Problem E1: Commercial Operations - Easy

20 points

Problem | My Submissions

The Fantastic Bureau of Hilarious Algorithms and Cautious Kaizen (FB HACK) is paid for handling transactions between offices distributed throughout the world.

Offices are connected in a network that transactions are routed through. Edges in the network are not directed (transactions can flow in both directions) and are weighted with the cost of using that edge in the transaction. Customers pay FB HACK the cost along the minimal path for handling their transaction.

However, timing is everything: The cost on each edge in the graph **changes as a linear function of time**, i.e. the cost of sending a transaction between offices i and j that are connected by an edge in the network is:

$$A_{ij}t + B_{ij}$$

at time t and FB HACK is allowed to schedule customers' transactions at its own discretion. You work for FB HACK, and your job is to schedule transactions to **maximize FB HACK's profit** by scheduling transactions at the times when customers would pay most for them.

Note: at no time does any edge have a negative cost

Constraints

FB Hack is relatively small with few offices and edges, and only enough capacity to run transactions at the start of the hour.

$1 \leq N \leq 10$
$1 \leq M \leq 30$
$0 \leq t \leq 8$ and t is an integer

$1 \leq I_k < J_k \leq N$
$-100 \leq A_k \leq 100$
$0 \leq B_k \leq 10^6$
$A_k t + B_k \geq 0$

Input

Your input starts with two integers: N and M, the number of offices and edges respectively. Offices are numbered sequentially from 1 to N with 1 being the source office of the transaction and N being the destination office. M lines follow, describing edges in the network with the kth such line consisting of four integers:

$$I_k \ J_k \ A_k \ B_k$$

describing an edge between office I_k and J_k with cost $A_k t + B_k$ at time t.

There is at most one connection between each pair of FB HACK offices, and there is at least one path between the source FB HACK office and the destination FB HACK office.

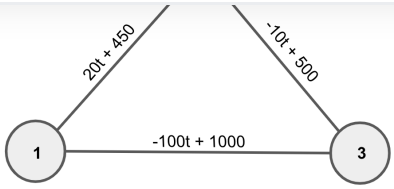
Output

Output a **single integer**, the maximum total fee that FB HACK can collect within the time range.

Explanation of Sample

FB HACK offices consist of office 1, office 2 and office 3 with 1 being the source office and 3 being the destination office.

- It costs:
  - $20t$ + 450 to send a transaction between office 1 and office 2
  - -$100t$ + 1000 to send a transaction between office 1 and office 3
  - -$10t$ + 500 to send a transaction between office 2 and office 3.



- t = 0 is the best time since the minimum cost in that case is 950 (1→ 2 → 3)
- t = 1 would yield a minimum of 900 (1→ 3)
- for all $t > 0$ the cost between offices 1 and 3 is < 950, so 950 is the answer.

Sample Input

```
3 3
1 2 20 450
1 3 -100 1000
2 3 -10 500
```

Sample Output

```
950
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