Interplanetary Communication Network Challenge

Difficulty: Medium

Tagline: Optimize energy cost for Earth-Mars communication

Problem Statement:

The year is 2150, and humanity has established colonies on Mars. Our mission is to design the most efficient interplanetary communication network between Earth and Mars colonies. Each colony needs to connect to at least one colony on the other planet, while minimizing the total energy cost.

You are given two groups of points: Earth colonies (Group 1) with N points, and Mars colonies (Group 2) with M points, where $N \geq M$. The cost of connections between colonies is given in an N x M matrix. cost[i][j] represents the energy required to connect the *i-th* Earth colony to the *j-th* Mars colony.

Your task is to find the minimum total energy cost to connect all colonies, ensuring each colony on both planets is part of the network.

Input Format:

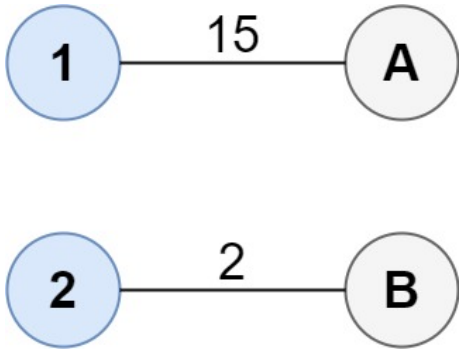
- The first line contains two integers, N (number of Earth colonies) and M (number of Mars colonies).
- The next N lines contain M integers each, representing the energy cost matrix cost[i][j].

Constraints:

- $1 \leq N, M \leq 12$
- $N \geq M$
- $0 \leq cost[i][j] \leq 100$

Output Format:

- Print the minimum total energy cost required to connect all colonies



Sample Input 0

2 2

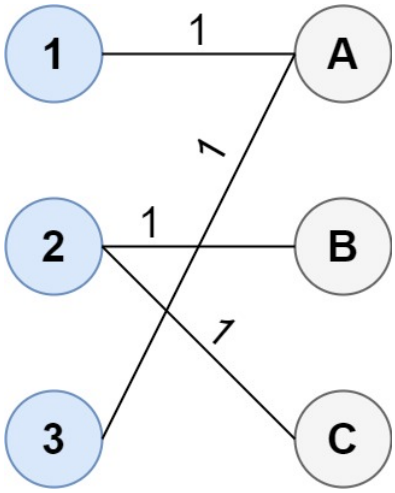
15 96

36 2

Sample Output 0

17

Explanation: Earth has 2 colonies (1, 2), Mars has 2 colonies (A, B). Cost matrix: [[15, 96], [36, 2]]. Optimal connections: 1--A, 2--B. Minimum total cost: 17



Sample Input 1:

3 3

1 3 5

4 1 1

1 5 3

Sample Output 1:

4

Explanation: Earth has 3 colonies (1, 2, 3), Mars has 3 colonies (A, B, C). Cost matrix: [[1, 3, 5], [4, 1, 1], [1, 5, 3]]. Optimal connections: 1--A, 2--B, 2--C, 3--A. Minimum total cost: 4

Sample Input 2:

5 3

2 5 1

3 4 7

8 1 2

6 2 4

3 8 8

Sample Output 2:

10

Explanation: The optimal connections minimize the total energy cost, resulting in a total of 10.