Problem 6: Big Ben's Big Brain Bamboozles a Bovine
4+2+3=9 Points

Problem ID: `rotate`
Rank: `2+2+3`

Sponsored Bounty: $100 [X-Camp](#) Discount Code for **every member** of the first team to solve any test set of this problem and fill out this [Google Form](#)!
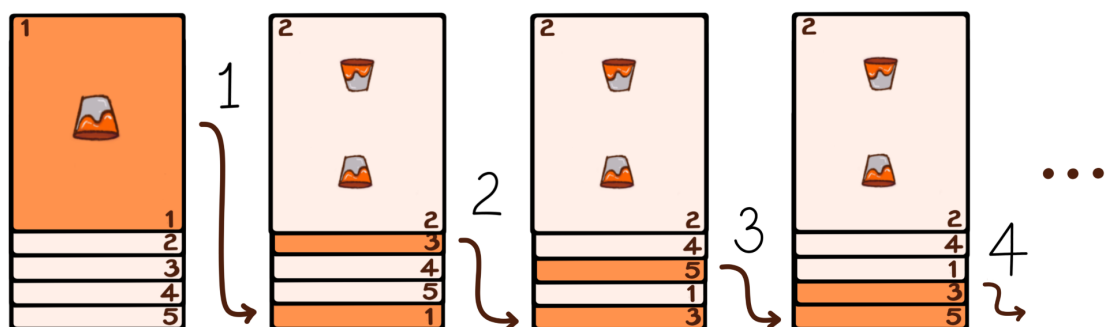
Introduction

In the bustling streets of Madrid stood a remarkable card dealer named El Gran Benjamín. Each of Benjamín's cards were imbued with magic, and his game was N Card Monte, a mystifying generalization of the classic [Three Card Monte](#). With a glint in his eye, Benjamín shuffled his deck, sliding cards with swift, practiced movements. His spectators were left in awe, trying to decipher the sequence in which the cards appeared. Eager to crack the secrets behind N Card Monte, Bessie the Cow embarks on a quest to unravel the patterns within Benjamín's shuffles.

Problem Statement

A deck of N cards is labeled with integers from 1 to N. Initially, they are sorted such that the top card is labeled 1 and the bottom card is labeled N. A shuffle is then performed on the deck:

1. Move the topmost card to the bottom of the deck. The deck now has a new ordering.
2. In the new ordering, move the second from topmost card to the bottom of the deck.
3. Then, move the third from topmost card to the bottom of the deck.
4. Continue this process until the bottom of the deck (and the order stops changing).

After the shuffle, find the position of the card labeled K. The topmost card is considered to be in position 1, the second from topmost in position 2, and so on. Here's an example with $N = 5$:

Input Format

The first line of the input contains a single integer T denoting the number of test cases that follow.

Each test case is described in a single line containing two space-separated integers N K denoting the number of cards in the deck and the card label we're looking for.

Output Format

For each test case, output a single line containing an integer denoting the position of the card labeled K, where the topmost card is in position 1, the second from topmost card is position 2, and so on.

Constraints

$1 \le T \le 100$

Main Test Set

$1 \le K \le N \le 100$

Bonus Test Set 1

$1 \le K \le N \le 10^6$
For this test set only, the sum of N across all test cases in a test file does not exceed 10^5.

Bonus Test Set 2

$1 \le K \le N \le 10^{18}$

Sample Test Cases

Main Sample Input   Download

```
6
1  1
5  1
5  2
6  3
6  4
98  57
```

Main Sample Output   Download
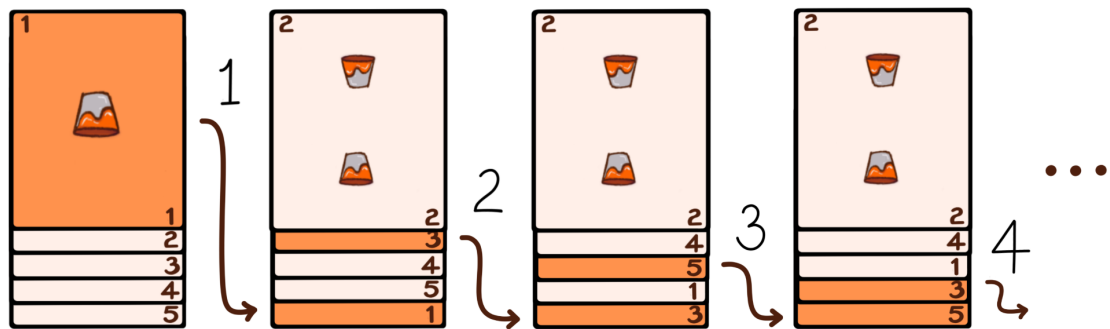
```
1
3
1
4
2
81
```
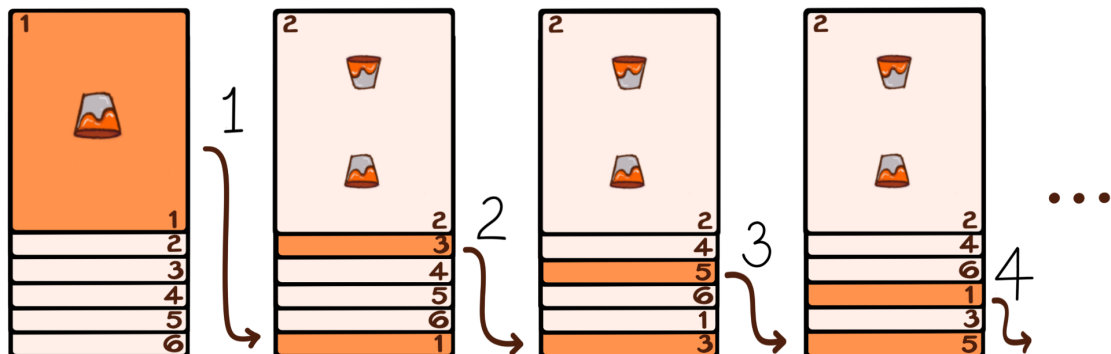
Main Sample Explanations

For test case #1, we only have 1 card. Shuffling does nothing, so the answer is 1 (the top card).

For test case #2, we have $N = 5$ cards and we're looking for the card labeled $K = 1$. After the first few steps of the shuffle process shown below, we see that the card labeled 1 is the third from topmost card.

For test case #3, we have 5 cards and we're looking for 2. As 2 is the top card, the answer is 1.

For test cases #4 and #5, the result of the few steps of the shuffle for 6 cards is shown below.

Bonus 1 Sample Input   Download

```
2
1337 420
6666 999
```

Bonus 1 Sample Output   Download

```
210
3583
```

Bonus 2 Sample Input   Download

```
1
31415926535897932 3846264338327950
```

Bonus 2 Sample Output   Download

```
1923132169163975
```