# Problem A. Rainbow Graph

| | |
|---|---|
| Input file: | `standard input` |
| Output file: | `standard output` |
| Time limit: | 10 seconds |
| Memory limit: | 1024 megabytes |

A graph without loops or multiple edges is known as a simple graph.

A vertex-colouring is an assignment of colours to each vertex of a graph. A proper vertex-colouring is a vertex-colouring in which no edge connects two identically coloured vertices.

A vertex-colouring with $n$ colours of an undirected simple graph is called an $n$-rainbow colouring if every colour appears once, and only once, on all the adjacent vertices of each vertex. Note that an $n$-rainbow colouring is not a proper colouring, since adjacent vertices may share the same colour.

An undirected simple graph is called an $n$-rainbow graph if the graph can admit at least one legal $n$-rainbow colouring. Two $n$-rainbow graphs $G$ and $H$ are called isomorphic if, between the sets of vertices in $G$ and $H$, a bijective mapping $f : V(G) \to V(H)$ exists such that two vertices in $G$ are adjacent if and only if their images in $H$ are adjacent.

Your task in this problem is to count the number of distinct non-isomorphic $n$-rainbow graphs having $2n$ vertices and report that number modulo a prime number $p$.

## Input

The input contains several test cases, and the first line contains a positive integer $T$ indicating the number of test cases which is up to 1000.

For each test case, the only line contains two integers $n$ and $p$ where $1 \le n \le 64$, $n + 1 \le p \le 2^{30}$ and $p$ is a prime.

We guarantee that the numbers of test cases satisfying $n \ge 16$, $n \ge 32$ and $n \ge 48$ are no larger than 200, 100 and 20 respectively.

## Output

For each test case, output a line containing "`Case #x: y`" (without quotes), where `x` is the test case number starting from 1, and `y` is the answer modulo $p$.

## Example

| standard input | standard output |
|---|---|
| 5<br>1 11059<br>2 729557<br>3 1461283<br>4 5299739<br>63 49121057 | Case #1: 1<br>Case #2: 1<br>Case #3: 2<br>Case #4: 3<br>Case #5: 5694570 |

## Note

If you came up with a solution such that the time complexity is asymptotic to $p(n)$, the number of partitions of $n$, or similar, you might want to know $p(16) = 231$, $p(32) = 8349$, $p(48) = 147273$ and $p(64) = 1741630$.

The following figures illustrate all the non-isomorphic rainbow graphs mentioned in the first four sample cases.

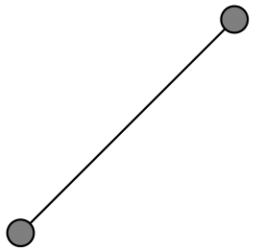

Figure 1: the non-isomorphic 1-rainbow graph with 2 vertices

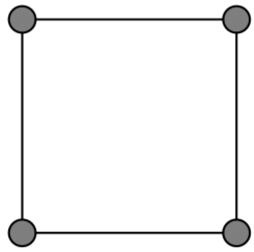

Figure 2: the non-isomorphic 2-rainbow graph with 4 vertices

Figure 3: the non-isomorphic 3-rainbow graphs with 6 vertices

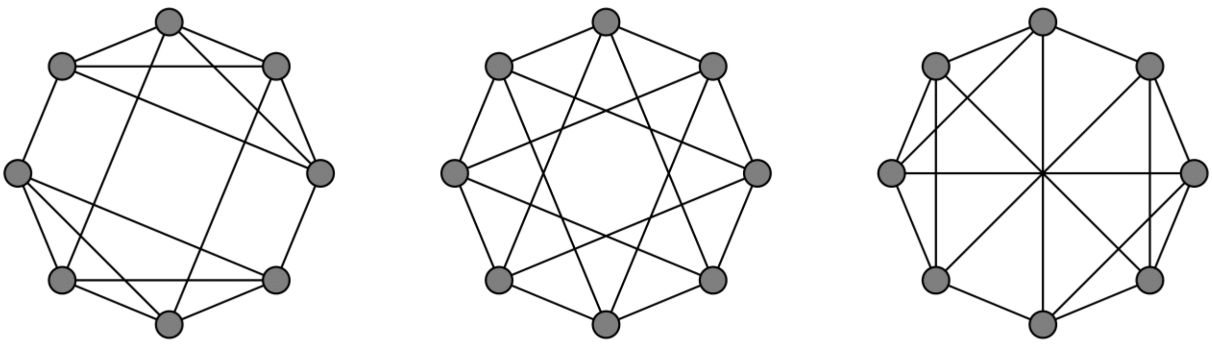

Figure 4: the non-isomorphic 4-rainbow graphs with 8 vertices