Hong Kong Olympiad in Informatics 2014
Senior Group

Task Overview

Task	CPU time limit	Score
Enumeration	1 second	50
Dividing the Cities	1 second	100
Gene Mutation 2	1 second	100
Input Method	1 seconds	100
Pharmaceutical Company	1 second	100

Notice:

Unless otherwise specified, inputs and outputs shall follow the format below:
- One space between a number and another number or character in the same line.
- No space between characters in the same line.
- Each string shall be placed in its own separate line.
- No trailing space(s) in each line.
- No empty lines, except that the input and output should end with the endline character.

C++ programmers should be aware that using C++ streams (cin / cout) may lead to I/O bottlenecks and substantially slower performance.

C/C++ programmers should use `"%I64d"` for 64-bit integers I/O.

For some problems 64-bit integers may be required. In Pascal it is `int64`. In C/C++ it is `long long int`.

Enumeration

Time Limit: 1 second

Problem

Write a program to read an integer N and output N^2 integers in the format specified below.

Input

The input contains an integer N ($1 \leq N \leq 10$).

Output

The output consists of N lines, each contains N integers.
The last integer in the last line is 1.
Otherwise, in the i-th line, the last integer is i greater than the first integer in the next line, and is preceded by $N - 1$ integers, each of them are $N - i + 1$ greater than the integer on its right.

Sample test

Input	Output
4	40 36 32 28 24 21 18 15 12 10 8 6 4 3 2 1

Dividing the Cities

Time Limit: 1 second

Problem

The exam period is coming soon. The teacher has already told the class beforehand that the following task will be included:

Once upon a time there are N cities and M bridges, that every bridge connects a pair of cities. The king wants to assign every city to one of his 10 *sons, such that none of his son own a pair of cities which are connected by a bridge.*

Alex is a smart student and he knows how to solve this kind of problem very well. However, Bob, his best friend, worries that he may not have enough time to complete it. Therefore, they decide to cheat in the exam and have devised a strategy.

Now they are taking the exam and Alex has completed it but Bob has not figured out the solution yet. Now, Alex is going to help Bob by giving Bob a *hint*. To be precise, he is going to write Bob a `01`-sequence S, that may help Bob to solve the task. The length of the S is up to Alex, but it cannot be too long, otherwise they may be caught cheating. We use to L denote the length of the sequence.

Your task is to write a program with two modes, `A` and `B`, that represents the behaviour of Alex and Bob:

Mode `A`

INPUT:	The configuration of the city, a valid assignment of the cities
PROCESS:	Based on the problem and Alex's answer, produce a hint for Bob. The hint should be as short as possible.
OUTPUT:	A `01`-sequence hint S to be sent to Bob

Mode `B`

INPUT:	The configuration of the city, and `01`-sequence hint S from Alex
PROCESS:	Based on the problem and hint received, complete the exam.
OUTPUT:	A valid assignment of the cities

Constraints

For all test cases, $1 \leq N \leq 3000, 0 \leq M \leq 10000$.

Judging and Scoring

For each test case, we will first run your program in Mode `A`. If the program runs successfully and returns a valid output, we will run your program again in Mode `B`. This time the output, if also valid, will be used for scoring. If there are any error(s) during any stage, you will get no points for that case. The points you get depend on the length of S, i.e. L:

- if $0 \leq L \leq 4800$, you get 100% score for that test case
- if $L > 12000$, you get zero score for that test case
- otherwise you get $25 + \frac{12000-L}{120}\%$ score for that test case

Input

The first line contains a character, `A` or `B`, indicating the mode. In both modes, the city will be inputted in the following format:

The next line contains two integer N and M, the following M lines each contains two integers X_i and Y_i ($X_i < Y_i$). specificity a bridge. There will be at most 1 bridge between any pair of cities. In addition, **the input is sorted** by increasing X_i then Y_i. The above input for the city in both modes `A` and `B` will be **exactly** the same.

Then for mode `A`, a valid assignment will be given after the input of the city. The line contains N integers in $1, 2, \ldots 10$, where the i-th integer is the owner of the i-th city.

