IP Blocks
Problem ID: ip

Note: The following is a fictitious depiction of Quora's security system.

Quora has been crawled by various attackers and the team occasionally had to deal with such attackers. To secure the product, Quora decides to allow only known IP addresses and has collected n IPv4 address blocks. However, there were too many IP blocks to store and we want to reduce the storage size by minimizing the set of address blocks. For instance, 172.226.69.220/31 and 172.226.69.222/31 can be merged into 172.226.69.220/30.

The IPv4 address blocks will be provided in Classless Inter-Domain Routing (CIDR) notation. CIDR notation specifies an IP address, a slash ('/') character, and a decimal number. The IP address is a 32-bit integer, split up into 4 groups of 8 bits (octets) separated by periods ('.') for readability. The decimal number is the count of consecutive leading 1-bits (from left to right) in the network mask. For example, the IPv4 block 198.51.100.0/22 represents the 1024 IPv4 addresses from 198.51.100.0 to 198.51.103.255.[1]

Given the IPv4 address blocks, write a program to find a set of blocks which has the same coverage as the input data and minimizes the number of blocks.

Input

Your program will receive input from standard input.

The first line contains a positive integer n representing the number of IPv4 address blocks.

In the following n lines, one IPv4 address block will be provided per line.

Output

Your program should write to standard output.

Print a minimal set of address blocks. Print one address block per line, in any order.

If there are multiple possible answers, print any one of them.

Constraints

- $2 \leq n \leq 10^5$

Scoring

There are 50 test cases. You will get 2 points per correct test case.

Sample Input 1	Sample Output 1
8 172.224.224.32/31 172.224.224.34/31 172.224.224.36/31 146.75.169.110/31 146.75.169.112/31 146.75.169.114/31 146.75.169.116/31 146.75.169.118/31	146.75.169.110/31 146.75.169.112/29 172.224.224.32/30 172.224.224.36/31

[1] https://en.wikipedia.org/wiki/Classless_Inter-Domain_Routing

Xuora
Problem ID: xuora

Given a single integer n, find the minimum possible integer m such that we can choose n distinct positive integers less than or equal to m with bitwise XOR equal to 0.

Input

Your program will receive input from standard input.

You will receive a single line containing the integer n.

Output

Your program should write to standard output.

On the first line, print a single integer m, the answer to the problem.

On the second line, print $m - n$ space-separated integers which are the integers that are **not** chosen as part of the n distinct numbers with bitwise XOR equal to 0. If there are multiple possible answers, print any one of them.

It is guaranteed that for the given test cases, $m - n \leq 2 \cdot 10^5$.

Constraints

- $3 \leq n \leq 10^{18}$

Subtasks

You will get points for each subtask when you pass all of the testcases of the subtask.

1. $3 \leq n \leq 20$ (23 points)
2. $3 \leq n \leq 500$ (21 points)
3. $3 \leq n \leq 10^{18}$ (56 points)

Sample Explanation

In Sample Input 1, the smallest possible m is 5, and we can choose 4 integers $\{2, 3, 4, 5\}$ with bitwise XOR equal to 0, and leave $\{1\}$.

In Sample Input 2, the smallest possible m is 9, and we can choose 5 integers $\{3, 4, 6, 8, 9\}$ with bitwise XOR equal to 0, and leave $\{1, 2, 5, 7\}$.

Sample Input 1	Sample Output 1
4	5 1

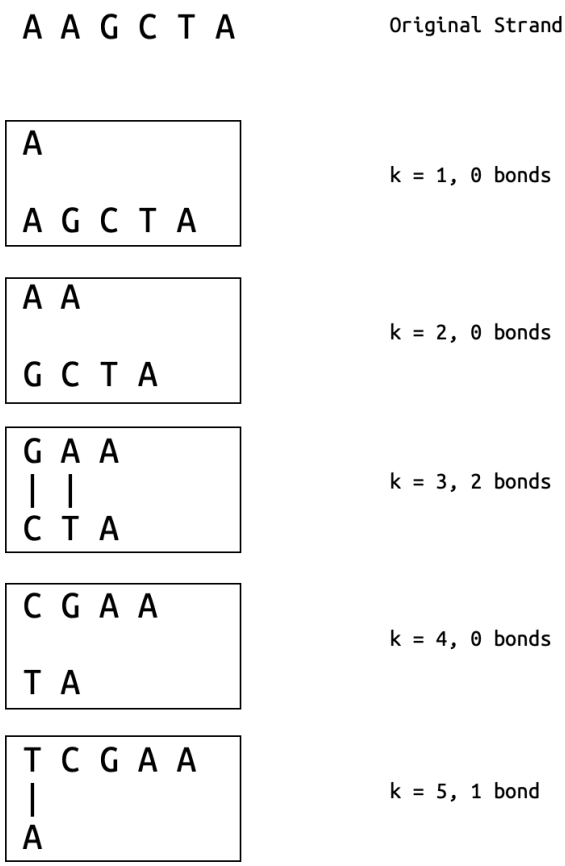
Sample Input 2	Sample Output 2
5	9 1 2 5 7

