**CSE221 - Lab Final Exam**

**Duration: 70 Minutes | Total Marks: 20**

Harry Potter was exploring the Forbidden Forest when he stumbled upon a mysterious stone. The stone turned out to be a map of the Wizarding World, a land full of magic and wonder. Harry was thrilled to visit this enchanting place.

The map showed an **undirected** graph of magical cities, numbered from ***1*** to ***N***, with ***M*** roads connecting them. The Wizarding World was known for its fast travel, where it took only **one unit** of time to move between any two cities.

Despite his magical abilities, Harry had never encountered such a map before and sought your help. Harry was curious to know how to solve the following problems:

1. Create a graph using an Adjacency List and show it.
2. Given a starting vertex ***A*** and a destination vertex ***Z***, calculate the minimum amount of time to reach vertex ***Z*** from ***A***.
3. If there are ***P*** forbidden cities, then find the shortest path from ***A*** to ***Z***. Forbidden means you can not go through those cities.
4. If there are ***Q*** mysterious cities that allow teleportation between any two mysterious cities with one unit of time, then find the minimum amount of time to reach vertex ***Z*** from ***A***.

**See the input output format for better understanding.**

| **Marks Distribution** | **Allocated Points** |
| --- | --- |
| Taking input from a text file | 2 points |
| Showing the output in a text file | 2 points |
| Making graph and show the adjacency list  *[* ***1*** *mark will be redacted if the output format doesn’t match.]* | 3 + 2 = 5 points |
| Correct Output B | 6 Points |
| Correct Output C | 3 points |
| Correct Output D | 2 Points |

**Input**

The first line contains two integers ***N*** and ***M*** (1 ≤ N ≤ 104, 1 ≤ M ≤ 106), which are the number of cities and the number of roads.

Then, ***M*** lines describe the roads on the map. The i-th of them contains two

integers ***ui*** and ***vi*** ( 1 ≤ ui,vi ≤ 106) which denote the endpoints of the roads. **Please note that the graph is undirected.**

After that, two integers are given ***A*** and ***B*** (1 ≤ A, B ≤ 106), which are the source and destination vertices respectively.

In the next line you will be given an integer value ***P*** (1 ≤ P ≤ N). The following line will contain ***P*** integers (1 ≤ Pi ≤ N) separated by a space, which denotes ***P*** forbidden vertices.

In the next line you will be given an integer value ***Q*** (1 ≤ K ≤ N). The following line will contain ***Q*** integers (1 ≤ Qi ≤ N) separated by a space, which denotes ***Q*** mysterious vertices.

**Output**

You should show four outputs.

**Output A:** Show the Adjacency List of the graph.

**Output B:** Print the minimum amount of time required to travel from A to B. It is guaranteed that there exists at least one path from A to B.

**Output C:** Considering the P forbidden vertices, find the shortest path from A to B. If it is not possible to reach A to B, print “Not possible”.

**Output D:** Find the minimum amount of time it will take to reach A to B considering the Q's mysterious vertices. It is guaranteed that there exists at least one path from A to B.

Please note, the Output C and Output D are not dependent on each other. For Output C, consider only the forbidden vertices, and for Output D, consider only the mysterious vertices.

**Sample Input Output**

**The ###” “### doesn’t appear in your input file. These lines are included so that you can understand the sample input more easily.**

| **Sample Input 1** | **Sample Output** |
| --- | --- |
| ### 13 vertices and 16 edges###  13 16  ### Next 16 lines represents the edges between u and v ###  1 2  2 4  12 11  8 7  4 5  5 8  4 6  8 6  1 3  7 4  3 4  8 9  8 11  9 10  10 13  13 12  ### A and B: The Source = 1 and Destination = 12 ###  1 12  ### Number of forbidden vertices P=4 ###  4  3 5 7 11  ### Number of mysterious vertices Q=3 ###  3  11 7 10 | **Output A:**  1: 2 3  2: 1 4  3: 1 4  4: 2 5 6 7 3  5: 4 8  6: 4 8  7: 8 4  8: 7 5 6 9 11  9: 8 10  10: 9 13  11: 12 8  12: 11 13  13: 10 12  **Output B:**  6 Unit Time  **Output C:**  1 2 4 6 8 9 10 13 12  **Output D:**  5 Unit Time |

**Sample Input 1 Graph**