For mode `B`, the next line contains one integer L, the length of the the 01-sequence hint S outputted by mode `A`. The next line contains S.

Output

The output of mode `A` is a `01`-sequence S in one line, which will be part of the input of mode `B`.

The output of mode `B` should be a valid assignment of the cities. Output N integers in a single line. The i-th integer is the owner in $(1, 2, \ldots 10)$ of the i-th city . Notice that Bob's assignment can be different from Alex's, as long as it is valid.

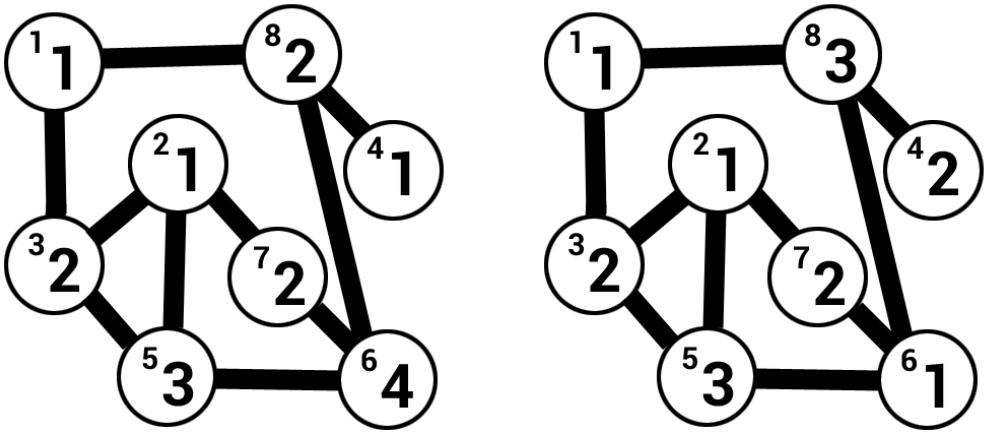
Sample test

Input of Mode A	Output of Mode A
A 8 10 1 3 1 8 2 3 2 5 2 7 3 5 4 8 5 6 6 7 6 8 1 1 2 1 3 4 2 2	01100011010001110

Input of Mode B	Output of Mode B
B 8 10 1 3 1 8 2 3 2 5 2 7 3 5 4 8 5 6 6 7 6 8 17 01100011010001110	1 1 2 2 3 1 2 3

Note: `01100011010001110` is only a sample to illustrate the format.

Explanation



Note

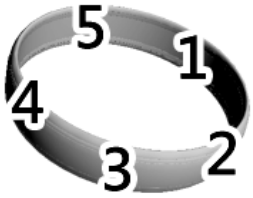
- Bridges may cross each other, but they do not connect since they are built in a 3-dimension world.
- During pretest, `OK` will be returned if you get a non-zero score for that pretest test case.
- This task is challenging.

Gene Mutation 2

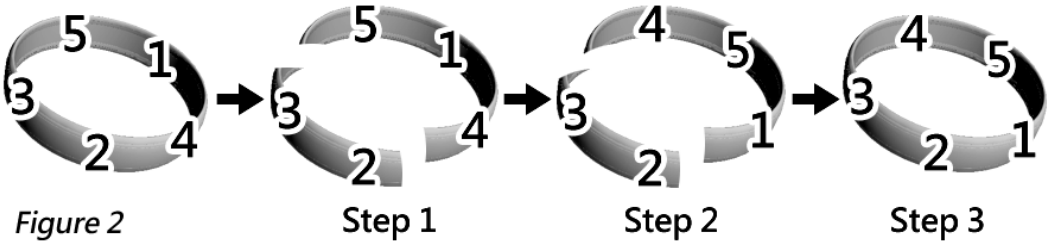
Time Limit: 1 second

Problem

Last year, Dr. Jones got The 'Mobel' Prize in Physiology or Medicine for his discovery 2 years ago about the mutation pattern from 'Supervirus' into 'Ultravirus'. For your information, 'Ultravirus' is a virus with a circular DNA inside, and the genes are represented by the integers from 1 to N in a clockwise, sorted, order. (Figure 1)



A patient was found yesterday to be infected by an unknown virus called 'Virus X', which also contains a circular DNA with N genes 1 to N arranged randomly. Like 'Supervirus', 'Virus X' can also be mutated into 'Ultravirus' by the following three steps (Figure 2):



1) Exactly 2 bonds are broken forming 2 strands of DNA.
2) The genes in each strands are rearranged by any means.
3) The 2 strands are joined together at the original breaking points.

