UTS Open '18 P6 - Subset Sum

Time limit: 1.0s **Memory limit:** 256M
Java: 3.0s

One day, **PlasmaVortex** gave **insect** a question to solve: the Subset Sum Problem! However, **insect** proved that it was NP-complete, so **PlasmaVortex** makes up a new problem about subset sums:

Each of the 2^N $(1 \leq N \leq 18)$ subsets of the set $\{1, 2, \ldots, N\}$ has an N-bit identifier s, where the i^{th} bit $(1 \leq i \leq N)$ of s is 1 if the set contains i, and 0 if the set doesn't contain i. Each set also has a value V_s $(0 \leq s < 2^N, 1 \leq V_s \leq 10^6)$. There are Q queries that come in two different types:

1. `1 s v` The set whose N-bit identifier is s has its value changed to v. $(0 \leq s < 2^N, 1 \leq v \leq 10^6)$
2. `2 a b` Let A and B be the sets with identifiers a and b $(0 \leq a, b < 2^N)$. Output the sum of the values of all sets X such that $A \subseteq X \subseteq B$. (Output 0 if there are no such sets X).

Help **insect** solve this modified subset sum problem!

Input Specification

The first line contains N and Q. $(1 \leq N \leq 18, 1 \leq Q \leq 10^5)$

The next line contains $V_0, V_1, V_2, \ldots, V_{2^N-1}$, the values of the 2^N subsets of $\{1, 2, \ldots, N\}$.
$(1 \leq V_0, V_1, V_2, \ldots, V_{2^N-1} \leq 10^6)$

Each of the next Q lines contains a query in the format specified above.

Output Specification

Output the answer to each type 2 query on a separate line.

Constraints

Subtask 1 [20%]

$1 \leq N \leq 10$

Subtask 2 [30%]

$a = 0$ for all type 2 queries.

Subtask 3 [50%]

No additional constraints.

Sample Input

```
3 4
1 1 2 3 5 8 13 21
2 4 7
2 1 2
1 3 7
2 1 3
```

Sample Output

```
47
0
8
```

Explanation for Sample Output

In the first query, $a = 4 = 100_2$ and $b = 7 = 111_2$ correspond to sets $A = \{1\}$ and $B = \{1, 2, 3\}$. There are 4 possible sets X that satisfy $A \subseteq X \subseteq B$, which are $\{1\}, \{1, 2\}, \{1, 3\}, \{1, 2, 3\}$, and the sum of their values is $5 + 13 + 8 + 21 = 47$.

In the second query, $a = 1 = 001_2$ and $b = 2 = 010_2$, so $A = \{3\}$ and $B = \{2\}$. No sets X satisfy $A \subseteq X \subseteq B$, so the answer is 0.

The third query changed the value of $\{2, 3\}$ to 7, and in the fourth query, the possible sets X with $A = \{3\} \subseteq X \subseteq \{2, 3\}$ are $X = \{3\}$ and $X = \{2, 3\}$. The sum of their values is $1 + 7 = 8$.