# E - Popcount Sum 3

Editorial (/contests/abc406/tasks/abc406_e/editorial)

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Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : $450$ points

## Problem Statement

You are given positive integers $N$ and $K$.

Find the **sum**, modulo $998244353$, of all positive integers $x$ that do not exceed $N$ and satisfy the following condition:

- the popcount of $x$ is exactly $K$.

You are given $T$ test cases; solve each of them.

▶ What is popcount?

## Constraints

- $1 \leq T \leq 100$
- $1 \leq N < 2^{60}$
- $1 \leq K \leq 60$
- $T$, $N$, and $K$ are integers.

## Input

The input is given from Standard Input in the following format:

$$
\begin{aligned}
&T\\
&\mathrm{case}_1\\
&\mathrm{case}_2\\
&\vdots\\
&\mathrm{case}_T
\end{aligned}
$$

$\mathrm{case}_i$ denotes the $i$-th test case. Each test case is given in the following format:

$$
N \quad K
$$

## Output

Output $T$ lines. The $i$-th line $(1 \leq i \leq T)$ should contain the answer for the $i$-th test case.

## Sample Input 1 Copy

```
2
20 2
1234567890 17
```

## Sample Output 1 Copy

```
100
382730918
```

For the first test case, there are nine positive integers not exceeding $20$ whose popcount is $2$: $3, 5, 6, 9, 10, 12, 17, 18, 20$. Their sum is $100$.

The remainder when $100$ is divided by $998244353$ is $100$, so output `100` on the first line.

Remember to output the sum modulo $998244353$.

/#telegram)

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