NOI '23 P4 - Trade

Time limit: 1.5s **Memory limit:** 512M

In recent years, the commercial development in country A has been rapid, but the domestic road construction has not kept up with the pace, which has clearly become a restriction on people's trade and has caused great concern for the managers.

Specifically, there are $2^n - 1$ cities in country A, where city 1 is the capital. For all non-capital cities i, there is a single one-way road that starts from city i and reaches city $\lfloor \frac{i}{2} \rfloor$. For convenience, these roads are called "first-class roads", and the city $\lfloor \frac{i}{2} \rfloor$ is called the "superior city" of city i.

In addition, there are m **directed** roads, where the i-th road goes from city u_i to city v_i, and they all have a special property: starting from city v_i and continuously walking along the first-class roads towards the "superior city", one can always reach city u_i. These roads are called "second-class roads".

Each road has a corresponding length. Therefore, for any two cities x and y in country A, one can calculate the minimum value of the sum of the lengths of the roads passed through from city x to city y, and this value is denoted as $\mathrm{dist}(x, y)$. However, due to serious defects in the road construction in country A, it may be impossible to reach city y from city x. For convenience, $\mathrm{dist}(x, y)$ is defined as 0 in this case. At the same time, a city does not need to pass through any road to reach itself, so $\mathrm{dist}(x, x)$ is defined as0.

Now, the managers hope to calculate these $\mathrm{dist}(x, y)$ values in order to measure the convenience of people's trade. However, since there are too many cities in country A, listing all these values one by one is too time-consuming. Therefore, the managers only hope to find the sum of all $\mathrm{dist}(x, y)$ values, that is, $\sum_{i=1}^{2^n-1} \sum_{y=1}^{2^n-1} \mathrm{dist}(x, y)$, and they hope that you can help.

Since the answer may be very large, you only need to output the answer modulo 998244353.

Input Specification

The first line of input contains two positive integers n and m.

The second line of input contains $2^n - 2$ positive integers. The i-th integer a_i represents the length of the "first-class road" from city $i + 1$ to city $\lfloor \frac{i+1}{2} \rfloor$.

Then m lines follow, each containing three positive integers u, v and w, representing a "second-class road" from city u to city v with length w.

Output Specification

Output a line containing an integer, representing the answer, taken modulo 998244353.

Sample Input 1

```
2 1
2 1
1 2 2
```

Sample Output 1

```
8
```

Additional Samples

Sample inputs and outputs can be found here.

- Sample 2 (`ex_trade2.in` and `ex_trade2.ans`).
- Sample 3 (`ex_trade3.in` and `ex_trade3.ans`).
- Sample 4 (`ex_trade4.in` and `ex_trade4.ans`).

Constraints

For all test data, it is guaranteed that: $2 \le n \le 18, 1 \le m \le 2^n, 1 \le u, v \le 2^n - 1, 1 \le a_i, w \le 10^9$.

Test ID	n	m	Additional Constraints
$1 \sim 2$	$= 8$	≤ 256	None
$3 \sim 4$	$= 9$	≤ 512	
$5 \sim 8$	$= 12$	$\le 4\,096$	
9	$= 16$	≤ 10	
10		≤ 50	
11		≤ 100	
12		$\le 65\,536$	A
$13 \sim 15$			None
$16 \sim 17$	$= 18$	$\le 262\,144$	A
$18 \sim 20$			None

Additional Constraint A: It is guaranteed that every "second-class road" starts from the capital (city 1).