A - 500 Yen Coins

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 100 points

Problem Statement

Takahashi has K 500-yen coins. (Yen is the currency of Japan.) If these coins add up to X yen or more, print `Yes`; otherwise, print `No`.

Constraints

- $1 \leq K \leq 100$
- $1 \leq X \leq 10^5$

Input

Input is given from Standard Input in the following format:

```
K X
```

Output

If the coins add up to X yen or more, print `Yes`; otherwise, print `No`.

Sample Input 1

```
2 900
```

Sample Output 1

```
Yes
```

Two 500-yen coins add up to 1000 yen, which is not less than $X = 900$ yen.

Sample Input 2

```
1 501
```

Sample Output 2

```
No
```

One 500-yen coin is worth 500 yen, which is less than $X = 501$ yen.

Sample Input 3

```
4 2000
```

Sample Output 3

```
Yes
```

Four 500-yen coins add up to 2000 yen, which is not less than $X = 2000$ yen.

B - Count ABC

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 200 points

Problem Statement

We have a string S of length N consisting of uppercase English letters.

How many times does `ABC` occur in S as contiguous subsequences (see Sample Inputs and Outputs)?

Constraints

- $3 \leq N \leq 50$
- S consists of uppercase English letters.

Input

Input is given from Standard Input in the following format:

N
S

Output

Print number of occurrences of `ABC` in S as contiguous subsequences.

Sample Input 1

```
10
ZABCDBABCQ
```

Sample Output 1

```
2
```

Two contiguous subsequences of S are equal to `ABC`: the 2-nd through 4-th characters, and the 7-th through 9-th characters.

Sample Input 2

```
19
THREEONEFOURONEFIVE
```

Sample Output 2

```
0
```

No contiguous subsequences of S are equal to `ABC`.

Sample Input 3

```
33
ABCCABCBABCCABACBCBBABCBCBCBCABCB
```

Sample Output 3

```
5
```

C - Count Order

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 300 points

Problem Statement

We have two permutations P and Q of size N (that is, P and Q are both rearrangements of $(1,\ 2,\ \ldots,\ N)$).

There are $N!$ possible permutations of size N. Among them, let P and Q be the a-th and b-th lexicographically smallest permutations, respectively. Find $|a - b|$.

Notes

For two sequences X and Y, X is said to be lexicographically smaller than Y if and only if there exists an integer k such that $X_i = Y_i\ (1 \leq i < k)$ and $X_k < Y_k$.

Constraints

- $2 \leq N \leq 8$
- P and Q are permutations of size N.

Input

Input is given from Standard Input in the following format:

N
$P_1 \ P_2 \ \ldots \ P_N$
$Q_1 \ Q_2 \ \ldots \ Q_N$

Output

Print $|a - b|$.

Sample Input 1

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

Sample Output 1

```
3
```

There are 6 permutations of size 3: $(1,\ 2,\ 3)$, $(1,\ 3,\ 2)$, $(2,\ 1,\ 3)$, $(2,\ 3,\ 1)$, $(3,\ 1,\ 2)$, and $(3,\ 2,\ 1)$. Among them, $(1,\ 3,\ 2)$ and $(3,\ 1,\ 2)$ come 2-nd and 5-th in lexicographical order, so the answer is $|2 - 5| = 3$.

Sample Input 2

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

Sample Output 2

```
17517
```

Sample Input 3

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

Sample Output 3

```
0
```

D - Semi Common Multiple

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 400 points

Problem Statement

Given are a sequence $A = a_1, a_2, \ldots\ldots a_N$ of N positive even numbers, and an integer M.

Let a *semi-common multiple* of A be a positive integer X that satisfies the following condition for every k $(1 \leq k \leq N)$:

- There exists a non-negative integer p such that $X = a_k \times (p + 0.5)$.

Find the number of semi-common multiples of A among the integers between 1 and M (inclusive).

Constraints

- $1 \leq N \leq 10^5$
- $1 \leq M \leq 10^9$
- $2 \leq a_i \leq 10^9$
- a_i is an even number.
- All values in input are integers.

Input

Input is given from Standard Input in the following format:

$N \ M$
$a_1 \ a_2 \ \ldots \ a_N$

Output

Print the number of semi-common multiples of A among the integers between 1 and M (inclusive).

Sample Input 1

```
2 50
6 10
```

Sample Output 1

```
2
```

- $15 = 6 \times 2.5$
- $15 = 10 \times 1.5$
- $45 = 6 \times 7.5$
- $45 = 10 \times 4.5$

Thus, 15 and 45 are semi-common multiples of A. There are no other semi-common multiples of A between 1 and 50, so the answer is 2.