DNA Dream
Problem ID: dna

Giannis is in an introductory biology class. Today he's learning about DNA bonding. He knows the basics: DNA is composed of nucleotides, and each nucleotide is composed of one of four nucleobases: adenine [A], thymine [T], cytosine [C], or guanine [G]. Additionally, he knows there are some base pairing rules for hydrogen bonding: A bonds with T, and C with G.

Unfortunately, Giannis didn't pay attention to the rest of class, and moreover has fallen asleep. In his dream, he found a sequence of a single strand of DNA, represented as a string s consisting of uppercase English characters 'A', 'T', 'C', or 'G', and he also noticed that in this dream world he could fold the single strand of DNA onto itself, with some folds leading to more bonds than others[1]. There are $n-1$ possible folds for a strand of length n.

For example, take the sequence AAGCTA.



The 5 possible folds are shown above, along with the number of bonds for that fold. You can uniquely describe a fold by the number of bases on the left side of the fold, denoted as k in the diagram above. Note that $1 \leq k \leq n-1$.

Giannis thinks he has to find the best fold of the DNA strand that maximizes the number of self-bonds in order to wake up from his dream. Help him find the best fold possible!

[1] This isn't really how DNA works in real life, but it is a dream, after all.

Input

Your program will receive input from standard input.

The first line of the input contains a single integer n.

The second line of the input contains s, the string consisting of n characters 'A', 'T', 'C', or 'G', representing the sequence of the single strand of DNA.

Output

Your program should write to standard output.

Print exactly one line containing two integers, k and m. m is the maximum number of bonds that can be achieved, and k is the number of bases on the left side of the fold that achieves that maximum number of bonds. Recall that $1 \leq k \leq n-1$. If there are multiple folds with the same maximum number of bonds, output the fold with the smallest k.

Constraints

- $2 \leq n \leq 3 \cdot 10^5$

Subtasks

You will get points for each subtask when you pass all of the testcases of the subtask.

1. $n \leq 10^3$ (33 points)
2. No additional constraints (67 points)

Sample Explanation

Sample Input 1 is the sequence described in the statement above. The optimal fold is $k = 3$, achieving 2 bonds.

Sample Input 1	Sample Output 1
6 AAGCTA	3 2

Sample Input 2	Sample Output 2
7 GGGGGAT	6 1

Sky City

Problem ID: city

There are n buildings and $n-1$ undirected roads connecting the buildings such that the network of roads forms a tree.

Outside every building there is a vehicle that you can rent. The cost of the vehicle at building i is c_i per unit distance travelled, and additionally a base cost of r_i to rent. So if you choose to rent the vehicle and travel d units distance, the rental costs you a total of $dc_i + r_i$.

The problem is to calculate the minimum cost to travel from building 1 to building i for all i. For each travel calculation, you should move through the shortest path, i.e. the simple path from building 1 to i.

Input

Your program will receive input from standard input.

The first line contains a positive integer n representing the number of buildings.

In the following $n-1$ lines, the i-th line contains integers x_i, y_i, and d_i, indicating that there is a road from buildings x_i and y_i of length d_i.
In the following n lines, the i-th line describes the cost parameters of the vehicle outside building i, c_i and r_i, representing the cost per unit distance travelled and cost to rent, respectively.

Output

Your program should write to standard output.

Print exactly one line containing $n-1$ integers. The i-th integer should be the minimum cost required to travel from building 1 to building $i+1$.

Constraints

- $2 \leq n \leq 2 \cdot 10^5$
- $1 \leq x_i, y_i \leq n; 1 \leq d_i \leq 10^4$
- $x_i \neq y_i$
- The given graph forms a tree
- $1 \leq c_i \leq 10^9; 0 \leq r_i \leq 10^9$.

