9
4
6
8
2
```

Sample Output:

```
10
```

Sample Output Explanation:

With POGCHAMP size 10, his first throw catches the first chicken, the second throw catches the second and third, and the last POGCHAMP catches the fourth and fifth.

Credits: Concept: Steven, Problem: Steven, Edited: Alex Y, Chicken Meister: Alex Y

Problem 5 - Chicken Capture

Problem:

The chickens have managed to fool Pepega Steven again. After failing his last plan, Steven has decided to upgrade his hardware (despite being deeply in debt from the POGCHAMPs he bought earlier). He has managed to trap the chicken's leader in an R (rows) by C (columns) grid, and the leader's body is represented by an A (rows) by B (columns) rectangle. Steven will fire N nets, each hitting a unique cell on the grid at (R_i, C_i) . Somehow, the chicken leader knows exactly where each and every net will land before they are shot and needs to maximize the number of cells between himself and the nearest net in order to not get caught (calculate the distance by adding the horizontal distance and vertical distance). However, the chicken leader has a severe case of nausea and does not like being rotated, so he will not do so. If the chicken leader positions himself optimally to ensure not being caught, what is the distance from the nearest net to his body?

Input Format (capture.in):

The first line contains 5 integers, N ($1 \leq N \leq 1000$), R ($1 \leq R \leq 200$), C ($1 \leq C \leq 200$), A ($1 \leq A \leq X$), and B ($1 \leq B \leq Y$). The next N lines contain 2 integers, R_n and C_n , signifying the position of that net.

Output Format (capture.out):

A single integer signifying the maximum minimum distance of a net to the chicken's body.

Sample Input:

```
3 5 5 1 2
1 0
3 3
0 3
```

Sample Output:

```
3
```

Sample Output Explanation:

```
0 0 0 1 0
1 0 0 0 0
0 0 0 0 0
0 0 0 1 0
2 2 0 0 0
```

The 1's represent where the nets are, and the 2's represent the chicken's body. By placing him in that position the minimum distance from any net to him is 3. Since this is the optimal position for the leader, the minimum distance is maximized.

Credits: Concept: Alex Y, Problem: Steven, Edited: Emma, Chicken Meister: Alex S

Problem 6 - KFC (Korean Fried Chicken)**Problem:**

The chickens have decided to try and bribe their way out of NFC. Since they are chickens, the bank won't give them a loan. Therefore, they have decided to invest in the stock market to make money. The chicken leader, using his powers of clairvoyance, can predict the stock prices of rival company KFC for N days in the future, namely P_1, P_2, \dots, P_N . However, being chickens, they prefer a lifestyle of instant gratification and want to maximize the happy days where the stock goes well for them. Therefore, they want to find a day to buy the stock such that they maximize the number of days after it that have a higher or equal stock price than their purchasing stock price. What day should they buy the stock? (Start counting at day 1; if there is a tie, start at the earliest day).

DISCLAIMER: Noctem is not sponsored in any way, shape or form by the company KFC. Any likeness to any existing fried chicken companies is PURELY coincidental and is not intended to be used maliciously.

Input Format (stonks.in):

First line contains an integer N ($1 \leq N \leq 10^6$). The next N lines each contain an integer P_i ($1 \leq P_i \leq 10^9$) signifying the stock price of that day.

Output Format (stonks.out):

A single integer containing the best day to buy the stock.

Sample Input:

```
5
10
6
9
4
6
```

Sample Output:

```
2
```

Sample Output Explanation:

Buying the stock on day 2 (price 6) leads to 2 days after it that have a higher or equal stock price, day 3 (price 9) and day 5 (price 6).

Credits: Concept: Steven, Problem: Steven, Edited: Marco, Chicken Meister: Alex Y.

Problem 7 - Jesús' Spring Rolls**Problem:**

Jesús (hay-zOOs) has just made N spring rolls, each with tastiness M_i . The spring rolls are lined up along a one dimensional number line. Anuj (Uh-nuh-juh) walks along the line, and he would like to fill himself up with spring rolls. However, as a picky eater, once Anuj chooses to eat a spring roll of a tastiness M_i , he will never eat another spring roll with tastiness less than M_i . Help find the maximum total tastiness Anuj can experience on his adventure across the table.

The spring rolls taste oddly familiar...

Input Format (spring.in):

The first line contains integer N ($1 \leq N \leq 4000$), and next N lines each contain an integer M_i ($1 \leq M_i \leq 10^9$).

Output Format (spring.out):

A single integer containing the maximum total tastiness Anuj can experience.

Sample Input:

```
6
25
50
39
42
69
49
```

Sample Output:

```
175
```

Credits: Concept: Steven, Problem: Alex Y, Edited: Marco, Chicken Meister: Alex Y

DISCLAIMER: No chickens, stocks, Stephens, spring rolls, or relatively prime numbers were harmed in the process of creating this contest. Do not attempt to reenact, reconstruct, or replicate any of the scenarios depicted above. Noctem Development is not responsible for any injuries or ailments attained while participating in this contest. Side effects to participating in this contest could include headaches, crying, vomiting, diarrhea, nausea, insomnia, death, or even the pain. Please read and code responsibly. Batteries not included.