Dr. Jones would like to know how many ways of breaking bonds that may allow 'Virus X' to be mutated into 'Ultravirus'.

Input

The first line is the integer N.
The second line has N integers, representing the order of the genes in the DNA of 'Virus X'.

Output

One integer only: the number of ways for 'Virus X' to break bonds so that 'Virus X' can be mutated into 'Ultravirus'.

Sample test 1

Input	Output
5 5 1 4 2 3	7

Sample test 2

Input	Output
5 4 2 3 5 1	7

Explanation for Sample Test 1

Here are the 7 ways: (Figure 3)

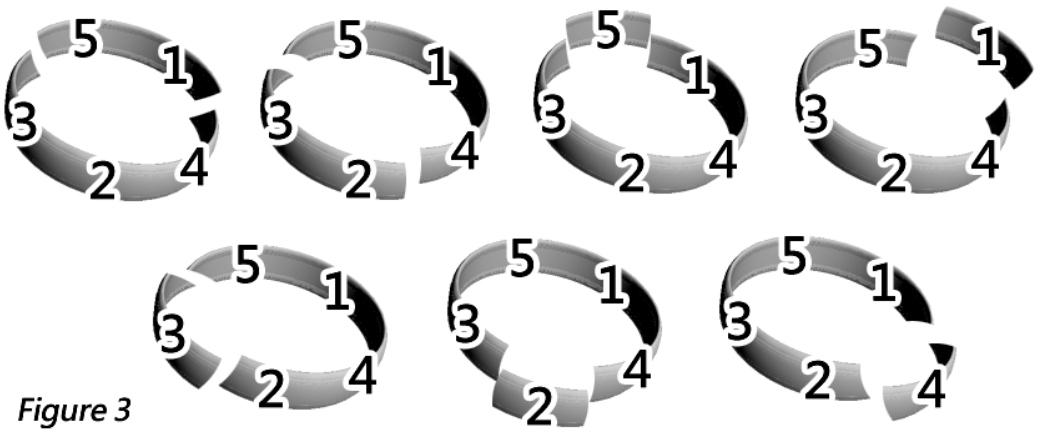


Figure 3

Constraints

In test cases worth 30% of the total points, $2 \leq N \leq 8$.
In test cases worth 50% of the total points, $2 \leq N \leq 500$.
In all test cases, $2 \leq N \leq 5000$.

Input Method

Time Limit: 1 seconds

Problem

Dr. Jones has just bought a new smartphone called the 'hkoiPhone'. He is not used to the touchscreen so he is trying to get familiar with it. It is very hard to type in smartphones due to small screen size. Mistypes happen very frequently. Some phones can automatically detect and correct those mistypes.

Interestingly, every time Dr. Jones types a word, he will always mistype exactly one letter, and no shorter or longer, and he will never type correctly. For example, for the correct word 'tomorrow', he may type 'tonorrow' or 'tomorroe' (etc.) but not 'tomottow', 'tomorral', 'tomorow' nor 'tomorrow' (same). However, the software of hkoiPhone is not advanced enough to handle this very special behaviour.

Therefore, being a research assistant of Dr. Jones, you want to write your own text input method to solve his problem. The method should store a list of correct, candidate words that he intends to type (we call this *dictionary*). After typing a message and before sending it out, the method should replace each of the words he has typed with the correct, corresponding ones.

