

Information

Source code limit

The size of each solution source code can't exceed 256 KiB.

Submissions limit

You can submit at most 50 solutions for each problem.

You can submit a solution to each task at most once per 30 seconds. This restriction does not apply in the last 15 minutes of the contest round.

Testing

Notice, that each subtask has a list of required subtasks. Subtask will be tested only if all tests of all required subtasks are passed. Be careful, some subtasks might not be tested, if your solution doesn't pass sample tests.

Scoring

We have two types of subtask scoring: "test" and "subtask".

"Test" means that points are awarded for each test in a subtask independently of other tests in this subtask.

"Subtask" means that points are awarded only if all tests in this subtask are passed.

For more information on subtask scoring read "Scoring" section of each problem.

The number of points scored for the problem is the total number of points scored on each of its subtasks. The score for the subtask is the maximum number of points earned for this subtask among all the solutions submitted.

Feedback

To get feedback for your solution, go to "Runs" tab in PCMS2 Web Client and use "View Feedback" link.

Scoreboard

The contestants' scoreboard is available during the contest. Use "Monitor" link in PCMS2 Web Client to access the scoreboard. The standings provided in PCMS2 Web Client are not final.

Problem A. The Game

Time limit: 1 second
Memory limit: 512 megabytes

Intellectual TV-game “What? Where? When?” is very popular. Throughout the game, a team of experts attempts to answer questions sent in by viewers. If experts answer the question correctly, one point is awarded to the team of experts, otherwise a point is awarded to the team of viewers. The game ends when one of the teams scores k points.

You are given a final score of $x : y$. So the game consisted of $x + y$ questions asked, and one of the teams scored exactly k points. You are not given k , since you can calculate it easily. You are asked to find any valid game scenario that finished with score $x : y$, as the list of scores after each question asked.

The score you are given is correct, and at least one question was asked.

Input

The first line consists of two integers x and y , the final score ($0 \leq x, y \leq 1000$; $x \neq y$).

Output

Print $x + y$ lines, i -th of them containing a score after i -th round. The numbers of points scored have to be separated by colon character (':'). You can print any game scenario that finishes with score $x : y$.

Scoring

Testing data for this problem consists of 10 test cases. For solving each test case you are awarded 10 points. Total score is the total sum of points for all test cases. The testing verdict for each test case is shown.

Examples

standard input	standard output
3 4	1:0 2:0 2:1 2:2 3:2 3:3 3:4
5 1	1:0 2:0 3:0 4:0 4:1 5:1

Problem B. Innome

Time limit: 2 seconds
Memory limit: 512 megabytes

Young software developer Michael succeeded on Innopolis Open and was awarded by Innobook laptop with a pre-installed “Innome” web browser. This strange web browser can support at most k open windows and the i -th open tab in the window uses i megabytes of memory. Michael knows that his new laptop has m megabytes of memory. Please help Michael to calculate the maximum number of tabs he can open.

Input

The first line contains single integer t , the number of tests. The next t lines contains description of the tests one per line. Each test is represented by two integers m and k , the size of Innobook memory and the maximum possible number of windows.

Output

For each test output a single integer on a separate line, the maximum number of tabs that Michael can open.

Scoring

Subtask	Score	Constraints			Scoring	Required subtasks
		t	m	k		
1	10	$t \leq 100$	$m \leq 10^6$	$k = 1$	subtask	—
2	10	$t \leq 100$	$m \leq 10^6$	$k \leq 2$	subtask	1
3	20	$t \leq 1000$	$m \leq 10^9$	$k \leq 10^9$	subtask	1 and 2
4	25	$t \leq 10^5$	$m \leq 10^9$	$k \leq 10^9$	subtask	1, 2 and 3
5	35	$t \leq 10^5$	$m \leq 10^{18}$	$k \leq 10^9$	subtask	1, 2, 3 and 4

Feedback

The verdict for each testcase of each subtask is shown.

Example

standard input	standard output
2	10
23 3	2
2 3	

Problem C. Coins on a tree

Time limit: 1 second
Memory limit: 512 megabytes

You have a rooted tree, some vertices have coins lying on them.

You can do the following operation any number of times: take some two vertices u and v , such that there are no coins at lowest common ancestor of u and v but both vertices u and v have non-zero amount of coins a_u and a_v and put $a_u + a_v$ coins at their lowest common ancestor.

Your goal is to maximize the sum of the number of coins on all vertices.

Input

The first line contains single integer n ($2 \leq n \leq 10^5$) — number of vertices of the tree.

The root of the tree is vertex 1.

The second line contains $n - 1$ integers p_2, p_3, \dots, p_n , p_i is the parent of vertex i ($1 \leq p_i < i$).

The third line contains n integers a_1, a_2, \dots, a_n , a_i is the number of coins that lie on vertex i ($0 \leq a_i \leq 10^5$).

Output

Print one integer — the maximum total amount of coins that you can get by applying the described operations.

