Tiger Hacks

Problem Set

2024

Rules

This competition is being facilitated with the use of HackerRank to submit and grade solutions. The following languages will be accepted on HackerRank: C++, Java, and Python3. We guarantee that all problems are solvable within the time limits.

The use of official language documentation and manuals is permitted, along with general tutorial sites. However, question-and-answer sites and forums are NOT PERMITTED. Sites like StackExchange, StackOverflow, and others will be blocked on the competition network; if caught, any attempt to evade this block will result in immediate disqualification.

Additionally, generative AI is NOT allowed under any circumstances. Tools such as ChatGPT and Github Copilot are not permitted. If caught, any attempt to use these tools will result in immediate disqualification.

Furthermore, teams may not accept assistance or advice from anyone not authorized to provide such assistance, including, but not limited to, other teams and chaperones.

Teams will be given example I/O test cases, but the I/O test cases used for grading will be hidden. The correctness of a solution is based on whether all test cases are passed; there is no partial credit. The examples provided will clearly indicate the expected output format.

Grading is done automatically; any deviation from the expected output will result in an incorrect result. This includes any extra whitespace, characters, or return/newline characters in the given output.

Should a tie impact the results of this contest, the time taken will be used as a tie-breaker. Thus, teams should keep time management in mind.

One laptop per team.

Question 1 - Pricing tickets

A group wants to purchase tickets for a safari. An adult ticket costs $10 and a child ticket costs $5. Given n adults and m children, find the total cost for the group to purchase tickets for everybody.

It is guaranteed that n and m will not be greater than 10^4

The first line of input will contain n
The second line of input will contain m

The output should be a single integer

Example 1 Input:
3
4

Example 1 Output:
50

Example 1 Explanation:
3 adult tickets cost $30
4 child tickets cost $20
The total cost of the tickets is $50

Question 2 - String Swap

The names of the different animals need to be scrambled. Given certain rules, scramble the names to create a fun puzzle for kids! The kids will love it!

Given a string, s, of length L and n rules containing i and j: switch the character in position i with the character in position j. The first character is in position 0 not position 1.

The first line of the input contains L and n space separated
The second line of the input contains the string s
The next n lines of the input contain i and j space separated

L and n will not be greater than 100
i and j will not be greater than L - 1
s will be made up of only uppercase and lowercase letters

Output the scrambled string

Example 1 Input:
5 2
Tiger
2 3
0 3

Example 1 Output:
gieTr

Example 1 Explanation:
For the first rule, we switch the characters in positions 2 and 3. In this case, we are switching the “g” and “e” which yields “Tiegr”.

For the second rule, we switch the character in positions 0 and 3. Here we switch the “T” and “g” which yield “gieTr.”

We have now completed all the rules so we output “gieTr.”

Question 3 - Binary Search Tree

The Safari leader is trying to keep track of all the different employees at the company. He decides to use a tree to construct a rough diagram of how the company looks where each employee is a node in the tree.

Given n numbers of nodes, k_0 to k_{n-1}, where each k is an integer: construct a binary search tree with the nodes and output the sum of the values of the nodes with no children. Each node should be inserted into the tree in the given order. The tree should not be automatically balanced or altered after a node is inserted.

It is guaranteed that n is less than 10^3
It is guaranteed that all k's will be positive integers less than 10^3

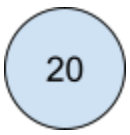
The first line of input is n followed by n lines of k values

The output should be a single integer

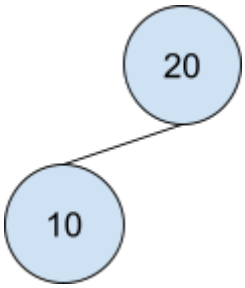
Example 1 Input:
4
20
10
30
15

Example 1 Output:
45

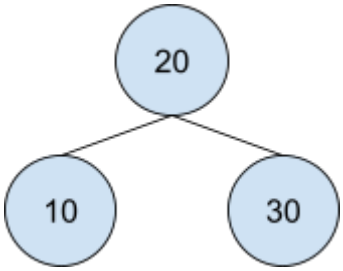
Example 1 Explanation:
Each node has a left and right child.
The first node is inserted into the top of the tree as a root node and starts with now children.
Here is a tree where the root node has a value of 20