Input

The first line contains two integers N and L, the number of words in the dictionary and the length of the words.
The next N lines consist of the words in the dictionary. Each word consists of lowercase letters only and is of length L. The words are given in alphabetical order.
The next line contains one integer W, the number of words in the sentence.
The next W lines consist of the words in the sentence. Each word consists of lowercase letters only, is of length L and satisfies the mistype behaviour for exactly one word in the dictionary.

Note

In the sample below, we are using actual English words. In the test cases, however, random generated synthetic words will be used. Nearly all the words and letters are generated independently and uniformly at random (the chance of each alphabet appearing is equal). The positions of the incorrect letter are also chosen independently and uniformly at random.

Output

Output W lines. The i-th line should contain the correct word of the i-th word in the sentence.

Sample test

Input	Output
6 8 computer hardware installs keyboard software speakers 4 conputer installa compuyer softwate	computer installs computer software

Constraints

For cases worth 50% of the total points, $1 \leq N, W \leq 2000, 6 \leq L \leq 20$.
For all cases, $1 \leq N, W \leq 20000, 6 \leq L \leq 50$.

Pharmaceutical Company

Time Limit: 1 second

Problem

A pharmaceutical company would like to produce a special drug.
Production of a drug is a very complicated process. But for simplicity, only 2 processes are considered: 1) synthesize the drug powder 2) capsule the powder. Two types of workers are hired. There are X workers to specialize in making the drug powder and Y workers to specialize in capsuling.

Due to limited capital, only 1 factory is rented, so the boss would like the X workers to use the factory to finish the powder synthesis part, and then the X workers would leave and let the capsuling be done by the Y workers.

Before each of the X workers starts, he/she needs Px units of time for preparation. The i-th worker ($1 \leq i \leq X$) needs Ta_i units of time for synthesizing the powder for 1 capsule. After synthesizing certain amount of powders, Qx units of time are needed for tidying up the factory before the Y workers come.

Similarly, each of the Y workers needs P_y units of time for preparation. The j-th worker ($1 \leq j \leq Y$) needs Tb_i units of time for making 1 completed capsule. After all powders are capsuled, Qy units of time are needed for tidying up the factory after a day of work.

Note that all workers do their jobs **simultaneously** once they enter into the factory.

For some unknown reasons, the boss is very mean to the Y workers. If they cannot capsule ALL the powder before the factory closes, they will be fired. Given that the factory opens for T units of time everyday, determine at which moment the 2 groups of workers should shift, so that the Y workers would not be fired and the number of capsules produced daily can be maximized.

Input

The first line contains 7 integers: T, X, Y, Px, Qx, Py, Qy. The second line contains X integers, Ta_i. ($1 \leq i \leq X$) The third line contains Y integers, Tb_j. ($1 \leq j \leq Y$)

Output

The first line contains an integer that represents which unit of time (counting from when the factory opens) the 2 groups should shift The second line contains an integer which is the maximum number of capsules produced daily. If there are multiple solutions that can maximize the number of capsules, output the earliest time for the shift.

Sample test

Input	Output
20 2 3 1 1 1 1 2 3 1 1 1	14 10

Input	Output
10 2 1 1 1 1 2 1 1 2	3 2

Explanation

Among the 20 units of time, 14 is for synthesis of powder and 6 is for capsuling. For the first 14 units of time, each of the 2 workers needs 1 unit of time for preparation. The 1st worker uses 12 units of time to synthesize powder for 6 capsules, and at the same time, the 2nd one can synthesize powder for 4 capsules. Therefore 6+4=10 capsules in total. The remaining 1 unit of time is for tidying up the factory. ($14 = 1 + 12 + 1$) For

capsuling, $6 = 1 + 4 + 1$. 4 units of time allow the 3 workers to make 12 completed capsules, more than enough for the amount of powder produced.

Constraints

In test cases worth 50% of the total points, $1 \leq T, Ta_i, Tb_j, Px, Qx, Py, Qy \leq 1,000$, $1 \leq X, Y \leq 100$
In all test cases, $1 \leq T, Ta_i, Tb_j, Px, Qx, Py, Qy \leq 10^9$, $1 \leq X, Y \leq 100,000$.

Hints

64-bit integer types may be needed.