# BRAC UNIVERSITY
## Department of Computer Science and Engineering

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| **Lab Final Examination** | CSE 221: Algorithms | **Semester**: Summer 2023 |
| **Duration**: 75 Minutes | Lab Section: 3 | **Full Marks**: 20 |
| **No. of Question(s)**: 1 | Set: 3B | **No. of Page(s)**: 2 |

| Name:<br><br>(Please write in CAPITAL LETTERS) | ID: | Obtained Marks: |
|---|---|---|

Answer the following question(s).

**Question 1: CO3,CO5,CO6 [20 Points]**

A parcel delivery company named “Third” is looking to establish some new delivery hubs. The company plans to create one hub for every well-connected area(s). There exists a L number of landmarks in the whole country and if some landmarks have direct or indirect connections to each other they form a well-connected area. For example: if landmark 1 has a road connecting to 2, 2 has a road connecting to 3 and there exists another road from 3 to 1 then 1, 2, 3 form a well connected area. Again, if 1 has a road to 4, another connection must exist from 4 to 1 or 2 or 3 for it to be a part of that connected area. Each of these roads is one-way hence, if there were only one road from 4 to 5 we cannot consider 5 to be a part of the same well-connected area. Your task is to find out the number of hubs that will be created in total and report to the finance department.

After your report, the finance department realized that there are not enough resources to fund all the hubs and so by some logic, they decided to only establish hubs in areas that have ODD landmarks. You need to find out which of these areas will have a new hub.

Tasks :

VII. Read input from input_3B.txt file. [1]

VIII. Build the Adjacency List(s). [4]

IX. Implementation of Main Algorithm. [7]

X. Counting the total number of well-connected areas these landmarks form [3]

XI. Determining the eligible areas that have an ODD number of landmarks [3]

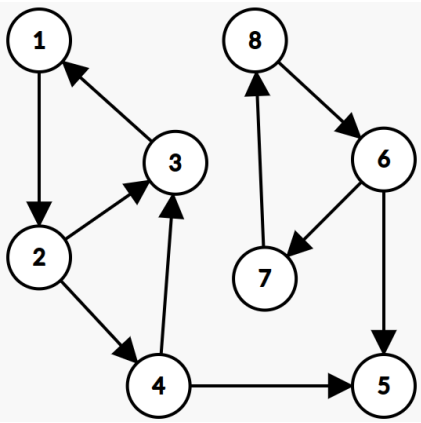
XII. Write output to output_3B.txt. [2]

Input

- The first line of input will give you the total L number of Landmarks and the total number of roads R between two landmarks.
- The next R lines of input will give you directed connections existing between two Landmarks.

Output

- The first part shows the total number of well-connected areas these landmarks form.
- The second part shows only the areas where new hubs will be created.

| Sample Graph | Sample Input | Sample Output |
|---|---|---|
|   | 8 10<br>1 2<br>4 3<br>2 3<br>2 4<br>3 1<br>4 5<br>6 5<br>6 7<br>7 8<br>8 6 | 3<br>678<br>5 |