Worksheet 1 - Introduction to Competitive Programming

Competitive Programming

Spring 2024

Approach to solving ICPC Problems:

1. Read the problem statement carefully.
2. Pay attention to the input/output format specification.
3. Abstract the problem.
4. Design an algorithm.
5. Implement and debug.
6. Submit.
7. AC!

1. New Year's Meet Up

There are three friends living in Lineland on the Straight Line Street Ox. The first friend named Linear lives on point x_1, the second friend called Quadratic lives on point x_2 and the third friend named Polynomial lives on point x_3. They all have to meet up at any one point to celebrate the New Year together. Help them find the minimum total distance they will have to travel to reach some point to celebrate the New Year!

Constraints:

- $1 \leq x_1 \leq 100$
- $1 \leq x_2 \leq 100$
- $1 \leq x_3 \leq 100$

Input:

The input consists of a single line containing a value for x_1, x_2, x_3 which represents the co-ordinates of the houses of the first(Linear), second(Quadratic) and third(Polynomial) friend respectively, separated by space.

Output:

The output prints a single integer representing the minimum total distance the friends need to travel in order to meet together at some point.

Sample:

Input	Output
7 1 4	6
30 20 10	20

In the first sample, the friends should meet at point 4. Thus, the first friend has to travel a distance of 3 (from point 7 to point 4), the second friend also has to travel a distance of 3 (from point 1 to point 4), and the third friend should not go anywhere because he lives at the point 4.

Exercise:

In the space provided, indicate the outputs for the given inputs.

Input	Output
6 17 22	
10 2 7	
7 12 2	

Propose:

Provide sample inputs and outputs below without reusing any of the values provided above.

Input	Output

Explanation:
Briefly explain the algorithm you were able to devise to solve this problem.

2. Foods Loved by Everyone?

Osama loves mango sticky rice.

Besides this, he loves creme brulee, tenderloin steak and so on, and believes that these foods are loved by everyone.

To prove that hypothesis, he conducted a survey on M kinds of foods and N people whether they like these foods or not.

Find the number of foods liked by N people.

Constraints:

- $1 \leq N, M \leq 10^6$
- $1 \leq K_i \leq M$
- $1 \leq A_{ij} \leq M$
- For each i ($1 \leq i \leq N$), $A_{i1}, A_{i2}, ...A_{iK_i}$ are distinct.

Input:

The first line contains N and M separated by space. Then there are N more lines in the format:

$K_1\ A_{11}\ A_{12}\ \ldots\ A_{1K_1}$
$K_2\ A_{21}\ A_{22}\ \ldots\ A_{2K_2}$
.
.
$K_N\ A_{N1}\ A_{N2}\ \ldots\ A_{NK_N}$

Output:

The output prints the number of foods liked by all the N people.

Sample:

Input	Output
3 4 2 1 3 3 1 2 3 2 3 2	1
5 5 4 2 3 4 5 4 1 3 4 5 4 1 2 3 5 4 1 2 3 4	0

Exercise:

In the space provided, indicate the outputs for the given inputs.

Input	Output
4 8 2 3 4 5 3 4 5 6 4 5 6 7 5 6 7 8	
3 5 1 2 3 2 3 4 3 4 5	
4 6 1 2 4 2 3 4 5 3 4 5 6 4 5 6	

Propose:

Provide sample inputs and outputs below without reusing any of the values provided above.

Input	Output

Explanation:
Briefly explain the algorithm you were able to devise to solve this problem.

3. Megalomaniac

Tweety, who was appointed as the wizard of the Problem Workshop in the Kingdom of Looney Tunes, got too excited and took on too many jobs.

Let the current time be 0. Tweety has N jobs numbered 1 to N.

It takes A_i units of time for Tweety to complete Job i. The deadline for Job i is time B_i, and he must complete the job before or at this time.

Tweety cannot work two or more jobs simultaneously, but when he completes a job, he can start working on another immediately.

Can Tweety complete all the jobs in time? Help us find out!

Constraints:

- $1 \leq N \leq 2$ x 10^5
- $1 \leq A_i, B_i \leq 10^9$ ($1 \leq i \leq N$)

Input:

The first line of input contains the integer N. It is further followed by N more lines in the following format: $A_1 B_1$ . . . $A_N B_N$

Output:

If Tweety can complete all the jobs in time, print Yes; if he cannot, print No.

Sample:

Input	Output
5 2 4 1 9 1 8 4 9 3 12	Yes
3 334 1000 334 1000 334 1000	No

Exercise:

In the space provided, indicate the outputs for the given inputs.

Input	Output
4 1 2 4 5 3 8 1 7	
5 2 8 1 6 4 5 7 18 3 14	
13 384 8895 1725 9791 170 1024 4 11105 2 6 578 1815 702 3352 143 5141 1420 6980 24 1602 849 999 76 7586 85 5570	

Propose:

Provide sample inputs and outputs below without reusing any of the values provided above.

Input	Output

Explanation:
Briefly explain the algorithm you were able to devise to solve this problem.

Rough Work

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