Belgium Algorithm Contest

Belgium Algorithm Contest
Round 1 - 2017

Do not open before the start of the contest.

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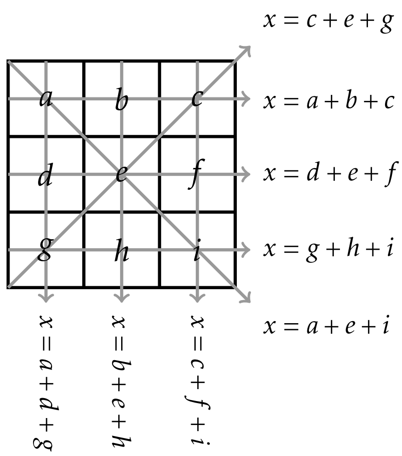
Belgium Algorithm Contest

Problem A
It's magic!
Time limit: 1s

Alice is on the train home after a long day of work. She wants to relax so she grabs the newspaper standing on the the next seat and starts reading it. After a while she gets bored and looks at the puzzle section. Annoyingly, there is only one puzzle left undone.

The puzzle consists of a 3×3 grid in which she has to place the numbers $1, 2, 3, 4, 5, 6, 7, 8, 9$ (one in each cell and each number must be used exactly once). The goal is to have every row, column and the two diagonals with the same sum, x.



Can you help her find **all** the solutions?

Input

This problem has no input.

Output

For each solution print a single line with 10 integers, $x, a, b, c, d, e, f, g, h, i$ separated by single spaces. The value of x should be the sum of every row, column and diagonals and the values of $a, b, \ldots, i$ should be the values in the cells as shown in the figure above.

The solutions **must** be sorted lexicographically. This means that they must be sorted by x and for the same value of x they must be sorted by a and for the same values of a, by b, and so on.

For example, imagine that

$$10, 2, 1, 4, 6, 3, 5, 7, 8, 9$$
$$10, 2, 1, 3, 4, 5, 6, 7, 8, 9$$
$$11, 1, 2, 3, 4, 5, 6, 7, 8, 9$$

are all the solutions. Then you must print:

```
10 2 1 3 4 5 6 7 8 9
10 2 1 4 6 3 5 7 8 9
11 1 2 3 4 5 6 7 8 9
```

Note that these are not valid solutions, it is just to explain the output format.

Belgium Algorithm Contest

Problem B
NP-complete
Time limit: 1s

Bob just came home from his algorithmic class with the following problem as homework:

Given a set of integers S and an integer t, write an algorithm that decides whether or not there exists a subset $X \subseteq S$ such that the sum of the elements of X is equal to t.

He has learned from his complexity class that this problem is NP-complete and therefore did not even bother giving it a try. Because you are a strong believer that just because a problem is NP-complete it does not mean we should not try to solve it, you decide to solve it yourself.

Input

The first line of the input contains a single integer n, the number of elements of S. The next line contains n integers $s_1, s_2, \ldots, s_n$ separated by single spaces giving the elements of S. The last line contains a single integer t, the target number.

Constraints

- $1 \leq s_i < 2^{63}$
- $0 \leq t < 2^{63}$
- $1 \leq n \leq 63$
- $s_i > s_1 + s_2 + \ldots + s_{i-1}$ for all $i = 2, \ldots, n$

Output

A single line with yes if such a subset exists or no otherwise.

Example

Input 1	Output 1
4 1 2 4 8 7	yes

Input 2	Output 2
4 1 3 5 10 7	no

Belgium Algorithm Contest

● Problem C
Teddybears
Time limit: 1s

Bob is at a fair and, as in any fair, there are a lot of games that allow him to win giant teddy bears. One game in particular catches his eye. There are n bins and each one of them corresponds to a different teddy bear. People can buy tickets and place them on the bin of their choice. At the end of the day one ticket will be picked **uniformly at random** from each bin. If Bob's ticket is selected, he will win the teddy bear corresponding to that bin.

After observing the game for some time, Bob counted that the i-th bin contains b_i tickets. He would like to know what is the probability of winning **at least one** teddy bear if he buys all of the k remaining tickets and places them optimally in the bins.

He decides to buy **all** k remaining tickets. Now he wonders where he should place his tickets in order to maximize his probability to gain **at least one** teddy bear.

Can you help him?

Input

The first line of the input contains a single integer n giving the number of bins. The next line contains n integers $b_1, \ldots, b_n$ separated by single spaces giving the number of tickets initially in each of the n bins. Finally follows a line with a single integer k, the number of tickets Bob has.

Constraints

- $1 \leq n \leq 3000$
- $0 \leq k \leq 500$
- $0 \leq b_i \leq 1000$

Output

A single line with the probability of winning at least one teddy bear if Bob places his tickets optimally. The output must be accurate to an absolute or relative error of at most 10^{-7}.

