Travel Plan

时间限制：2s
内存限制：512MB

提交地址：https://www.luogu.com.cn/problem/CF1868C

题面翻译

给定一颗 n 个节点的完全二叉树，每个点有权值 $a_i \in [1,m]$，定义从 i 到 j 的路径的权值 $s_{i,j}$ 为路径上的最大点权。

求所有树（m^n 种点权）的 $\sum_{i=1}^{n}\sum_{j=i}^{n} s_{i,j}$ 的和，模 998244353。

题目描述

During the summer vacation after Zhongkao examination, Tom and Daniel are planning to go traveling.

There are n cities in their country, numbered from 1 to n. And the traffic system in the country is very special. For each city i ($1 \leq i \leq n$), there is

- a road between city i and $2i$, if $2i \leq n$;
- a road between city i and $2i+1$, if $2i+1 \leq n$.

Making a travel plan, Daniel chooses some integer value between 1 and m for each city, for the i-th city we denote it by a_i.

Let $s_{i,j}$ be the maximum value of cities in the simple † path between cities i and j. The score of the travel plan is $\sum_{i=1}^{n}\sum_{j=i}^{n} s_{i,j}$.

Tom wants to know the sum of scores of all possible travel plans. Daniel asks you to help him find it. You just need to tell him the answer modulo $998\,244\,353$.

† A simple path between cities x and y is a path between them that passes through each city at most once.

输入格式

The first line of input contains a single integer t ($1 \leq t \leq 200$) — the number of test cases. The description of test cases follows.

The only line of each test case contains two integers n and m ($1 \leq n \leq 10^{18}$, $1 \leq m \leq 10^5$) — the number of the cities and the maximum value of a city.

It is guaranteed that the sum of m over all test cases does not exceed 10^5.

输出格式

For each test case output one integer — the sum of scores of all possible travel plans, modulo $998\,244\,353$.

样例 #1

样例输入 #1

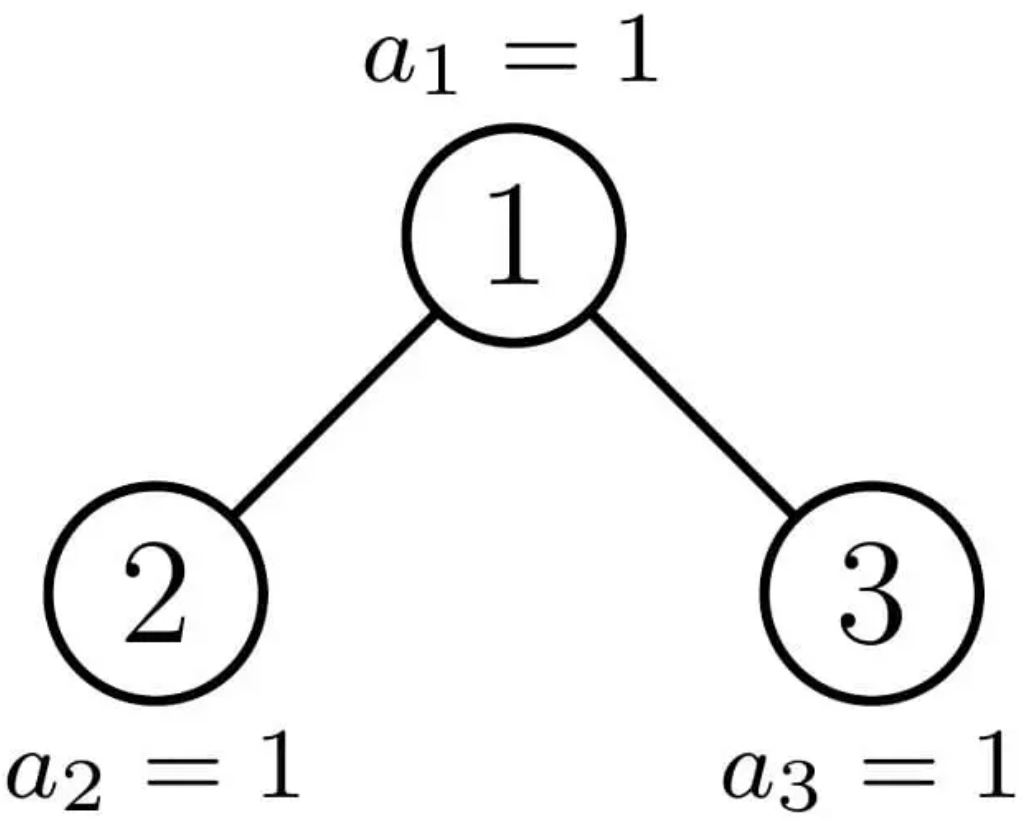
```
5
3 1
2 2
10 9
43 20
154 147
```

样例输出 #1

```
6
19
583217643
68816635
714002110
```

提示

In the first test case, there is only one possible travel plan:



Path $1 \to 1$: $s_{1,1} = a_1 = 1$.