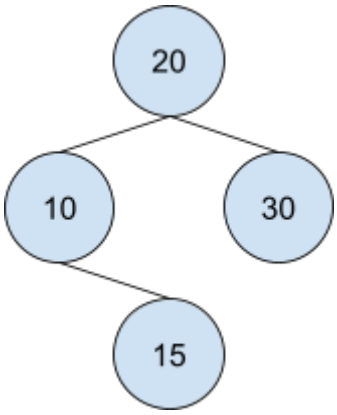
Now to insert 10 into this tree we check if 10 is less than or equal to 20. Because it is, we then check if 20 has a left child node. It does not so 10 is inserted as the left child to the 20 node.



Inserting 30 into the tree follows the same procedure except it is inserted as the right node of 20 instead of the left.



To next insert 15 into this tree, we check if 15 is less than or equal to 20. It is so we next check if 20 has a left child node. Because it does, we now reevaluate our checks for our inserted value at our new node, 10. Because 10 is childless and 15 is greater than 10, we insert 15 as 10’s right child node.



In this case, only 15 and 30 do not have any children so the solution is 15+30=45.

Question 4 - Mischievous Monkeys

Safarist Robert is in shambles in many respects, as the safari animals do not respect his authority and frequently mess around with him. The latest pranks the Monkeys have played on him was to steal his meticulous safaring notes and scramble everything. To do this, they simply shifted all the letters a certain number of times to the right (i.e., to shift 'A' twice to the right would yield 'C'). Spaces should remain spaces.

The number of times they shifted is given by the ASCII value (a numerical value that represents letters) of the last letter of the final word of the fifth sentence in the rules.

Your job is to help Safarist Robert by un-encrypting his important files. We guarantee all characters in the unscrambled message are capital letters or spaces, and that each sting is less than 500 characters long.

Example:

Input:
QFFBU

Output:
APPLE

Question 5 - Giraffe Problem

Somewhere in the wilderness, a giraffe exists. The giraffe knows you. They have given you a 5x5xn 3D array wherein n represents the number of layers. The goal is to identify the treasure location on the grid based on the values in the grid based on the values within each cell. The grid is initially incomplete, with some cells represented by a "?".

Find the formula to calculate the missing values in the Commons.

After completing the grid, find the layer and the coordinates (i, j) where the sum of the row values is the highest across all layers and rows. This row with the highest sum reveals the treasure's location.

There is a specific formula you need to calculate the unknown values. To figure out the formula, search the large room where we all first met (yes you actually have to get up and go).

Where i and j are row and column indices and k is the layer index (all 0-indexed)

After filling in the cells identify the row with the maximum sum

Return the layer and row ("k i") where this row exists

Input Format
First Line: n, number of layers
Next n blocks: each layer is a 5x5 grid, with rows represented by a space separated numbers or "?" for unknowns

n will not be greater than 500

Output format
k and i space separated

Example:
For the sake of this example, we assume the formula for the missing cells is i + k - j. This is not the correct formula to not give away the problem.

Input:
1
5 3 12 8 ?
? 6 ? 10 ?
15 ? 14 21 ?
? ? 24 19 ?
? 17 ? 11 25

Output:
0 4

Explanation:

Grid with filled in cells:
5 3 12 8 -4
1 6 -1 10 -3
15 1 14 21 -2
3 2 24 19 -1
4 17 2 11 25

The row with the largest value in the last one

Question 6 - Pangolin Polynomials

The pangolins on our safari love to perform artistic displays by orienting themselves into shapes along the savannah (do pangolins live in the Savannah? Questions for Safarist Robert...)

In any case, the Safari administration wants to determine the area of the shapes made by the pangolins, in order to use it for promotional activities.

The polygons that the pangolins form are simple, i.e. they do not intersect themselves.

The first line of input is n, the number of pangolins.
The next n lines each contain x and y, the coordinate of the i-th pangolin.

Return the UNSIGNED area of the polygon that the pangolins form, rounded to the nearest whole number (round up for .5).

