Problem A. The Fastest of All Time

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

With the arrival of the Olympics, Amy needs to build the best team to compete in the pizza delivery match.

Being extremely charismatic and prepared, Amy selected N of the best athletes in the pizza carrying event to help her country win a medal.

The pizza loading competition is simple. The competitors have to deliver p pizzas from the starting point to the end point. That's it, the task is really simple.

Each member of the team chosen by Amy is numbered from 1 to N. Each of them has a strength A_i, which means that it takes A_i seconds to deliver exactly one pizza from the starting point to the end point and return to the starting point again.

The day of the competition is close. With Amy's ambitious goal to beat the world record, she wants to know the minimum time her team can deliver the p pizzas.

Given the information of each competitor in Amy's team, determine the minimum time for this team to complete the task.

Input

The first line of the input consists of two integers N and p that represent the number of members of the team and the number of pizzas that need to be delivered.

The second line of the input has N integers A_1, A_2, ..., A_N, that represent, in order, the time needed for each competitor to carry a pizza and return to the start.

- $1 \leq N \leq 2 \cdot 10^5$
- $1 \leq p \leq 10^9$
- $1 \leq A_i \leq 10^9$

Output

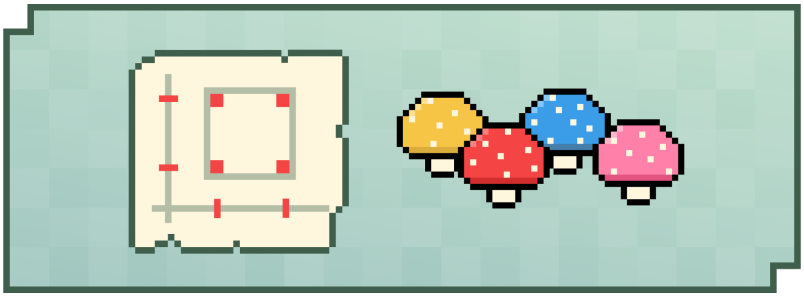
A single integer, the minimum time for the team to complete the task.

Examples

standard input	standard output
4 5 10 10 10 10	20
3 7 4 6 1	6

Problem B. Mushrooms

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes



In Amy's town, Sonic and his friends participate in an obstacle course to prepare for the Olympics. Four mushrooms are strategically positioned in the corners of the main square, which has the shape of a square when seen on a map. Each mushroom is located at a vertex of the main square.

Amy is anxious to calculate the total area occupied by the main square in her beloved city. Can you help her?

Input

Four lines, each one containing two integers (x, y) that represent the coordinates of the mushrooms $(-1000 \leq x, y \leq 1000)$.

It is guaranteed that the area of the square is positive and its sides are parallel to the axes of the Cartesian plane. The coordinates of the mushrooms are randomly given.

Output

A single integer that represents the area of the main square.

Examples

standard input	standard output
1 3 5 7 1 7 5 3	16
1 -1 -1 -1 1 1 -1 1	4

Problem C. Multiple Long Jumps

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

In the Olympics of Amy and Sonic's universe, a new sport has been added: multiple long jumps. The aim is not necessarily to make the longest jumps, but to collect as many coins as possible from the jump stations between the jumps.

There are $2^N - 1$ jump stations on the jumping platform, indexed from 1 to $2^N - 1$. Station i contains a_i coins. The competitor starts at station 1 and, for each station k they pass, including 1, they perform the following actions in order:

1. They collect all a_k coins contained in station k.
2. If $k \geq 2^{N-1}$, they end their jumps. Otherwise, they jump to station $2k$ or station $2k + 1$, as they choose.

Amy is taking part in this competition and wants to know the maximum number of coins she can collect in order to win the competition.

Input

The first line of input contains one integer N ($1 \leq N \leq 18$). The second line contains $2^N - 1$ integers $a_1, a_2, ..., a_{2^N-1}$ separated by spaces ($0 \leq a_i \leq 100$).