Scoring

Subtask	Score	Additional constraints	Scoring	Required subtasks
1	5	$n \leq 5, a_i \leq 1$	subtask	—
2	5	$n \leq 20$	subtask	1
3	10	$n \leq 2000, a_i \leq 1$	subtask	1
4	20	$n \leq 2000$	subtask	1,2,3
5	20	$a_i \leq 1$	subtask	1,3
6	40	—	subtask	1,2,3,4,5

Feedback

For each subtask the score and the verdict for the first failed testcase is shown.

Examples

standard input	standard output
3 1 1 0 1 1	4
5 1 1 3 4 5 3 4 2 4	18

Problem D. Game of Wizards

Time limit: 1 second
Memory limit: 512 megabytes

Gandalf and Saruman are playing a game. Gandalf has n potions in a row, and Saruman has m potions in a row. Each potion has a magical power, Gandalf's potions have powers a_1, a_2, \dots, a_n , and Saruman's potions have powers b_1, b_2, \dots, b_m . Initially both of them have no unit of mana.

Players take turns. Gandalf moves first.

At each turn player takes the **leftmost** potion he has, drinks it, and receives x units of mana, where x is the power of the taken potion. If player does not have any potion on his turn, he loses the game. After drinking the potion, player may use his magical powers to destroy some potions of his opponent. Destroying one potion costs one unit of mana.

Each player wants to win, and, furthermore, wants to finish the game with the maximum possible number of potions left. A player who is going to lose tries to minimize the number of potions of the opponent in the end of the game. Determine who is going to win and how many potions they have at the end of the game if both players play optimally.

Input

The first line contains two integers n and m — the number of potions that Gandalf and Saruman have, respectively ($1 \leq n, m \leq 200$).

The second line contains n integers a_1, a_2, \dots, a_n — the powers on Gandalf's potions from left to right ($0 \leq a_i \leq 200$).

The third line contains m integers b_1, b_2, \dots, b_m — the powers on Saruman's potions from left to right ($0 \leq b_i \leq 200$).

Output

Print the name of the player who wins the game and the number of potions that the winning player has at the end of the game.

Scoring

Subtask	Score	Additional constraints	Scoring	Required subtasks
1	5	$a_i = 0, b_i = 0$	subtask	—
2	10	$n, m \leq 5$	subtask	—
3	25	$n, m \leq 20$	subtask	2
4	35	$n, m \leq 100$	subtask	2, 3
5	25	—	subtask	1, 2, 3, 4

Feedback

For each subtask the score and the verdict for the first failed testcase is shown.

Examples

standard input	standard output
5 4 1 0 1 4 4 2 3 0 5	Gandalf 0
3 4 1 3 4 3 2 0 0	Saruman 2
9 9 2 0 1 2 1 1 2 1 2 1 2 1 1 1 0 1 2 2	Gandalf 1

Problem E. Boolean Expression

Time limit: 3 seconds
 Memory limit: 512 megabytes

You are given a boolean expression, consisting of «0», «1», operations «&» (boolean “AND”), «|» (boolean “OR”), «^» («XOR», boolean “exclusive OR”), and parentheses. A correct boolean expression can be defined recursively: an expression is correct, if it is either equal to one character «0» or «1», or it is an application of some boolean operation to two correct boolean expressions. For simplicity, every application of a boolean operation is put into parentheses. The given expression does not contain spaces or any other characters except the ones described above. For instance, «((0|1)|0)», «(0&1)» and «0» are correct expressions, and «0|1», «0|1&1» and «(0)» are not.

Calculate the result of this expression. By the way, the expression is changing! You are also given m queries to change a character at some position. Calculate the value of the given expression after each query.

Input

First line contains string S , a correct boolean expression with at most 800 000 characters.

Next line contains a single integer m ($1 \leq m \leq 400\,000$) — number of queries. Then, m lines follow. Each line contains an integer and a character p_i c_i , meaning that you should change a character at position p_i to c_i . It's guaranteed that the expression remains correct after every query.

Output

Output $m + 1$ characters «0» or «1» on a single line. First character should be equal to the value of the original expression. Next m characters should be equal to the value of the expression after each query.

Scoring

Subtask	Points	Constraints		Scoring	Required subtasks
		$ S $	m		
1	10	$ S \leq 5$	$m \leq 10$	subtask	—
2	10	$ S \leq 200$	$m \leq 200$	subtask	1
3	20	$ S \leq 2\,000$	$m \leq 2\,000$	subtask	1 and 2
4	25	$ S \leq 200\,000$	$m \leq 100\,000$	subtask	1, 2 and 3
5	35	$ S \leq 800\,000$	$m \leq 400\,000$	subtask	1, 2, 3 and 4

Feedback

For each subtask the score and the verdict for the first failed testcase is shown.

Example

standard input	standard output
((1&1)^(0 1)) 3 11 0 7 5 0	0110