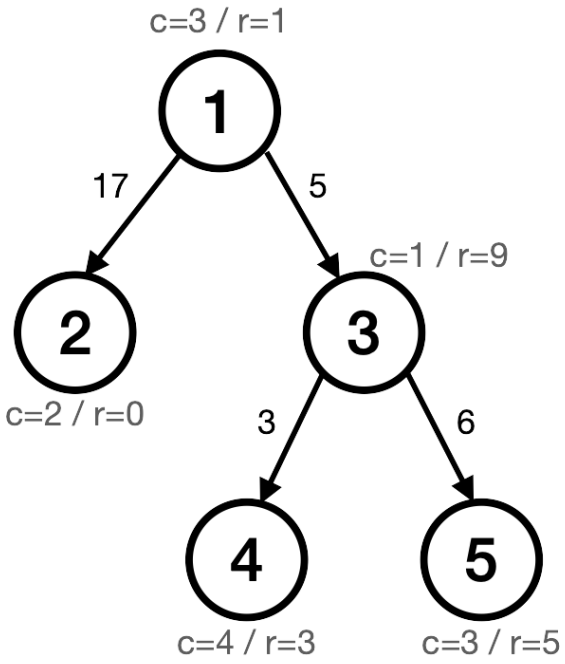
Subtasks

You will get points for each subtask when you pass all of the testcases of the subtask.

1. $n \leq 10^3$ (19 points)
2. The given tree is linear and rooted at building 1 (32 points)
3. No additional constraints (49 points)

Sample Explanation

The city in Sample Input 1 is shown below:



- The minimum cost to travel to building 2 is $1 + 3 \times 17 = 52$.
- The minimum cost to travel to building 3 is $1 + 3 \times 5 = 16$.
- The minimum cost to travel to building 4 is $1 + 3 \times 8 = 25$.
- The minimum cost to travel to building 5 is $16 + 9 + 1 \times 6 = 31$.

Sample Input 1	Sample Output 1
5 2 1 17 1 3 5 3 4 3 5 3 6 3 1 2 0 1 9 4 3 3 5	52 16 25 31

Rectangular Picture

Problem ID: picture

For the Quora Drawing Challenge 2022, we drew a rectangular picture in an interesting way. First, we put n pins on a coordinate system. If any 4 pins form a rectangle whose edges are parallel to the coordinate axes, we draw that rectangle. After the Challenge had concluded, we realized that there are lots of rectangles in the resulting picture. Count how many rectangles there are in the picture.

Input

Your program will receive input from standard input.

The first line contains a positive integer n representing the number of pins.

In the following n lines, the i-th line contains two positive integers x_i and y_i representing the location of the i-th pin.

Output

Your program should write to standard output.

Print exactly one line containing a single integer: the number of rectangles in the resulting picture.

Constraints

- $1 \leq n \leq 3 \cdot 10^3$
- $-10^9 \leq x_i, y_i \leq 10^9$

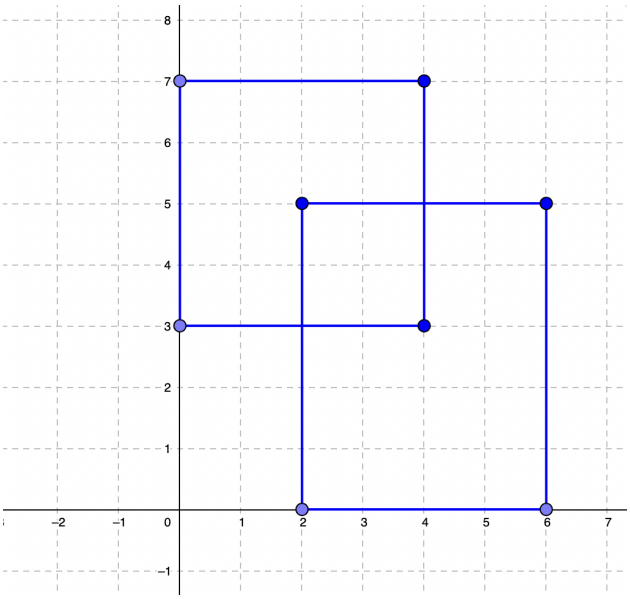
Subtasks

You will get points for each subtask when you pass all of the testcases of the subtask.

