



HUST

ĐẠI HỌC BÁCH KHOA HÀ NỘI
HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY

ONE LOVE. ONE FUTURE.



ĐẠI HỌC
BÁCH KHOA HÀ NỘI
HANOI UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Applied Algorithm Lab

Bus inter-city

ONE LOVE. ONE FUTURE.

- There are n city: $1, 2, \dots, n$.
 - Between 2 cities, there may exist a **bidirectional road** connecting them.
 - Each city i has a **bus route i** with:
 - **$C[i]$** : The fare required each time a passenger boards the bus.
 - **$D[i]$** : The maximum number of cities the bus can travel through in a single journey using the connected roads.
- **Objective**: Find a path from city 1 to city n with lowest cost.
- **Input**: n, m (#roads), $\{C(1), D(1)\}, \dots, \{C(n), D(n)\}$, the set of roads
- **Output**: The minimum cost of the path

- Example

Input

6 6
10 2
30 1
50 1
20 3
30 1
20 1
1 2
1 3
1 5
2 4
2 5
4 6

Output

30

Explain: the path found from
city 1 to city 6 with
mimimum cost is

On bus from city 1 -> city 4
cost \$10

On bus from city 4 -> city 6
cost \$20

Total cost: $\$10 + \$20 = \$30$

- Idea to solve: Use Dijkstra algorithm on a new cost graph
 - Build **cost graph**: A graph with same node set but edge (u,v) means we can go on bus from u to go to v , cost $c(u,v) = C[u]$, $\text{dist}[u][v] \leq D[u]$
 - Use BFS(u) with a depth limitation
 - Run Dijkstra from node 1 to find min cost path to city n



HUST

THANK YOU !