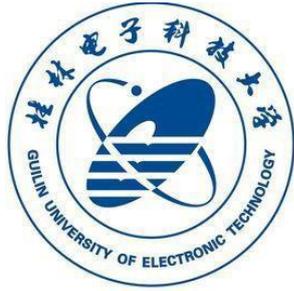


China Collegiate Programming Contest Guilin Site

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.

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, \dots, a_n , is generated randomly, and the probability of being $1, 2, \dots, n$ are all $\frac{1}{n}$ for each a_i ($i = 1, 2, \dots, n$).

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

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
104147662762941310907813025277584020848013430.758061352192

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, \dots, 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 ($1 \leq n, m \leq 200\,000$), denoting the length of the sequence and the number of operations.

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

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

- $op = 1$ means a modification on the sequence. Grammy will append an integer k ($0 \leq k \leq 255$) at the end of the sequence so the sequence becomes A_1, A_2, \dots, 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 ($1 \leq k \leq N$), 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	Alice
1 2 3 4 5	Grammy
1 6	Alice
2 5	
1 7	
2 5	
2 1	

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 ($1 \leq T \leq 10\,000$), the number of cases.

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

The second line contains n integers w_1, w_2, \dots, w_n ($1 \leq i \leq n, 1 \leq w_i \leq 10^9$), 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	3
3	112
1 2 3	0
3	122
5 5 5	