Example

Input 1	Output 1
4 1 1 1 1 4	0.9375

Input 2	Output 2
2 1 499 500	0.998004

Belgium Algorithm Contest

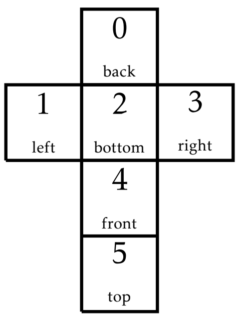
Problem D
Slice and dice
Time limit: 1s

Alice likes to collect colored cubes. Her little brother Craig is jealous of her beautiful collection so he decides to create his own. To do so, he bought a very big cube made of white material and k colors (all non-white). His process to create his collection is the following, starting with $i = 1$:

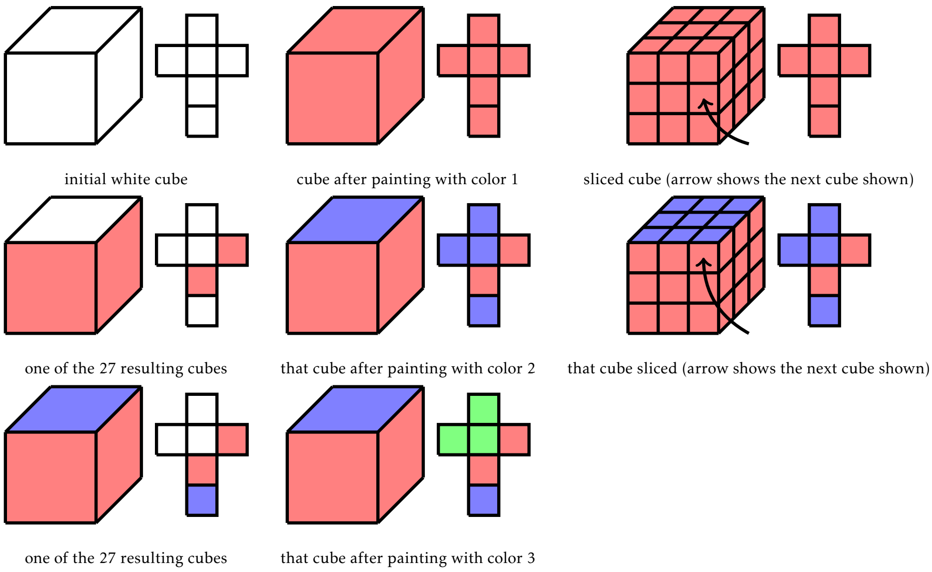
1. Paint the **white and visible** faces of the current cube with color i.
2. If $i + 1 \leq k$:
   (a) Slice the current cube into 27 smaller cubes by making two horizontal and vertical cuts.
   (b) For each of those cubes, repeat this process with $i = i + 1$.

Note that since the initial cube is made of white material, after slicing, the interior faces will be white. Also, at step $2(a)$ non-white faces keep their color.

To represent the colors on the faces of a cube more easily, we will use the following indexing of the flattened version of a cube (viewed from the top):



To better understand the procedure that Craig uses to create his cubes, consider the following figure which shows one of the 27^3 cubes that he can obtain with three colors ($k = 3$).



At the end of the day, after having created all his cubes, he mixed them with the cubes from his sister Alice by mistake. Now they need your help. **Thankfully none of Alice's cubes have a color pattern that could have been generated using Craig's process.**

Your task is to, given a cube, tell whether it belongs to Alice or Craig.

Input

The first line of the input contains a single integer k, representing the number of colors that Craig has. The next line contains 6 integers $c_1, c_2, \ldots c_6$ separated by single spaces representing the colors on the faces of the cube. The colors are given in the same order as above (back, left, bottom, right, front, top).

Constraints

1. $1 \leq k \leq 100$
2. $1 \leq c_i \leq 100$

Output

A single line with either `alice` if the cube belongs to Alice or `craig` otherwise.

Example

Input 1	Output 1
3 3 3 3 1 1 2	craig

Input 2	Output 2
2 1 1 2 1 2 1	alice

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Belgium Algorithm Contest

● Problem E
Graph seaquencing
Time limit: 3s

A sequence representation of an an undirected graph is a sequence $a_1 a_2 a_3 \ldots a_k$ of nodes of the graph such that:

- for each edge $\{x, y\}$ in the graph, there exists at least one i such that $\{a_i, a_{i+1}\} = \{x, y\}$;
- for each i, $\{a_i, a_{i+1}\}$ is an edge of the graph.

Given a graph, your task is to find the minimum length of a sequence representation of that graph.

Input

The first line of the input contains two integers n and m separated by a single space representing the number of nodes and edges of the graph, respectively. Then follow m lines each with two integers u and v meaning that nodes u and v are connected by an undirected edge.

There are no parallel edges and each edge is given at most once.

Constraints

- the graph has at most 20 nodes with an odd degree
- $2 \leq n \leq 60000$
- $1 \leq m \leq 200000$
- $0 \leq u, v < n$

Output

A single line with an integer k, the minimum length of a sequence representation of the given graph.

Example

Input 1

```
3 2
0 1
1 2
```

Output 1

```
3
```

Input 2

```
5 4
1 0
2 0
3 0
4 0
```

Output 2

```
7
```

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