

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, $S = \{1, 2, 3, \dots, n\}$. 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

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

Output Format

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

Sample Input 0

```
3
5 2
8 5
2 2
```

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	$\& 011 = (010)_2 \Rightarrow (2)_{10}$
24010	$\& 100 = (000)_2 \Rightarrow (0)_{10}$
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**.