105 學年度
全國大專電腦軟體設計競賽
台大校內初賽

National Taiwan University

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Language	Version	Compile Flags	Extensions
C	gcc 5.4.0	`-g -O2 -std=gnu99 -static -lm`	`.c`
C++	g++ 5.4.0	`-g -O2 -std=gnu++11 -static -lm`	`.cc, .cpp`
Java	javac 1.8.0	`-encoding UTF-8 -sourcepath . -d .`	`.java`

Problem	Problem Name	Time Limit	Memory Limit
A	LingYee	1 s	256 MB
B	A problem about Matrix Multiplication	2 s	1024 MB
C	Prime Permutations	2 s	256 MB
D	Palinworm	3 s	512 MB
E	Polycraft	1 s	256 MB
F	A Problem about pocky	1 s	256 MB
G	Elections	1 s	128 MB
H	4A0B	3 s	256 MB
I	A Problem Related to Simple Polygon	1 s	128 MB
J	Be Friends Again	4 s	256 MB

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A. LingYee

Problem ID: lingyee

LingYee is a curious baby!

The most interesting thing for LingYee is playing with 0(ling) and 1(yee). Since LingYee has played many kinds of ling-yee game, she is very similar to solving problems of bit strings in ACM.

For example, LingYee solved an easy problem yesterday described as follows:

Give you a bit string of length N, what is the longest continuous zeros(lings) in this bit string?

Of course, this problem is so easy for LingYee, so she decides to make this problem harder:

From all possible bit strings of length N, what is the expectation length of the longest continuous zeros(lings)?

LingYee challenges you if you can solve this harder problem!

Input

Input only contains one integer N, meaning has been described above.

- $1 \leq N \leq 3000$

Output

Output the expectation value.

If the expectation value is $\frac{A}{B}$, where $gcd(A, B) = 1$, please output $A \times B^{-1} \bmod 10^9 + 7$.

Sample Input 1	Sample Output 1
1	500000004

Sample Input 2	Sample Output 2
2	1

Sample Input 3	Sample Output 3
3	375000004

B. A problem about Matrix Multiplication

Problem ID: matrix

Sometimes you will see some irrational problems in Taiwan NCPC contest. Here will give you an example.

Given two HUGE matrix A and B. Please output the multiplication of $A \times B$.

Ha! Ha! It is irrational since everything is HUUUUUUGE.

To make this problem become possible (?), we will reduce the I/O size. Now, given four seed of a, b, c, d can generate the input matrix via Xorshift random number generator. You can see an implementation on Wikipedia.

Oh Oh! I forgot you can not access the network, so here is an implementation of Xorshift from Wikipedia:

```
uint32_t x, y, z, w;
uint32_t xorshift() {
    uint32_t t = x;
    t ^= t << 11;
    t ^= t >> 8;
    x = y; y = z; z = w;
    w ^= w >> 19;
    w ^= t;
    return w & ((1 << 24) - 1);
}
void getInputMatrix(
    int n, uint32_t matrix[][7000],
    uint32_t a, uint32_t b, uint32_t c, uint32_t d
) {
    x = a; y = b; z = c; w = d;
    for (int i = 0; i < n; ++i) {
        for (int j = 0; j < n; ++j) {
            A[i][j] = xorshift();
        }
    }
}
```

Also, you should pass your output matrix to a hash function. We will give you the other number p to do that. Here is the implementation of hash function.

```
const int MOD = 1000000007;
int hash(int n, long long matrix[][7000], int p) {
    long long v = 0;
    for (int i = 0; i < n; ++i) {
        for (int j = 0; j < n; ++j) {
            v *= p;
            v += matrix[i][j];
            v %= MOD;
        }
    }
    return v;
}
```

Input

Input only contains one line with ten integers n, A_a, A_b, A_c, A_d, B_a, B_b, B_c, B_d, p. Matrix A is constructed from applying n, A_a, A_b, A_c, A_d into `getInputMatrix()`. Matrix B is constructed from applying n, B_a, B_b, B_c, B_d into `getInputMatrix()`. p is for hash function.

- $1 \leq n \leq 7000$
- $1 \leq A_a, A_b, A_c, A_d, B_a, B_b, B_c, B_d < 2^{32}$
- $2 \leq p < 10^9 + 7$

Output

Please output one interger which is the result of $\text{hash}(n, A \times B, p)$.

