July 2025 CSE 208: Data Structure and Algorithms II Sessional

Assignment 1: Single Source Shortest Path Algorithms

Department of Computer Science and Engineering
Bangladesh University of Engineering and Technology

December 2025

Problem 1: Cheapest Route with One Coupon

You are analyzing a global flight network centered around Dhaka (DAC).

A traveler wants to fly from Syrjälä International Terminal Hazrat Shahjalal International Airport to London Heathrow Airport. Each flight between countries has a fixed ticket price. The traveler has one international discount coupon that can be used to halve the cost of any one flight in the journey. (If the cost is x, it becomes $\lfloor x/2 \rfloor$)

You are given a list of international flights with their prices. Find the minimum possible travel cost from Dhaka to London.

Input

The first input line has two integers *n* and *m*, the number of airports and flight connections. The cities are numbered *1,2,…,n*. Airport *1* is Hazrat Shahjalal International Airport, and airport *n* is London Heathrow Airport.

After this there are m lines describing the flights. Each line has three integers *a*, *b*, and *c*: a flight begins at city *a*, ends at city *b*, and its price is *c*. Each flight is unidirectional.

You can assume that it is always possible to get from Dhaka to London.

Output

Print one integer: the price of the cheapest route from Dhaka and London.

Constraints

- $2 \le n \le 10^5$
- $1 \le m \le 10^5$
- $1 \le a, b \le n$
- $1 \le c \le 10^9$

Input	Output
3 4 1 2 3 2 3 1 1 3 7 2 1 5	2

Problem 2 — Detecting a Negative Cycle

You are given a directed graph. Using the Bellman–Ford algorithm, detect whether the network contains a negative cycle.

If negative cycle exists, print any negative cycle.

Input

The first input line has two integers n and m, the number of nodes (numbered *1,2,....,n*) and edges. Then, there are m lines describing the edges. Each line has three integers *a*, *b*, and *c*: directed edge from *a* to *b* with cost *c*.

Output

If there is no negative cycle, print *-1*. Otherwise, print the vertices of the cycle in correct order.

Constraints

- $2 \le n \le 10^5$
- $1 \le m \le 10^5$
- $1 \le a, b \le$ n
- $1 \le c \le 10^9$

Input	Output
6 7 1 2 3 2 3 4 1 4 2 2 4 5 4 5 -1 6 3 -2 5 2 3	-1
6 7 1 2 3 2 3 4 1 4 2 2 4 5 4 5 -10 6 3 -2 5 2 3	2 4 5
8 10 1 2 3 2 3 4 1 4 2 2 4 5 4 5 -1 6 3 -2 5 2 3 6 8 1 8 7 1 7 6 -4	6 8 7

In case of printing cycle order, for example in input 2, 2 4 5, 4 5 2, 5 2 4 all are okay but 2 5 4 is not okay.

Important instructions

- Submit only two source code files for the two problems.You can use any language of your choice.
- **Do not copy. Any proof of copy will result in -100%.**
- **Submission Deadline: 11.55 PM, 14th December 2025**
- For any queries, you can contact me at **amsrumi@gmail.com**, **rumi@teacher.cse.buet.ac.bd**

Marks distribution

Task	Marks
Problem 1	12
Problem 2	8
Total	**20**