# China Collegiate Programming Contest
# Guilin Site

*CCPC 2021*

## November 6 (Practice Session)


# Problems

A Random Permutation
B Game on Sequence
C Club Assignment

*Do not open before the contest has started.*

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# Problem A. Random Permutation

| | |
|---|---|
| Input file: | standard input |
| Output file: | standard output |
| Time limit: | 1 second |
| Memory limit: | 512 megabytes |

An integer sequence with length $n$, denoted by $a_1, a_2, \cdots, a_n$, is generated randomly, and the probability of being $1, 2, \cdots, n$ are all $\frac{1}{n}$ for each $a_i$ $(i = 1, 2, \cdots, n)$.

Your task is to calculate the expected number of permutations $p_1, p_2, \cdots, p_n$ from 1 to $n$ such that $p_i \leq a_i$ holds for each $i = 1, 2, \cdots, n$.

## Input

The only line contains an integer $n$ $(1 \leq n \leq 50)$.

## Output

Output the expected number of permutations satisfying the condition. Your answer is acceptable if its absolute or relative error does not exceed $10^{-9}$.

Formally speaking, suppose that your output is $x$ and the jury's answer is $y$. Your output is accepted if and only if $\frac{|x-y|}{\max(1,|y|)} \leq 10^{-9}$.

## Examples

| standard input |
|---|
| 2 |
| standard output |
| 1.000000000000 |

| standard input |
|---|
| 3 |
| standard output |
| 1.333333333333 |

| standard input |
|---|
| 50 |
| standard output |
| 1041476627629413109078130252775840208480134 30.758061352192 |

# Problem B. Game on Sequence

| | |
|---|---|
| Input file: | `standard input` |
| Output file: | `standard output` |
| Time limit: | 4 seconds |
| Memory limit: | 512 megabytes |

Grammy is playing a game with her roommate Alice on a sequence $A$ with $n$ non-negative integers $A_1, A_2, \ldots, A_n$. The rules of the game are described as follows.

1. They play the game by moving the single token on the sequence, initially the token is at position $k$.
2. Grammy takes the first move, and they take moves alternatively.
3. In any move with the token at position $i$, the current player must move the token to the next position $j$ such that $j > i$ and $A_j$ differs from $A_i$ on at most one bit in binary representation.
4. The player who can't make any legal move loses the game.

They play this game many times and the sequence can be modified many times. Grammy wants to ask you for some initial states who will win the game if both play optimally.

## Input

The first line of input contains 2 integers $n$ and $m$ ($1 \le n, m \le 200\,000$), denoting the length of the sequence and the number of operations.

The second line contains $n$ integers $A_1, A_2, \ldots, A_n$ ($0 \le A_i \le 255$), denoting the sequence $A$.

The next $m$ lines each contains 2 integers $op$ ($1 \le op \le 2$) and $k$, denoting each operation:

- $op = 1$ means a modification on the sequence. Grammy will append an integer $k$ ($0 \le k \le 255$) at the end of the sequence so the sequence becomes $A_1, A_2, \ldots, A_{N+1}$ where $N$ is the current length of the sequence before modification.
- $op = 2$ means a new game starts with the token at position $k$ ($1 \le k \le N$), where $N$ is the current length of the sequence. You need to predict the winner of this game.

## Output

For each operation with $op = 2$, output one line containing "`Grammy`" if Grammy will win, or "`Alice`" if Alice will win when they play optimally.

## Example

| standard input | standard output |
|---|---|
| 5 5<br>1 2 3 4 5<br>1 6<br>2 5<br>1 7<br>2 5<br>2 1 | Alice<br>Grammy<br>Alice |

# Problem C. Club Assignment

| | |
|---|---|
| Input file: | `standard input` |
| Output file: | `standard output` |
| Time limit: | 2 seconds |
| Memory limit: | 512 megabytes |

There are $n$ freshmen who failed to join any club, they decided to set up two new clubs by themselves. It is encouraged to make more new friends in the club, so they want an extreme "random" partition result.

Formally, the personality of the $i$-th freshman can be represented as a positive integer $w_i$, the similarity between two freshmen $A$ and $B$ can be measured as $w_A \oplus w_B$, where "$\oplus$" denotes the bitwise xor operation. Your task is to assign each freshman to either the new club 1 or the new club 2, such that the smallest value of similarity between two freshmen in the same club is maximized.

## Input

The input contains multiple cases. The first line of the input contains a single integer $T$ ($1 \le T \le 10\,000$), the number of cases.

For each case, the first line of the input contains an integer $n$ ($3 \le n \le 100\,000$), denoting the number of freshmen.

The second line contains $n$ integers $w_1, w_2, \ldots, w_n$ ($1 \le i \le n,\ 1 \le w_i \le 10^9$), denoting the personality of each freshman.

It is guaranteed that the sum of $n$ over all cases does not exceed 200 000.

## Output

For each case, print two lines. Print a single integer in the first line, denoting the smallest value of similarity between two freshmen in the same club in your solution. Then print $n$ digits in the second line, denoting the solution you find. If the $i$-th freshman is assigned to the first club, the $i$-th digit should be '`1`', and if the $i$-th freshman is assigned to the second club, the $i$-th digit should be '`2`'.

If there is more than one solution, any one of them will be accepted.

## Example

| standard input | standard output |
|---|---|
| 2<br>3<br>1 2 3<br>3<br>5 5 5 | 3<br>112<br>0<br>122 |