Sample Input 1	Sample Output 1
1 2 3 4 5 6 7 8 9 10	50873769

Sample Input 2	Sample Output 2
2 3 4 5 6 7 8 9 10 11	891416296

Sample Input 3	Sample Output 3
7000 7001 7002 7003 7004 7005 7006 7007 7008 7009	276810293

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C. Prime Permutations

Problem ID: perime

You are a math genius.

You love primes.

You love permutations.

Given a positive integer n, we can define $p(n)$ as the set of integers which can be constructed by permuting the digits in n. For example, $p(112) = \{112, 121, 211\}$, and $p(100) = \{1, 10, 100\}$. You are now curious about what numbers in $p(n)$ are also prime numbers. A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself.

Input

The input contains exactly one line with a positive integer n.

- $1 \leq n \leq 10^9$

Output

Please output an integer m in the first line, which denotes the number of primes in $p(n)$. The following m lines should list that numbers, one per line, in ascending order.

Sample Input 1	Sample Output 1
217	2 127 271

Sample Input 2	Sample Output 2
31337	9 13337 17333 31337 33317 33713 37313 71333 73133 73331

D. Palinworm

Problem ID: palinworm

Stringworm is a mystery malware that only exists on Unix-like systems. Although it's a malware, it won't actually hurt your system except continuously consuming your storage by generating lots of plain text file, hence the name.

For years, it has been a nightmare for companies like Banonical and BlueHat since the worm is incredibly hard to eliminate. Once a node is infected, stringworm would have its replications spread all over the cluster. Furthermore, stringworms mutate so fast that any signature scanning mechanism hardly captures any one of them.

Geo-Cold, one of the top hacker on the earth, make up his mind to reveal the mechanism of stringworm, so that stringworm would no longer eat up all the space of his VPSes.

After 49 hours of hard work, Geo-Cold found that 87.122 percents of stringworm is just a bunch of instruction sequences used to replicate and hide its core, a modified old malware so called palinworm.

Palinworm is the first self-evolving worm on the world that has been long forgotten. Geo-Cold himself, fortunately, is one of the developers of palinworm, hence should be able to settle the worm easily, if palinworm had not evolved for such a long time. Palinworm has become very complex over years, the only thing remains the same is it would scans for palindromes on the system by a special rule, and make decisions based upon those palindromes.

In order to study the relationship between those palindromes and the actions that stringworm would take, Geo-Cold decides to set up a sandbox with plenty of plain text files and a stringworm. He would then simulate the palinworm to find out the palindromes stringworm uses and record all the system call that stringworm calls.

According to Geo-Cold's memory and observation, palinworm will keep a fixed list of strings S in itself used to rank palindromes. A palindrome P would have a rank equals to its length multiply by the number of strings in S that contains P. It would scan for **odd-palindromes** by reading all the plain text files one by one and concatenating those contents together one after another. And, every time it concatenates a new file onto the current result, it would take an action based upon the odd-palindrome substring of current result that has the highest rank.

However, the simulation must be fast enough to catch up the well-evolved stringworm. Which tends to be too hard for a hacker without solid ICPC background. May you help Geo-Cold?

Input

The input file contains multiple lines of lowercase letters and a line equals to "`---`" as a separator. All the lines before the separator is a string S_i in S and all the lines after that is a plain text file's content P_i. All files have been sorted by the order that palinworm would open.

- $\sum |S_i| \leq 3 \times 10^6$
- $\sum |P_i| \leq 3 \times 10^6$
- $1 \leq |S_i|, |P_i|$

Output

For every P_i, find the highest-ranked odd-palindrome in the concatenation result. You should output the starting position, ending position, and the number of strings in S containing that palindrome. If there is a tie, output the one with minimal starting position. If there's still a tie, output the one with minimal ending position. In order to minimize the output file, you should not output anything if the answer didn't change after concatenating P_i.

Note that all positions in output is 0-index.

Sample Input 1	Sample Output 1
abacaba abac a --- ca ba	1 1 3 1 3 2

Sample Input 2	Sample Output 2
aba b b --- a a b a	0 0 1 2 2 3 1 3 1

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E. Polycraft

Problem ID: polycraft

Your factory produces convex polyhedrons, which are composed of metal polygon plates. For convenient transportation, the products are sold in unfolded 2D nets and the customers have to fold them to 3D polyhedrons by themselves. Now given the required shape of a polyhedron, you have to design the corresponded net such that the perimeter is minimized to reduce the cost of reconstruction for customers.

