Hong Kong Olympiad in Informatics 2013
Senior Group

Task Overview

Task	CPU time limit	Score
Enumeration	1 second	50
Bacteria Research	1 second	100
Safe Storage	1 second	100
TB	2 seconds	100
Unfair Santa Claus	1 second	100

Notice:
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.

Enumeration

Time Limit: 1 second

Problem

Write a program to read an integer N and output $N(N+5)/2$ 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.
In the i-th line, the first two integers on each line are 1 and 1, followed by i integers, each of them is the sum of the two integers on its left.

Sample test

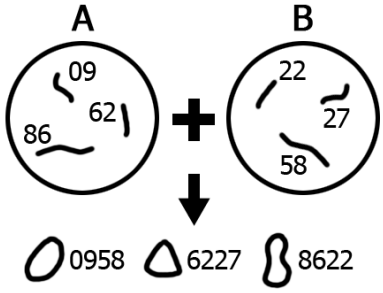
Input	Output
4	1 1 2 1 1 2 3 1 1 2 3 5 1 1 2 3 5 8

Bacteria Research

Time Limit: 1 second

Problem

Dr Jones is doing research on the effect when genes combine together to form new bacteria. There are exactly N genes in each of two groups (A and B), and each gene is represented by a two digit number from 00 to 99. The same gene may appear in both group and appear more than once. A new bacteria is formed by joining one gene from Group A with another gene from the Group B, so that the bacteria will carry a 4-digit number *aabb*, where *aa* is the gene number from Group A and *bb* is the gene number of Group B. Therefore, when Dr Jones put the genes together, exactly N bacteria will form.



There are many possible outcomes as the process is random. However, the bacteria are particularly powerful and dangerous overall when the *greatest common divisor* of them is large. Dr Jones wants to obtain the most powerful bacteria for research purpose, so he asked you to write a program to find out the maximum possible *greatest common divisor*, and how he should manually combine the genes.

The *greatest common divisor* of one or more integers is the largest positive integer that divides all the numbers.

Input

The first line contains the single integer N.
The second and third line each contains N integers, the gene numbers of Group A and Group B respectively. The $2N$ numbers are **not** all 00.

Output

The first line is the maximum greatest common divisor of the N bacteria. The next N lines are the numbers of the N bacteria in any order. You may output the numbers with or without leading zeros. If there is more than one solution, output any of them.

Sample test

Input	Output
3 09 62 86 22 27 58	479 0958 6227 8622

Input	Output
5 99 19 39 79 59 95 98 97 96 99	1999 1999 3998 9995 5997 7996

Constraints

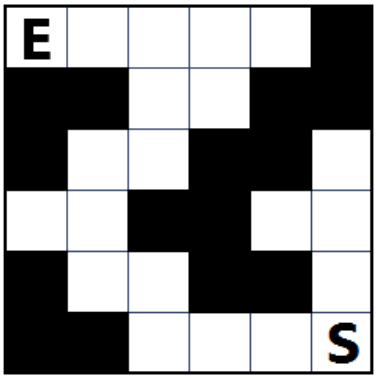
In test cases worth 30% of the total points, $1 \leq N \leq 10$.
In test cases worth 50% of the total points, $1 \leq N \leq 100$.
In test cases worth 65% of the total points, the maximum possible *greatest common divisor* is at least 100.
In all test cases, $1 \leq N \leq 50000$.

Safe Storage

Time Limit: 1 second

Problem

After getting the powerful bacteria, Dr Jones wants to store them in a safe. The room is a N by N grid with empty cells and walls. The entrance and the safe must be located at two different corners of the room. From the entrance, Dr Jones can move to an adjacent empty cell each step. The *distance* between two grids is the minimum number of steps required in to travel between them. Below is an example of a 6×6 room with distance between entrance and safe = 12:



The place is equipped with security alarms, so that when any intruders broke in, the alarm will set off. However, if the distance between the safe and the entrance is too short, the intruder may have enough time to flee before the police arrive. At the same time, since Dr Jones will have to access the safe quite often, he do not want them placed too far as well. He is most comfortable when the *distance* is as close as possible to D. Please help Dr Jones design the room layout.

Input

Integer N and D in a single line.

Output

A N by N room describing the maze according to the format:
`E` : Entrance
`S` : Safe
`.` : Empty grid
`#` : Wall

Sample test

Input	Output
6 14	E..... #.###. ..#... .#..## .#.... ...#.S

Input	Output
3 4	..E .#. S..

