Day 6: Bitwise Operators



Objective

Today, we're practicing bitwise operations. Check the attached tutorial for more details.

Task

We define S to be a sequence of distinct sequential integers from 1 to n; in other words, $S = \{1, 2, 3, \ldots, n\}$. We want to know the maximum bitwise AND value of any two integers, a and b (where a < b), in sequence S that is also *less than a given integer*, k.

Complete the function in the editor so that given n and k, it returns the maximum a & b < k.

Note: The & symbol represents the bitwise AND operator.

Input Format

The first line contains an integer, q, denoting the number of function calls.

Each of the q subsequent lines defines a dataset for a function call in the form of two space-separated integers describing the respective values of n and k.

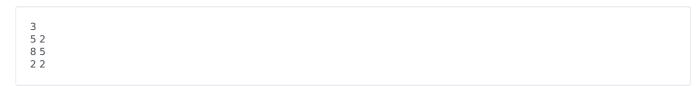
Constraints

- $1 \le q \le 10^3$
- $2 \le n \le 10^3$
- $2 \le k \le n$

Output Format

Return the maximum possible value of a & b < k for any a < b in sequence S.

Sample Input 0



Sample Output 0

```
1
4
0
```

Explanation 0

We perform the following q = 3 function calls:

1. When n=5 and k=2, we have the following possible a and b values in set $S=\{1,2,3,4,5\}$:

$$ab$$
 $a \& b$
 $12001 \& 010 = (000)_2 \Rightarrow (0)_{10}$
 $13001 \& 011 = (001)_2 \Rightarrow (1)_{10}$
 $14001 \& 100 = (000)_2 \Rightarrow (0)_{10}$
 $15001 \& 101 = (001)_2 \Rightarrow (1)_{10}$

```
23010 & 101 = (000)_2 \Rightarrow (0)_{10}^{10}
25010 & 101 = (000)_2 \Rightarrow (0)_{10}
34011 & 100 = (000)_2 \Rightarrow (0)_{10}
35011 & 101 = (001)_2 \Rightarrow (1)_{10}
45100 & 101 = (100)_2 \Rightarrow (4)_{10}
```

The maximum of any a & b that is also < k is 1, so we return 1.

- 2. When n=8 and k=5, the maximum of any a & b < k in set $S=\{1,2,3,4,5,6,7,8\}$ is 4 (see table above), so we return 4.
- 3. When n=2 and k=2, the maximum of any a & b < k in set $S=\{1,2\}$ is 0 (see table above), so we return 0.

Sample Input 1

```
2
9 2
8 3
```

Sample Output 1

```
1 2
```

Explanation 1

We perform the following q=2 function calls:

- 1. When n=9 and k=2, the maximum of any a & b < k in set $S=\{1,2,3,4,5,6,7,8,9\}$ is 1 (see table above), so we return 1.
- 2. When n=8 and k=3, the maximum of any a & b < k in set $S=\{1,2,3,4,5,6,7,8\}$ is 2 (see table above), so we return 2.