



## USACO 2023 JANUARY CONTEST, PLATINUM PROBLEM 2. MANA COLLECTION

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English (en) ▼

**\*\*Note:** The time limit for this problem is 5s, 2.5 times the default. The memory limit for this problem is 512MB, twice the default.\*\*

Bessie has recently taken an interest in magic and needs to collect mana for a very important spell. Bessie has  $N$  ( $1 \leq N \leq 18$ ) mana pools, the  $i$ th of which accumulates  $m_i$  mana per second ( $1 \leq m_i \leq 10^8$ ). The pools are linked by a collection of  $M$  ( $0 \leq M \leq N(N-1)$ ) directed edges  $(a_i, b_i, t_i)$ , meaning that she can travel from  $a_i$  to  $b_i$  in  $t_i$  seconds ( $1 \leq a_i, b_i \leq N$ ,  $a_i \neq b_i$ ,  $1 \leq t_i \leq 10^9$ ). Whenever Bessie is present at a pool, she can collect all the mana stored at that location, emptying it. At time 0, all mana pools are empty, and Bessie can select any pool to start at.

Answer  $Q$  ( $1 \leq Q \leq 2 \cdot 10^5$ ) queries, each specified by two integers  $s$  and  $e$  ( $1 \leq s \leq 10^9$ ,  $1 \leq e \leq N$ ). For each query, determine the maximum amount of mana Bessie can collect in  $s$  seconds if she must be at mana pool  $e$  at the end of the  $s$ th second.

### INPUT FORMAT (input arrives from the terminal / stdin):

First line contains  $N$  and  $M$ .

Next line contains  $m_1, m_2, \dots, m_N$ .

Next  $M$  lines contain  $a_i, b_i, t_i$ . No ordered pair  $(a_i, b_i)$  appears more than once in the input.

Next line contains  $Q$ .

Next  $Q$  lines contain two integers  $s$  and  $e$ .

### OUTPUT FORMAT (print output to the terminal / stdout):

$Q$  lines, one for each query.

### SAMPLE INPUT:

```
2 1
1 10
1 2 10
4
5 1
5 2
100 1
100 2
```

### SAMPLE OUTPUT:

```
5
50
100
1090
```

First query: Bessie takes 5 mana from pool 1 after 5 seconds.

Second query: Bessie takes 50 mana from pool 2 after 5 seconds.

Third query: Bessie takes 100 mana from pool 1 after 100 seconds.

Fourth query: Bessie takes 90 mana from pool 1 after 90 seconds and 1000 mana from pool 2 after 100 seconds.

Fourth query. Bessie takes 50 mana from post. 1 after 50 seconds and 1000 mana from post. 2 after 100 seconds.

**SAMPLE INPUT:**

```
4 8
50000000 100000000 20000000 70000000
1 2 20
2 1 50
2 3 90
1 3 40
3 1 10
4 1 25
1 4 5
4 3 70
3
8 3
1000000000 1
500000 4
```

**SAMPLE OUTPUT:**

```
160000000
239999988050000000
119992550000000
```

An example where Bessie is able to collect much larger amounts of mana.

**SCORING:**

- Inputs 3-4:  $N \leq 10, Q \leq 100$
- Inputs 5-9:  $N \leq 10$
- Inputs 10-14:  $Q \leq 100$
- Inputs 15-17:  $N = 16$
- Inputs 18-20:  $N = 17$
- Inputs 21-24: No additional constraints.

Problem credits: Benjamin Qi

Contest has ended. No further submissions allowed.