Restrictions of the polyhedron and the net:

- The required polyhedron is convex and given in coordinates of vertices. No four vertices are on the same face.
- Any folding is unavailable. The net has to be fully unfolded.
- However, overlapping is available.
- On the final polyhedron, any seam on faces is ugly. Therefore, the boundary of the net must be edges of the polyhedron.

Input

The first line is an integer N, which is the number of vertices of the polyhedron. Then followed with N lines. Each line has three integers x_i, y_i, z_i, which indicate a vertex of the polyhedron.

- $4 \leq N \leq 300$
- $-10000 \leq x_i, y_i, z_i \leq 10000$

Output

Output a single floating-point number which is the perimeter of the net. Your answer will be considered correct if its relative error does not exceed 10^{-6}.

Sample Input 1	Sample Output 1
4 0 0 0 0 1 1 1 1 0 1 0 1	8.485281

Sample Input 2	Sample Output 2
4 10 0 0 0 1 0 0 0 0 0 0 1	24.00

F. A Problem about pocky

Problem ID: pocky

There are n boys and n girls in the social activity. One of the games they play is passing rubber band via pocky. Different from normal social activity game, there are only two teams, boys' team and girls' team.

The rule of the game is following,

1. Both teams have n vests numbered from 1 to n.
2. The opponent team will give an integer number sequence $a_1 \dots a_m$ of length m. All numbers will be in 1 to n (inclusive) and all adjacent numbers are not the same ($a_i \neq a_{i+1}$ for all $1 \leq i < m$).
3. After the opponent team giving the sequence, the other team starts to plan the vest wearing strategy. Notice that team members can not exchange the vests during the game.
4. When the game starts, the rubber band will be put on the pocky which is held in the mouth of the team member wearing vest numbered by a_1. Then, the team member wearing vest numbered by a_1 have to pass the rubber band to the pocky of the team member wearing vest numbered by a_2 without using hands, and so on. The game will end when the rubber band is passed $m-1$ times and is on the pocky of the team member wearing vest numbered by a_m.
5. The first team finished is the winning team.

Shiky is an algorithm master. He never loses in any strategy games. He believes that he will win this game just as same as before. He finds out that the larger height difference between two team members, the harder to pass rubber band between their pockys. Base on this observation, he defines the difficulty of passing rubber band as the absolute difference of the heights.

You are the leader of the opponent team of Shiky. You know Shiky has written a program to calculate the minimum possible sum of the difficulty of his team. Since you don't want to lose, you decide to write a program with the same function for your team.

PS: Since Shiky has a girlfriend, it will not work to seduce him to obtain the source code.

Input

There are two integers n and m in the first line. It indicates that there are n boys and n girls, and Shiky's team will give you a sequence of length m. There are n integers $h_1, h_2 \ldots, h_n$ in the second line indicating the heights of all members of your team. There are m integers $a_1, a_2 \ldots, a_m$ in the third line indicating the sequence given by Shiky's team.

- $1 \leq n \leq 20$
- $2 \leq m \leq 1000$
- $120 \leq h_i \leq 240$
- $1 \leq a_i \leq n$
- $a_i \neq a_{i+1}$ for all $1 \leq i \leq m - 1$

Output

Output an integer indicates the minimum possible sum of the difficulty of your team.

Sample Input 1	Sample Output 1
3 3 170 175 180 1 2 3	10

Sample Input 2	Sample Output 2
4 3 165 162 161 170 3 4 3	2

Sample Input 3	Sample Output 3
8 15 240 120 140 160 180 155 173 172 5 1 4 1 2 3 4 8 7 3 6 4 1 2 8	258

G. Elections

Problem ID: election

There are n islands and $2n-2$ bridges across these islands where each bridge connects two islands. Currently, there is a president election over these islands. Your camp, the Hilala camp decide to buy exactly $n-1$ bridges among these $2n-2$ bridges so that these n islands are connected using your camp's bridges. You will decorate these bridges so that your supporters can travel between any two islands by always using the bridges you have bought. However, you do very care about people who do not like your camp – they all support the other camp, the Trumpapa camp. Therefore, it is very nice of you to buy the bridges under the constraint that the remaining $n-1$ bridges also connecting all n islands together. So their supporters need not travel using any of your bridges.

What is the minimum cost you need to buy $n-1$ bridges?

Input

The first line contains an integer n, then $2n-2$ lines follows. Each of the following lines contains 3 integers u_i, v_i, w_i, indicating that there is a bridge connecting u_i and v_i and it costs you w_i million dollars to buy this bridge.

