

# CSE 208 Offline 4

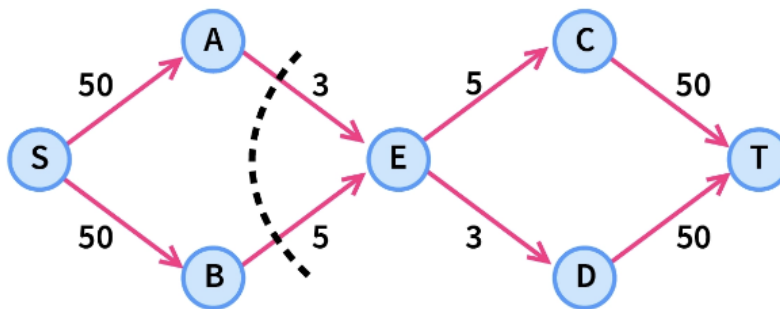
## Assignment on Max Flow

Deadline: 08 Jan, 2024 11:55pm

### Problem 1:

You're given a flow network  $G = (V, E)$ , source  $s$ , sink  $t$  and the capacities of every edge  $c(u, v)$ .

- (a) Find the max flow of the network and report the node that has max flow passing through it (max inflow and outflow except the source and the sink). For example in the below image node E has the max inflow and outflow which is 8.
- (b) Find the minimum cut and the capacity of the minimum cut using the Ford-Fulkerson method. For example the min cut of the flow network below is [ {S, A, B}, {E, C, D, T} ] and the min cut capacity is 8.



### Input:

The first line of input contains 2 integers  $N$  and  $M$  – denoting respectively the number of nodes and the number of edges.

The next  $M$  lines contain three integers  $u, v, c$  ( $1 \leq u, v \leq N$ ,  $1 \leq c \leq 100$ ) – denoting that there is an edge between nodes  $u$  and  $v$  and the edge has capacity  $c$ .

The next line contains two integers  $s$  and  $t$  – the source node and the sink node.

### Output:

- (a) Two comma separated integers ( $n\_max, f\_max$ ) representing the node which has the max flow passing through it and the value of the max flow through the node. If multiple such nodes exist, print any one.
- (b) The 1st line should print the min cut of the flow network in the format [ {s, v1, v2 ...} , {... v3, v4, t} ]. And the 2nd line should print the capacity of the min cut. In case of multiple min cuts, report any one.

(a) Sample input/output

Sample input	Sample output
6 9 1 2 16 1 3 13 3 2 4 2 4 12 3 5 14 4 3 9 5 4 7 4 6 20 5 6 4 1 6	4 19

(b) Sample input/output

Sample input	Sample output
6 9 1 2 16 1 3 13 3 2 4 2 4 12 3 5 14 4 3 9 5 4 7 4 6 20 5 6 4 1 6	[ {1, 2, 3}, {4, 5, 6} ] 23

## Problem 2:

Imagine you are the matchmaker for a matrimonial service. Your objective is to find the maximum matches possible based on certain criteria identified through their bio-data. After reading through all the bio-data you found the following criteria set by the candidates:

- No man will marry a woman if the gap in their heights exceeds 10 inches.
- No woman is willing to marry a man if the age difference surpasses 5 years.
- Both individuals must either be non-divorced or both divorced.
- Of course a single man can marry a single woman and vice versa.

Given the bio-data/information of a group of men and women, your task is to find the maximum matches possible between them. You can assume that all men and women are currently unmarried (never married or divorced).

### Input:

First line will contain two integers  $m, n$  ( $1 \leq m, n \leq 50$ ) denoting the number of men and women. Each of the next  $m$  lines will contain the information for a man, and each of the next  $n$  lines will contain the information for a woman. An information will contain three integers denoting the height in inches, age in years and 1 or 0 depending on if they are divorced or not respectively. Assume that Height will be between 50 and 80, age will be between 20 and 50.

### Output:

The maximum number of matches you can make.

Sample input	Sample output
2 2 70 30 0 60 20 0 71 25 0 71 35 0	1
2 2 70 30 0 60 20 0 70 25 0 70 35 0	2

Hint: Think of it as a bipartite graph where biodata of men is in one set and biodata of women is in another set. There is an edge between a man and a woman node if their criteria matches.

## **Marks Distribution**

### **Problem 1:**

- Implementing ford-fulkerson 50%
- Printing accurate output 50%

### **Problem 2:**

- Mapping the problem into flow network: 50%
- Finding the accurate result: 50%

## **Instructions:**

- (1) Please DO NOT COPY solutions from anywhere (your friends, seniors, internet etc.). Any form of plagiarism (irrespective of source or destination), will result in getting -100% marks in the online/offline.
- (2) Rename all the problem solutions according to your student ID. If your ID is 2105XXX, then create a folder named 2105XXX. Afterward, rename problem 1 as 2105XXX\_problem1.cpp, and similarly, rename the others. Next, move all the solutions inside the folder. Create a zip file of that folder. Lastly, submit the zip file.
- (3) You get 10 marks for each right answer. A viva will also be conducted. If the teacher finds that you don't know how to implement it, you'll get a score of 0.