1. $n \leq 10^2$ (17 points)
2. $0 \leq y_i \leq 1$ (19 points)
3. No additional constraints (64 points)

Sample Explanation

For Sample Input 1, the pins and resulting rectangles are shown below.



2 rectangles are drawn for the given pins, and there are 3 rectangles in the resulting picture. The 3 rectangles are:

- $(0, 3) - (4, 3) - (4, 7) - (0, 7)$
- $(2, 3) - (4, 3) - (4, 5) - (2, 5)$
- $(2, 0) - (6, 0) - (6, 5) - (2, 5)$

Sample Input 1	Sample Output 1
8 0 3 0 7 4 3 4 7 2 0 2 5 6 0 6 5	3

Sample Input 2	Sample Output 2
8 2 1 3 1 1 2 4 2 1 3 4 3 2 4 3 4	11

Cake Splitting

Problem ID: cake

Quora is celebrating the launch of new subscriptions options for creators. The company ordered a huge cake for everyone to enjoy. The cake is in a shape of convex polygon represented by n points in the coordinate system. There are m employees in the celebration. Each employee will come in order, split the cake with a line, and take the piece with smaller area. Assume an employee doesn't want cake if their line doesn't intersect with the cake.

What is the remaining area of the cake after the celebration?

Note: It is guaranteed that both the absolute and relative area difference of the two pieces after each split are more than 10^{-6}.

Input

Your program will receive input from standard input.

The first line contains two space-separated positive integers n and m, representing the number of edges of the cake, and the number of employees in the celebration.

In the following n lines, the i-th line contains two real numbers containing up to 12 decimal points x_i and y_i representing the location of the ith point. The points will be given in counter-clockwise order around the cake.

In the following m lines, the i-th line contains four space-separated real numbers containing up to 12 decimal points $x_{1i}, y_{1i}, x_{2i}, y_{2i}$ representing that the line of the i-th employee will pass through (x_{1i}, y_{1i}) and (x_{2i}, y_{2i}).

Output

Your program should write to standard output.

Print exactly one line containing a number representing the area of the remaining part of the cake. The answer will be considered correct if the absolute or relative difference is no more than 10^{-6}.

Constraints

- $3 \leq n \leq 10^5$
- $1 \leq m \leq 10^5$
- $-10^6 \leq x_i, y_i \leq 10^6$

Subtasks

You will get points for each subtask when you pass all of the testcases of the subtask.

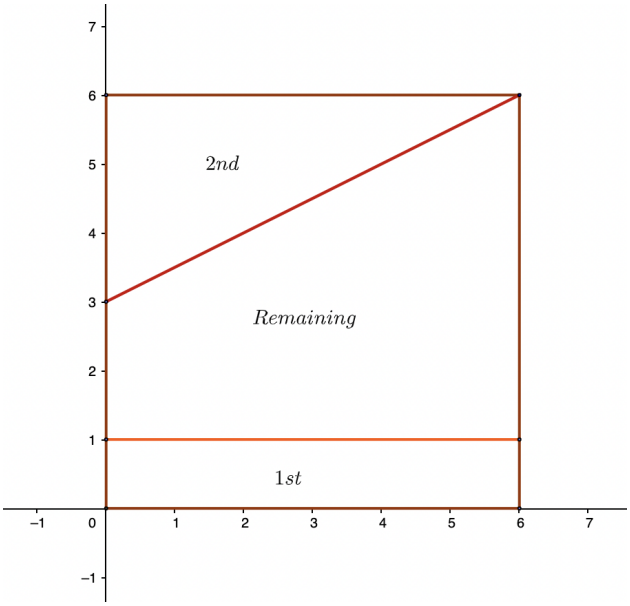
1. $n, m \leq 10^3$ (34 points)
2. No additional constraints (66 points)

Sample Explanation

In Sample Input 1, the cake consists of 4 corners and there are 2 employees.

- The first employee cuts the bottom part.
- The second employee cuts the the cake from left to top right corner, and takes the smaller part.

The cuts are shown below:



The remaining part of the cake has corners (0, 1), (0, 3), (6, 6), and (6, 0) and has area 21.

Sample Input 1	Sample Output 1
4 2 0.000000 0.000000 6.000000 0.000000 6.000000 6.000000 0.000000 6.000000 0.000000 1.000000 1.000000 1.000000 2.000000 4.000000 4.000000 5.000000	21.000000

[ML] Cold Start Upvote Prediction

Problem ID: coldstart

Note: The following is a fictitious depiction of Quora's cold start ranking system.

