Assignment-8

Maximum Flow: Toy Exchange

Toy Exchange

- During the pre-puja bonanza, a toy company has put **m** different types (numbered from 1 to **m**) of Disney toys in their hot-selling RC cars. You can find the Disney toy only after you have bought a RC car and opened the box. Sumana just loves toy company's cars and the Disney toys, and wants to collect as many different Disney toys as possible.

- So Sumana tries to trade some of the toys she has with her **n** friends to get toys that she does not have. Any of Sumana's friends (say X) will trade a toy with Sumana if and only if X has a duplicate of that toy, and Sumana gives X a toy X does not have. Moreover, Sumana's friends are not as crazy as Sumana about collecting toys, so they don't exchange any toys among themselves; they just exchange with Sumana to make her happy.

Toy Exchange

- Sumana is clever and has realized that in some cases it might be good to exchange a Disney toy she has for another toy of a type she already possesses, or trade off a toy even if she has only one copy of it. Given that Sumana knows exactly how many toys of each type each of her friends has, can you help her find the maximum number of different Disney toys that she can get by trading toys with her friends?
- **Input:**
- The first line contains the value of **m** ($0 < \mathbf{m} \leq 25$) and **n** ($0 < \mathbf{n} \leq 25$).
- The second line contains **m** integers, with the j-th integer indicating the number of toys of type j that Sumana has.
- This is followed by **n** lines, one for each of Sumana's **n** friends. Each of these lines contains **m** integers, with the j-th integer indicating the number of toys of type j possessed by that friend. Note that Sumana or a friend may not possess any toy of a particular type, in which case that number will be 0.
- **Output:** Print the maximum number of Disney toys Sumana can collect.

Toy Exchange: Input and Output

- Input :

  3 1
  3 0 0
  1 3 3

- Output : 1
- Input :

  4 2
  3 3 0 0
  0 0 3 0
  1 1 0 2

- Output : 4

Submission

- Last date: 3-NOV-2024 (till 11:59 P.M.) (Sunday)
- Programming language: C/C++
- Single File: 24CS06001_A8.c/.cpp or 24AI06001_A8.c/.cpp
- Subject Line: 24CS06001_A8 or 24AI06001_A8
- Email to: pds2016autumn@gmail.com

Network flow graph: Vertices

- Graph has n+m+1 nodes
- 0-th node represents Sumana (the source node)
- 1-st to m-th nodes represent m different toys available
- (m+1)-th (m+n-1)-th nodes represent n-1 different friends of Sumana
- (m+n)-th node represents dummy sink node.

Network flow graph: Directed Edges and their Weights

- 0 to i (where i is 1 to m) : Number of i-th toys that Sumana has.
- j (where j is m+1 to m+n-1) to i (where i is 1 to m) : (Number of i-th toys that j has) - 1. (if j th friend does have i-th toy more than 1)
- i (where i is 1 to m) to m+n : 1.
- i (where i is 1 to m) to j (where j is m+1 to m+n-1) : 1. (if j th friend does not have i-th toy)
- Solution: maxFlow(0, n+m) gives the maximum number of different toys Bob can get.