

Contest Duration: 2025-05-17(Sat) 22:00 (<http://www.timeanddate.com/worldclock/fixedtime.html?iso=20250517T2100&p1=248>) - 2025-05-17(Sat) 23:40 (<http://www.timeanddate.com/worldclock/fixedtime.html?iso=20250517T2240&p1=248>) (local time) (100 minutes)

[Back to Home \(/home\)](/home)

[🏠 Top \(/contests/abc406\)](/contests/abc406)

[📋 Tasks \(/contests/abc406/tasks\)](/contests/abc406/tasks)

[❓ Clarifications \(/contests/abc406/clarifications\)](/contests/abc406/clarifications)

[📊 Results ▼](#)

[🏆 Standings \(/contests/abc406/standings\)](/contests/abc406/standings)

[🏆 Virtual Standings \(/contests/abc406/standings/virtual\)](/contests/abc406/standings/virtual)

[📖 Editorial \(/contests/abc406/editorial\)](/contests/abc406/editorial)

[💬 Discuss \(https://codeforces.com/blog/entry/142913\)](https://codeforces.com/blog/entry/142913)



E - Popcount Sum 3

[Editorial \(/contests/abc406/tasks/abc406_e/editorial\)](/contests/abc406/tasks/abc406_e/editorial)



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:

2026-01-02 (Fri)
05:24:06 +11:00

T
case₁
case₂
⋮
case _{T}

case _{i} denotes the i -th test case. Each test case is given in the following format:

N 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
```

Copy

Sample Output 1

Copy

```
100
382730918
```

Copy

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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[Rule \(/contests/abc406/rules\)](/contests/abc406/rules) [Glossary \(/contests/abc406/glossary\)](/contests/abc406/glossary)

[Terms of service \(/tos\)](/tos) [Privacy Policy \(/privacy\)](/privacy) [Information Protection Policy \(/personal\)](/personal) [Company \(/company\)](/company)

[FAQ \(/faq\)](/faq) [Contact \(/contact\)](/contact)