Many new answers are added to Quora every day, but the quality of an answer is varying and difficult to determine from the text alone. We often need some user feedback to determine whether an answer is good, but also want to avoid showing a bad answer to many people. In this problem, we will try to determine the expected quality of an answer based only on a small amount of feedback from a small set of "critic" users. Formally, given whether k initial "critic" users would upvote an answer, determine the expected number of total upvotes if the answer was shown to t total users selected from the general population.

For this problem, you will be given a training dataset where both the reactions from the k critic users and the total upvotes after t users see the content are provided, and a testing dataset where only the results of the first k critic users are provided. Your task is to predict the total upvotes after t users see the answers in the testing dataset.

Notes

For this problem we have significantly increased resource limits to allow for ML-based solutions, though you will still need to be mindful of time constraints. Recall that the time limit and memory limit of the evaluation server for each problem is shown in the corresponding problem statement provided on the Challenge website.

Input

Your program will receive input from standard input.

The first line will contain five space-separated integers, k, t, n, m, and u. k is the number of critic reactions provided, t is the number of total users the content will be shown to, n is the number of answers in the training dataset, m is the number of answers in the testing dataset, and u is the number of distinct users in the dataset.

The next $2n$ lines describe the training dataset.

- For the first n lines, the i-th line contains k pairs of integers formatted as follows:

  ```
  x_1:a_1 x_2:a_2 ...x_k:a_k
  ```

  representing the critic users who saw the i-th answer in the training dataset. a_j is 1 if user x_j saw and upvoted answer i, and 0 if user x_j saw but did not upvote answer i.

- For the next n lines, the i-th line contains a single integer representing the number of upvotes the answer eventually received after being shown to t users.

Finally, m lines follow. The i-th line contains k pairs of integers formatted as follows:

```
x_1:a_1 x_2:a_2 ...x_k:a_k
```

representing the critic users who saw the i-th answer in the testing dataset. a_j is 1 if user x_j saw and upvoted answer i, and 0 if user x_j saw but did not upvote answer i.

Output

Your program should write to standard output.

Print m lines. On the i-th line, print a single integer representing the predicted number of upvotes after t users view the i-th answer in the testing dataset.

Constraints

- $10 \leq k \leq 20$
- $k < t \leq 2 \cdot 10^2$
- $10^3 \leq n \leq 10^4$
- $0 < m < n$
- $10^2 \leq u \leq 5 \cdot 10^2$
- $0 \leq x_j < u$

Scoring

Score will be proportional to the L2 loss on the test dataset. Baseline solutions were used to generate minimum and maximum L2 losses for scoring.

Sample Explanation

A sample input and output are attached on the challenge website under the statement for this problem. **The sample input is the real first test case**. Note that if your solution is working locally but not in the system, it may be because of TLE.

[ML] Subtracting Data

Problem ID: subtracting

Machine learning models are great, but sometimes they take a long time to train. To fix this, we've decide to delete most of our data! In this problem, your task is to select a subset of the data to remove while minimizing the impact on the performance of the resulting model trained on the data.

Specifically, for this problem you'll be given a training set as input and must output the indexes of k training samples to remove such that the resulting balanced accuracy score[1] when the model is tested on a hidden test set is maximized.

Input

Your program will receive input from standard input.

The first line will contain three space-separated integers $n, m,$ and k.

n lines follow. The i-th line contains m space-separated integers $x_1, x_2, \ldots x_m$ representing the model's training data features of the i-th training data point.

Next, n lines follow. The i-th line contains one integer y_i representing the label for the i-th training data point.

Output

Your program should write to standard output.

Print k lines representing the (0-indexed) indexes of the training data points to remove from the training set.

Constraints

- $10^3 \leq n \leq 10^4$
- $2 \leq m \leq 8$
- $k < n$
- $0 \leq x_i \leq 10^3$
- $0 \leq y_i \leq 19$
- The training and test set are generated from the same distribution.

Scoring

Score is inversely proportional to the change in balanced accuracy score of the model. A baseline random solution has been used to determine the minimum balanced accuracy score to score any points (it is intended that a uniformly random solution scores no points).

Sample Explanation

A simple input and output, as well as the checker used for this problem are attached on the challenge website under the statement for this problem. These are intended to help test solutions locally. The sample input is not part of the real test set.

[1] https://scikit-learn.org/stable/modules/generated/sklearn.metrics.balanced_accuracy_score.html