Kick Start 2015 - Round A

Googol String

Problem

A "0/1 string" is a string in which every character is either `0` or `1`. There are two operations that can be performed on a 0/1 string:

- **switch**: Every `0` becomes `1` and every `1` becomes `0`. For example, "100" becomes "011".
- **reverse**: The string is reversed. For example, "100" becomes "001".

Consider this infinite sequence of 0/1 strings:

S_0 = ""

S_1 = "0"

S_2 = "001"

S_3 = "0010011"

S_4 = "001001100011011"

...

$S_N = S_{N-1}$ + "0" + **switch**(**reverse**(S_{N-1})).

You need to figure out the Kth character of S_{googol}, where googol = 10^{100}.

Input

The first line of the input gives the number of test cases, **T**. Each of the next **T** lines contains a number **K**.

Output

For each test case, output one line containing "Case #x: y", where x is the test case number (starting from 1) and y is the **K**th character of S_{googol}.

Limits

Time limit: 30 seconds per test set.
Memory limit: 1GB.
$1 \leq \mathbf{T} \leq 100$.

Small dataset (Test Set 1 - Visible)

$1 \leq \mathbf{K} \leq 10^5$.

Large dataset (Test Set 2 - Hidden)

$1 \le \mathbf{K} \le 10^{18}$.

Sample

Sample Input

```
4
1
2
3
10
```

Sample Output

```
Case #1: 0
Case #2: 0
Case #3: 1
Case #4: 0
```