Sample Input 2

```
3 100
14 22 40
```

Sample Output 2

```
0
```

The answer can be 0.

Sample Input 3

```
5 1000000000
6 6 2 6 2
```

Sample Output 3

```
166666667
```

E - Change a Little Bit

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 500 points

Problem Statement

For two sequences S and T of length N consisting of 0 and 1, let us define $f(S, T)$ as follows:

- Consider repeating the following operation on S so that S will be equal to T. $f(S, T)$ is the minimum possible total cost of those operations.
  - Change S_i (from 0 to 1 or vice versa). The cost of this operation is $D \times C_i$, where D is the number of integers j such that $S_j \neq T_j (1 \leq j \leq N)$ just before this change.

There are $2^N \times (2^N - 1)$ pairs (S, T) of different sequences of length N consisting of 0 and 1. Compute the sum of $f(S, T)$ over all of those pairs, modulo $(10^9 + 7)$.

Constraints

- $1 \leq N \leq 2 \times 10^5$
- $1 \leq C_i \leq 10^9$
- All values in input are integers.

Input

Input is given from Standard Input in the following format:

$$
\begin{array}{l} N \\ C_1 \quad C_2 \quad \cdots \quad C_N \end{array}
$$

Output

Print the sum of $f(S, T)$, modulo $(10^9 + 7)$.

Sample Input 1

```
1
1000000000
```

Sample Output 1

```
999999993
```

There are two pairs (S, T) of different sequences of length 2 consisting of 0 and 1, as follows:

- $S = (0), T = (1)$: by changing S_1 to 1, we can have $S = T$ at the cost of 1000000000, so $f(S, T) = 1000000000$.
- $S = (1), T = (0)$: by changing S_1 to 0, we can have $S = T$ at the cost of 1000000000, so $f(S, T) = 1000000000$.

The sum of these is 2000000000, and we should print it modulo $(10^9 + 7)$, that is, 999999993.

Sample Input 2

```
2
5 8
```

Sample Output 2

```
124
```

There are 12 pairs (S, T) of different sequences of length 3 consisting of 0 and 1, which include:

- $S = (0, 1), T = (1, 0)$

In this case, if we first change S_1 to 1 then change S_2 to 0, the total cost is $5 \times 2 + 8 = 18$. We cannot have $S = T$ at a smaller cost, so $f(S, T) = 18$.

Sample Input 3

```
5
52 67 72 25 79
```

Sample Output 3

```
269312
```

F - Xor Shift

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 600 points

Problem Statement

Given are two sequences $a = \{a_0, \ldots, a_{N-1}\}$ and $b = \{b_0, \ldots, b_{N-1}\}$ of N non-negative integers each.

Snuke will choose an integer k such that $0 \leq k < N$ and an integer x not less than 0, to make a new sequence of length N, $a' = \{a'_0, \ldots, a'_{N-1}\}$, as follows:

- $a'_i = a_{i+k \bmod N}\ XOR\ x$

Find all pairs (k, x) such that a' will be equal to b.

▶ What is XOR ?

Constraints

- $1 \leq N \leq 2 \times 10^5$
- $0 \leq a_i, b_i < 2^{30}$
- All values in input are integers.

Input

Input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \\
a_0 \quad a_1 \quad \ldots \quad a_{N-1} \\
b_0 \quad b_1 \quad \ldots \quad b_{N-1}
\end{array}
$$

Output

Print all pairs (k, x) such that a' and b will be equal, using one line for each pair, in ascending order of k (ascending order of x for pairs with the same k).

If there are no such pairs, the output should be empty.

Sample Input 1

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

Sample Output 1

```
1 3
```

If $(k, x) = (1, 3)$,

- $a'_0 = (a_1 \ XOR\ 3) = 1$
- $a'_1 = (a_2 \ XOR\ 3) = 2$
- $a'_2 = (a_0 \ XOR\ 3) = 3$

and we have $a' = b$.

Sample Input 2

```
5
0 0 0 0 0
2 2 2 2 2
```

Sample Output 2

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

Sample Input 3

```
6
0 1 3 7 6 4
1 5 4 6 2 3
```

Sample Output 3

```
2 2
5 5
```

Sample Input 4

```
2
1 2
0 0
```

Sample Output 4

```

```

No pairs may satisfy the condition.