Path $1 \to 2$: $s_{1,2} = \max(1, 1) = 1$.

Path $1 \to 3$: $s_{1,3} = \max(1, 1) = 1$.

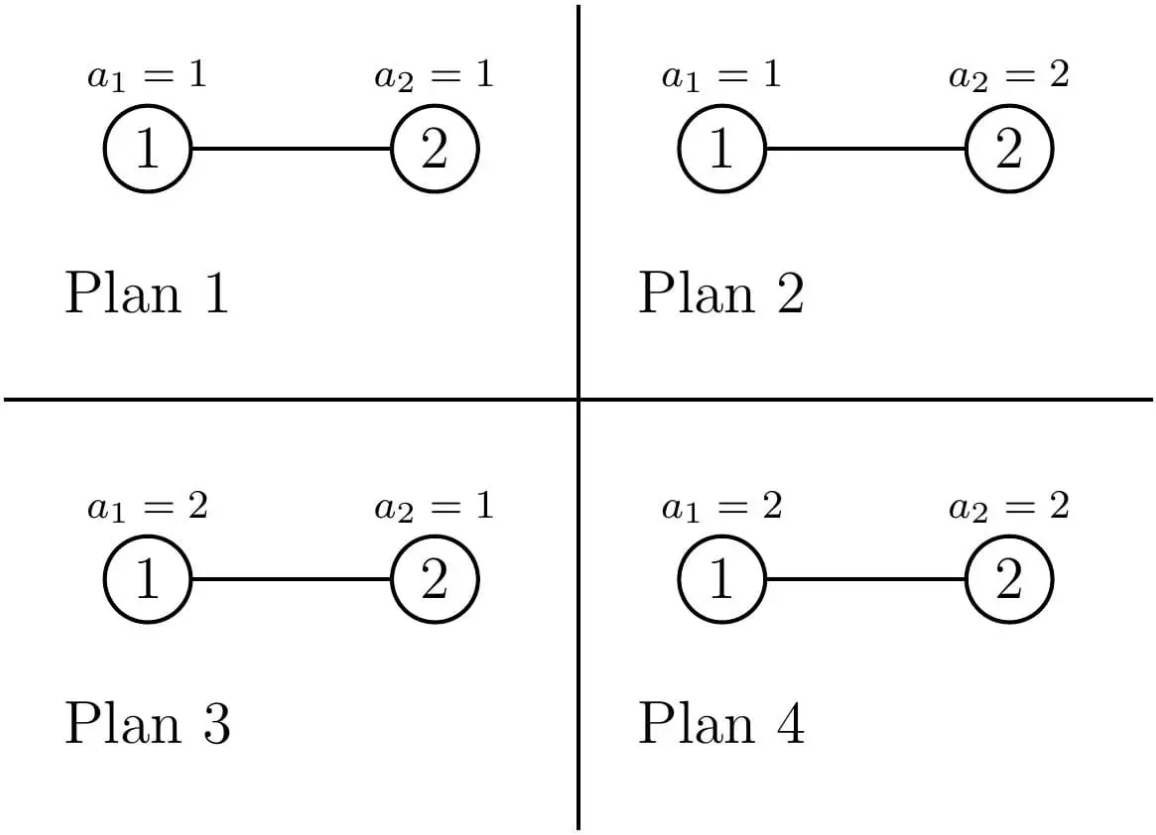
Path $2 \to 2$: $s_{2,2} = a_2 = 1$.

Path $2 \to 1 \to 3$: $s_{2,3} = \max(1, 1, 1) = 1$.

Path $3 \to 3$: $s_{3,3} = a_3 = 1$.

The score is $1 + 1 + 1 + 1 + 1 + 1 = 6$.

In the second test case, there are four possible travel plans:



Score of plan 1 : $1 + 1 + 1 = 3$.

Score of plan 2 : $1 + 2 + 2 = 5$.

Score of plan 3 : $2 + 2 + 1 = 5$.

Score of plan 4 : $2 + 2 + 2 = 6$.

Therefore, the sum of score is $3 + 5 + 5 + 6 = 19$.