Shuffling Game

Antonio just learned about Kai's new method to shuffle a deck of cards and wants to develop a game from it. You probably know the shuffling procedure, but as a reminder, here it is: you have a deck of $m = 2^n$ cards for some integer $n > 0$, and you start by laying all the cards in a single row. Then you take the first card from the left, put it below the first row, as the left-most card of a second row; take the next card from the first row and put it on top of the first card in the second row; now you take the third card and move it to the right of the little pile of cards that you just created in the second row and put the fourth card from the first row on top of it. Continue this pattern until you have moved all the cards from the first row to the second row.

Now you keep shuffling from the second row in which you have $m/2$ piles of two cards each. Take the top card from the first pile and move it one row below, then take the top card from the second pile and move it on top of the first card on the row below, followed by the next card from the first pile, and then another card from the second pile. You just built a pile of four cards by shuffling the first two piles of two cards, by picking iteratively from the first and second pile. Do the same with the next pair of piles on the second row, and continue on until you have moved all the cards from the second to the third row.

In essence, you start from a row of piles of the same number of cards, and shuffle them in a row of half the number of piles, each with twice the number of cards. Continue this process until you are left with a single big pile.

Antonio turns this into a game. He chooses a bunch card from the original deck, and you must guess the position of each one of those cards in the shuffled deck.

Input

The first line contains two numbers: the non-negative integer $n \leq 60$ and the number $t \leq 100$ of cards selected by Antonio. Each of the following t lines contain the position p ($1 \leq p \leq 2^n$) of a card selected by Antonio in the original deck, where $p = 1$ and $p = 2^n$ indicate the left-most and right-most cards in the very first row, respectively.

Output

For each of the t cards selected by Antonio, a line containing the position of that card in the shuffled deck, where 1 indicates the top of the deck, and 2^n indicates the bottom.

Sample input 1

```
2 4
1
2
3
4
```

Sample output 1

```
2
4
1
3
```

Limits

Time limit is 1 seconds. Memory limit is 256 megabytes.