Output

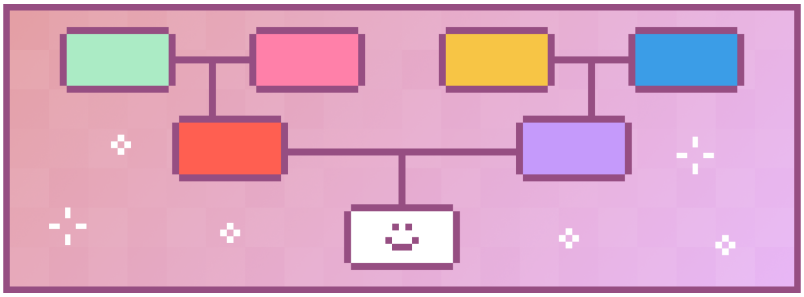
Print one integer, the maximum number of coins Amy can collect.

Examples

standard input	standard output
2 5 10 20	25
3 0 2 6 100 60 75 90	102
1 42	42

Problem D. Heritage

Input file:	`standard input`
Output file:	`standard output`
Time limit:	8 seconds
Memory limit:	1024 megabytes



Mya — the founder of the Ultrasonic Olympic Games — is in her last moments and is trying to decide how to divide her enormous fortune among her relatives. Thus, for each family member, she assigned a value x_i, which represents the amount the i-th person will receive if included in the will. However, to avoid creating discord among different parts of the family, Mya decided that if a person u is included in the will, none of their ancestors can be included as well. Moreover, Mya also decided that exactly K of her relatives must be in the will.

Given the family's genealogical tree, help Mya find the highest total value she can distribute among her relatives, respecting the conditions described.

Input

The first line of the input contains two integers N and K ($2 \leq N \leq 10^5, 0 \leq K \leq min(N-1, 1000)$), representing the number of people in Mya's family and the number of relatives to be chosen, respectively.

The second line of the input contains $N-1$ integers x_i ($2 \leq i \leq N$, $0 \leq x_i \leq 10^9$), representing the value that the i-th family member will receive if included in the will.

The third line of the input contains $N-1$ integers p_i ($2 \leq i \leq N$, $1 \leq p_i \leq N$), representing the direct ancestor of the i-th family member.

Note that the identifier 1 represents Mya, and that she cannot be included in her own will.

Output

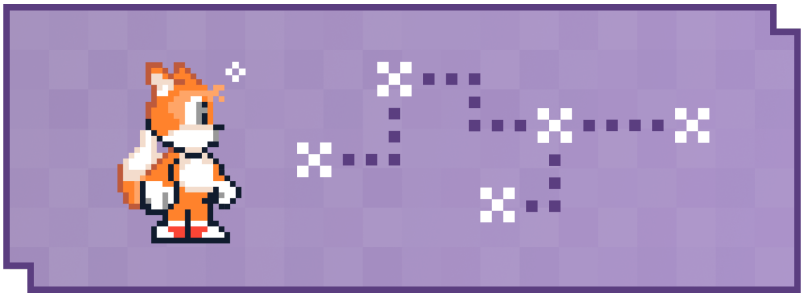
Print a single integer S representing the highest total value Mya can distribute among her relatives. If it is not possible to choose exactly K heirs, this value should be zero.

Examples

standard input	standard output
7 4 3 1 1 1 1 1 1 1 2 2 3 3	4
8 3 10000 7 10 12 5 2 1 1 2 3 3 2 6 6	27
5 3 7 3 8 6 1 2 3 4	0

Problem E. Short Steps

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes



As a great enthusiast of the Ultrasonic Olympic Games, Amy decided to learn more about the history of this event. To do so, she decided to visit all the locations that have hosted the Games. However, to undertake these trips, Amy can only use her friend Tails' old and limited car. Thus, Amy can only travel from one venue A at position (x_A, y_A) directly to another venue B at position (x_B, y_B) if the Euclidean distance between them is at most D, as the car cannot withstand longer uninterrupted journeys without serious failures.

The Euclidean distance between two points (x_A, y_A) and (x_B, y_B) is given by $dist(A, B) = \sqrt{(x_A - x_B)^2 + (y_A - y_B)^2}$.