- $2 \leq n \leq 16$
- $1 \leq u_i, v_i \leq n$
- $1 \leq w_i \leq 10^6$

Output

Output the minimum cost, or "`impossible`" (without quotes) if it is impossible to do so.

Sample Input 1

```
2
1 2 3
1 2 4
```

Sample Output 1

```
3
```

Sample Input 2

```
5
1 2 3
2 3 4
3 4 5
4 5 6
1 3 7
3 5 2
5 2 8
2 4 3
```

Sample Output 2

```
12
```

Sample Input 3

```
3
1 2 3
2 3 5
1 2 7
1 2 8
```

Sample Output 3

```
impossible
```

H. 4A0B

Problem ID: guess

You are playing the following Bulls and Cows game with your friend, farmer John:

John writes down a four digits number without duplication and asks you to guess what the number is. Each time you make a guess, John provides a hint that indicates how many digits in said guess match the secret number exactly in both digit and position (called "bulls"), and how many digits match the secret number but locate in the wrong position (called "cows"). You will use successive guesses and hints to eventually derive the secret number. For example, if the secret number is 2514, and the guess is 1234, the hint would be 1 bulls and 2 cows. It's common to use a string in the form `0A0B` to represent a hint, like `1A2B` to denote 1 bull and 2 cows.

You and John decide to play 10000 games. If you can finish all games in no more than 54000 guesses, John will be impressed by your intelligence and give you an "Accepted".

Interaction

Your program should output each guess as a four digits number without duplication in one line. After making each guess, you need to make sure to flush standard output (like `fflush(stdout)` in C/C++). After each guess, there will be a hint to be read from standard input. The hint would be a line in the form `0A0B`.

Note that when you guess correctly, the hint would be `4A0B`, and the next game starts seamlessly, until you finish all 10000 games. After having guessed the right answer for 10000 times, your program should exit normally without any redundant output.

The secret numbers are generated randomly.

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I. A Problem Related to Simple Polygon

Problem ID: order

In order to let all teams be happy, NCPC always contains some very basic problems. Now it's an example:

Give you a simple polygon in either clockwise or counterclockwise order. Please answer me what order is it.

Input

The input contains $N+1$ lines. The first line contains one integer N, denoting the number of vertices of the simple polygon. In the following N lines, the i-th line contains two integers x_i, y_i denoting the i-th vertex in the simple polygon.

- $3 \leq N \leq 30$
- $-1000 \leq x_i, y_i \leq 1000$
- The area of this simple polygon is non-zero.

Output

If the simple polygon is given in clockwise order, print "`clockwise`" (without quotes) in one line. Otherwise, print "`counterclockwise`" (without quotes).

Sample Input 1	Sample Output 1
3 0 0 1 0 0 1	counterclockwise

Sample Input 2	Sample Output 2
3 0 0 0 1 1 0	clockwise

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J. Be Friends Again

Problem ID: loli

There are n lovely lolis in teacher LoliFarmer's class, numbered from 1 to n. Some pairs of them are direct friends, some pairs are not, and friendship is a bidirectional relationship. We say two lolis are indirect friends if there is a "loli path" between them. For example, if $(1, 2), (2, 3), (3, 4)$ are pairs of direct friends, then $(1, 4)$ is a pair of indirect friends.

The lolis are very shy, so a loli will only play with her friends, either direct friends or indirect friends are fine. As you can imagine, one might be happier if there are more people she can play with. So we define the happiness of i-th loli, $h(i)$, as the number of people willing to play with her in the class.

As a good teacher, LoliFarmer wants to know what's the total happiness $\sum_{i=1}^{n} h(i)$ of his class. But since the friendship is a dynamic relationship and may change as time goes on, it becomes a hard task. Please write a program to help LoliFarmer.

Input

The first line contains an integer n, denoting the number of lolis in LoliFarmer's class. The second line contains an integer m, denoting the number of times that the friendship is changed. Each of the following m lines contains two integers a_i, b_i, indicating that the friendship between them is changed. These changes are given in chronological order. Assume that nobody has friends in the beginning.

- $2 \leq n \leq 10^5$
- $1 \leq m \leq 5 \times 10^5$
- $1 \leq a_i, b_i \leq n$

Output

For each change, please output the total happiness $\sum_{i=1}^{n} h(i)$ of his class after that change in one line.

Sample Input 1	Sample Output 1
2 3 1 2 2 1 2 1	2 0 2

Sample Input 2	Sample Output 2
4 8 1 2 3 4 1 3 2 4 1 2 3 4 1 3 2 4	2 4 12 12 12 4 2 0