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Counter game

by dheeraj

Problem

Submissions

Leaderboard

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Editorial

Louise and Richard play a game. They have a counter set to N . Louise gets the first turn and the turns alternate thereafter. In the game, they perform the following operations.

- If N is not a power of 2 , reduce the counter by the largest power of 2 less than N .
- If N is a power of 2 , reduce the counter by half of N .
- The resultant value is the new N which is again used for subsequent operations.

The game ends when the counter reduces to 1 , i.e., $N == 1$, and the last person to make a valid move wins.

Given N , your task is to find the winner of the game.

Update If they set counter to 1 , Richard wins, because its Louise' turn and she cannot make a move.

Input Format

The first line contains an integer T , the number of testcases.
 T lines follow. Each line contains N , the initial number set in the counter.

Constraints

- $1 \leq T \leq 10$
- $1 \leq N \leq 2^{64} - 1$

Output Format

For each test case, print the winner's name in a new line. So if Louise wins the game, print "Louise". Otherwise, print "Richard". (Quotes are for clarity)

Sample Input

```
1
6
```

Sample Output

```
Richard
```

Explanation

- As 6 is not a power of 2 , Louise reduces the largest power of 2 less than 6 i.e., 4 , and hence the counter reduces to 2 .
- As 2 is a power of 2 , Richard reduces the counter by half of 2 i.e., 1 . Hence the counter reduces to 1 .

As we reach the terminating condition with $N == 1$, Richard wins the game.



Submissions: [15532](#)

Max Score: 30

Difficulty: Medium

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Current Buffer (saved locally, editable)  

C++  

```

1 #include <cmath>
2 #include <cstdio>
3 #include <vector>
4 #include <iostream>
5 #include <bitset>
6 #include <algorithm>
7 using namespace std;
8
9 template<size_t N>
10 bitset<N> subtract(bitset<N> a, bitset<N> b) {
11     bitset<N> result;
12     bool borrow = false;
13
14     for (int i = 0; i < N; i++) {
15         if (borrow && a[i]) {
16             borrow = false;
17             a[i] = 0;
18         }
19
20         if (b[i] > a[i]) {
21             borrow = true;
22             result[i] = 1;
23         } else {
24             result[i] = a[i] - b[i];
25         }
26     }
27
28     return result;
29 }
30
31 template<size_t N>
32 bitset<N> shift_right(bitset<N> a) {
33     bitset<N> result;
34
35     for (int i = 0; i < N-1; i++) {
36         result[i] = a[i+1];
37     }
38
39     return result;
40 }
41
42 template<size_t N>
43 bool is_power_of_two(bitset<N> a) {
44     int ones = 0;
45
46     for (int i = 0; i < N; i++) {
47         if (a[i]) {
48             ones++;
49         }
50
51         if (ones > 1) {
52             return false;
53         }
54     }
55
56     return true;
57 }
58
59 template<size_t N>
60 bitset<N> largest_power_of_two(bitset<N> a) {
61     bitset<N> result;
62     int ones = 0;
63
64     for (int i = N-1; i >= 0; i--) {
65         if (a[i]) {
66             result[i] = 1;
67             break;
68         }
69     }
70
71     return result;
72 }
73
74 template<size_t N>
75 bool is_one(bitset<N> a) {
76     for (int i = 1; i < N; i++) {
77         if (a[i]) {
78             return false;
79         }
80     }
81
82     return a[0] ? true : false;
83 }
84
85 string get_winner(uint64_t i) {
86     int player = 0;
87
88     bitset<65> bs(i);
89
90     while ( ! is_one(bs) ) {

```

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