Since it's an event with a lot of tradition, numerous locations have already been hosts, and Amy quickly became confused with so much information. So, it's up to you to answer Amy's various questions. Amy's question has the following format: given two venues S and T, is it possible to go from S to T — possibly using intermediate venues — without the car failing?

Input

The first line of the input contains three integers N, Q, and D ($1 \leq N, Q \leq 10^5, 0 \leq D \leq 3$), representing the number of seats, the number of questions, and the distance D described in the statement, respectively.

Each of the next N lines contains two integers x_i and y_i ($-10^9 \leq x_i, y_i \leq 10^9$), representing the coordinates of the i-th headquarters. It is guaranteed that all headquarters have different coordinates.

Finally, each of the last Q lines contains two integers S_i and T_i ($1 \leq S_i, T_i \leq N$), representing the seats of a question.

Output

Print Q lines, so that the i-th line represents the answer to the i-th question of Amy. The line must contain the character 'S' if it is possible to go from headquarters S_i to T_i and 'N' otherwise.

Examples

standard input	standard output
3 4 1 0 0 -1 0 1 0 1 2 2 3 3 1 1 1	S S S S
7 3 3 0 0 0 3 2 3 -2 4 -4 3 4 4 3 -1 1 7 1 5 5 6	N S S

Problem F. Score

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

During the Olympiads of this year, Amy was responsible for updating the scores of her country. In order to do this, she asked Sonic to help her know which were the victories of her country.

However, her country values some medals more than others. The score of each medal is the following:

- Victory in programming (after all, this is an Olympic sport): 8 points
- Victory in volleyball (after all, this is the coolest sport): 4 points
- Victory in soccer (after all, this is the country of soccer): 2 points
- Victory in race (after all, we have The Sonic): 1 point

Sonic was kind of lost with the amount of matches and, instead of giving to Amy which sport they won, he returned the sum of points.

Given the sum of the points, help Amy to count how many different sports they won.

Input

The input is an integer number N ($1 \leq N \leq 15$), the sum of the points returned by Sonic.

It is guaranteed that victory in each modality is unique.

Output

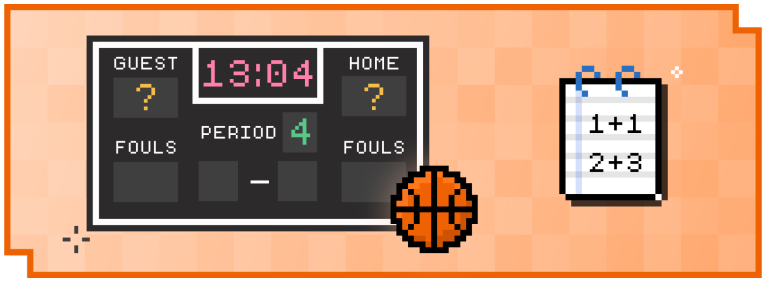
The output must be an integer, representing the number of sports in which Amy's country won medals.

Examples

standard input	standard output
1	1
12	2
15	4

Problem G. Basketball Match

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes



Sonic and Amy were watching the Olympics basketball finals. As Sonic is really detailed, he registered each score of the match in his notebook of annotations. For example, if team Time 1 scored with a free throw, he wrote "Time 1 +1". In the same way, if team Time 2 scored a triple, he registered "Time 2 +3".

Until the end of the match, everything was fine. However, at the end of the game, there was a problem with the scoreboard, and the teams scores were lost. Happily for the organizers, Sonic had every detail of the game written in his notebook.

Given the content of Sonic's notebook, what would be the result of the match between Time 1 and Time 2?

Input

The first line of input contains an integer n ($1 \leq n \leq 100$).

Then follow n lines, each in the format "Time t +k" (without quotes), which indicates that Time t made a basket of k points ($t \in \{1, 2\}$, $k \in \{1, 2, 3\}$).

Output

Print a line in the format "p_1 x p_2" (without quotes), where p_1 represents Time 1's score and p_2 represents Time 2's score. Note that there is a space before and a space after the "x".

Examples

standard input	standard output
6 Time 1 +1 Time 1 +1 Time 2 +2 Time 1 +3 Time 2 +2 Time 2 +3	5 x 7
1 Time 1 +2	2 x 0