Scoring

Per test case, let S be the full score of that test case. Let d be the absolute difference between D and the *distance* your output maze. Your score s is defined by:

$$s = \begin{cases} S & \text{if } d \leq 1 \\ 0.5S(1 - \frac{d}{N}) & \text{if } 1 < d < N \\ 0 & \text{if } d \geq N \end{cases}$$

The score for each test case will keep as floating point numbers, while the total points for this task will be rounded to the nearest integer.

Constraints

In test cases worth 20% of the total points, $N \leq 10$.
In test cases worth 50% of the total points, $N \leq 50$.
In all test cases, $2 \leq N \leq 1000$, $N - 1 \leq D \leq 0.5N^2$.

TB

Time Limit: 2 seconds

Problem

Tuberculosis(TB) is a disease. Dr Jones is inventing a new regimen (combination of medicine) for it. The regimen is combined by N groups of antibiotics where each group has M choices. He needs to select exactly one antibiotic from each group. Each antibiotic has a curing effect x and side effect y. It is better to have greater total curing effects and a lower maximum side effect. Let S be the multiset of antibiotic chosen. We can define the *risk index* of a regimen with the formula:

$$\frac{\max_{(x,y)\in S} y}{\sum_{(x,y)\in S} x}$$

In other words, the *risk index* is calculated by taking the maximum y among the antibiotics chosen and divided by sum of x among the antibiotics chosen.

There are too many possible combinations. You, being a research assistant of Dr Jones, will write a program to find out the best combination that has the **smallest** *risk index*.

Input

The first line consists of two integers N and M.
Each of the following N lines represent a group of antibiotics.
For the M pairs of integers in the line, the first integer is x and the second integer is y.

Output

Output the minimum *risk index*. Your answer will be considered correct if its absolute or relative error does not exceed 10^{-6}. You may output the number with or without trailing zeros.

Sample test

Input	Output
3 3 1 5 2 3 3 2 2 4 4 3 3 4 3 1 4 2 5 1	0.250000

Input	Output
4 3 3 1 4 1 5 9 2 6 5 3 5 8 9 7 9 3 2 3 8 4 6 2 6 4	0.125000

Explanation

In the first sample, if we take the third choice from groups 1 and 3, and the second choice from group 2, the *risk index* would be $\max(2,3,1)/(3+4+5) = 0.25$.

Constraints

In test cases worth 50% of the total points, $M^N \leq 10,000,000$.
In test cases worth 70% of the total points, $N, M \leq 300$.
In all test cases, $2 \leq N, M \leq 2000$. All input numbers are positive integers at most 10000.

Unfair Santa Claus

Time Limit: 1 second

Problem

It is finally Christmas time and Dr Jones can finally take a rest. He decided to dress up as Santa Claus to visit his patients in the hospital (We call Dr Jones 'Santa Claus' from now on). He has brought N pieces of chocolate bars. Interestingly, the first piece has 1 bar, the second piece has 2 bars, and so on. That is, the i-th piece has i bars, where $i = 1, 2, ..., N$.

When he arrives, there are only two patients, Alice and Bob, in the ward since others took a leave for the festival. So, Santa Claus is going to distribute the chocolate bars among them. Initially, Alice and Bob got no chocolate bars. Santa Claus will take out the chocolate pieces one by one and give it to the one who currently has less total number of chocolate bars In case of Alice and Bob have the same amount of chocolate bars, he will give it to Alice.

For example, if $N = 4$ and Santa Claus take out the chocolate pieces in the order: $3, 4, 1, 2$. He will give the 3-bar piece, the 1-bar piece and the 2-bar piece to Alice and the 4-bar piece to Bob. Hence Alice will receive 6 bars in total and Bob will receive 4 bars in total after all.

Although the method he divides the chocolate seems fair, but Santa Claus wants to see what would happen if the results turned out to be unfair. That is, he is going to take out the chocolate pieces in a specific order to maximize the difference of total chocolate bars received by Alice than Bob. In the example above, the difference is $6 - 4 = 2$, but it is not the largest we can archive. You are going to help Santa Claus to find the best sequence. If there is more than one best sequence, you may output any of them.

Input

Integer N in a single line.

Output

N integers separated by spaces, the order of chocolate pieces that Santa Claus take out.

Sample test

Input	Output
4	2 3 1 4

Input	Output
6	6 1 3 4 2 5

Constraints

In test cases worth 25% of the total points, $1 \leq N \leq 15$.
In test cases worth 50% of the total points, $1 \leq N \leq 1000$.
In all test cases, $1 \leq N \leq 500000$.

Hints

The sum of chocolate bars may exceed $2^{31} - 1$.