We guarantee that the polynomial is a planar, simple polygon, and that the points are all oriented correctly, i.e., they appear in order, counter clockwise. We guarantee that n < 3000. Furthermore, we guarantee that all coordinate points (x,y) are integer values less than 100,000,000.

Example:
Input:
4
1 4
3 6
4 4
2 1

Output:
8

Question 7 - Encrypted Message

A pack of sneaky sneaky hyenas has created their own little code so they can communicate secretly ;). One tells you a message and it is your job to decode it.

His message corresponds to the following instruction set with the following commands:

- ">": move the pointer one cell to the right
- "<": Move the pointer one cell to the left
- "+": Increment the value at the current cell by 1.
- "-": Decrement the value at the current cell by 1.
- ".": Output the ASCII character represented by the value at the current cell

The memory comprises an array of 10 cells initialized at zero wherein the pointer begins at the first cell.

Input Format
N, the number of instructions
Next N line contains two values separated by a colon

- The base of the instruction (an integer between 2 and 16).
- The encoded instruction in that base

N will always be less than 500.
The base will always be between 2 and 16, inclusive.

The instructions correspond to their ascii values as do the outputs given by the "." instruction

Only output what is specified by the "." instruction.

Example:
Input:
34
2:101011
2:101011
2:101011

```
2:101011
2:101011
2:101011
2:101011
2:101011
2:101011
2:101011
2:101011
2:101011
2:101011
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2:101011
2:101011
2:101011
2:101011
2:101011
2:101110
```

Output:

```
!
```

Explanation:

Cell 0 is incremented 33 times and then displayed

Question 8- Predicting states

Imagine a vast safari where every animal herd can be in one of two states: state A or state B. As the herds roam across the plains, they may shift between states based on certain probabilities, creating dynamic patterns that shift like the movement of the great migration. Your task is to track these transitions and determine the stable distribution of herds between the states — a challenge that requires keen observation and sharp analytical skills. So grab your binoculars and prepare to uncover the hidden order of the savanna's wandering wildlife!

You are given a table of probabilities:

	Ending in state A	Ending in state B
Starting in state A	0.6	0.4
Starting in state B	0.7	0.3

The table indicates the probability of a given end state, A or B, given a specific starting state, A or B.

For example, if the starting state is A, the probability of ending in state A is 0.6 or 60% and the probability of ending in state B is 0.4 or 40%. Over time, as states A and B transition, there emerges a general distribution of the probability of states A and B, one that does not necessarily depend on the prior state.

There is a way to find the general probabilities of each state that involves plugging in any starting state. Consider, for example, we start in state A, where the probability of remaining in A = 0.6 and going to B = 0.4, then for the next iteration, irrespective of the state we land in:

$P(A) = 0.64$
$P(B) = 0.36$

Note that this distribution is not a weighted average. In this case, the general probability of state A converges to $0.\overline{63}$ and state B to $0.\overline{36}$.

From this table you can find the probability of each event regardless of the starting state.

And output them, space separated, rounded to 6 decimal places.
Hint: P(A) + P(B) = 1

The 4 lines of input contain top left, top right, bottom left, and bottom right values of the table in that order.

The output should be P(A) and P(B), space-separated. This output should include the decimal point and the leading zero. This output will always be between 1 and 0.

The given inputs will not have more than 4 digits after the zero
The given inputs will always be between one and zero, never one or zero

Example 1 input:
0.6
0.4
0.7
0.3

Example 1 output:
0.636364 0.363636

Question 9 - Compound Words

Parts for safari signs have arrived but the words are all separated!

Given a target compound word t, and n number of words, w_0, w_1, w_2, …, find the two words that make up the compound word and return the two indexes of the words that make up the compound word in increasing order.

It is guaranteed that the target compound word, t, will always be less than 500 characters
It is guaranteed that each word, w, will always be less than 250 characters
It is guaranteed that n will be less than 10^6
It is guaranteed that each w will be unique

The first line of the input contains t
The second line of the input contains n
The next n lines of the input contain the w's

Example 1 Input:
wildlife
3
lion
life
wild

Example 1 Output:
1 2

Example 1 Explanation:
The two words that make up "wildlife" are "wild" and "life"
"wild" appears first and has an index of 2
"life" appears second and has an index of 1
The output is 1 2 because 1 is less than 2