National Institute of Technology, Calicut
Department of Computer Science and Engineering
CS2094 – Data Structures Lab

Assignment-5 (Advanced)

Submission deadline (on or before): **21.04.2015 (Tuesday) 5pm**

Naming Conventions for submission

Submit a single ZIP (.zip) file (do not submit in any other archived formats like .rar or .tar.gz). The name of this file must be ASSG5A<Number>_<ROLLNO>_<FIRSTNAME>.zip
(For example: ASSG5A_BxxyyyyCS_LAXMAN.zip). DO NOT add any other files (like temporary files, input files, etc.) except your source code, into the zip archive.

The source codes must be named as ASSG5A<Number>_<ROLLNO>_<FIRST NAME>_<PROGRAM-NUMBER>.<extension> (For example: ASSG5A_BxxyyyyCS_ LAXMAN_1.c).

Note: Implement the graphs using adjacency list representation in the following questions.

Questions:

1. Given a directed acyclic weighted graph G(V, E), where V is the set of vertices and E is the set of edges, find the shortest path (if one exists) and its weight from a source vertex 's' to a destination vertex 't' in O(V+E) time. If there is no path from 's' to 't', then output 'No Path from s to t'.

Format of the input file is as follows:

a. First line indicates the number of vertices i.e size of 'V' in the graph G

b. Second line indicates number of edges i.e size of 'E' in the graph G

c. Third line indicates source vertex 's'

d. Fourth line indicates destination vertex 't'

e. Next line onwards describe the end vertices of every edge and its weight in the following format:

vertex1 vertex2 Weight of an edge from *vertex1* to *vertex2*

Format of the output is as follows:

a. First line: Prints vertices belonging to the shortest path from 's' to 't'

b. Second line: Prints the weight of the shortest path from 's' to 't'

Sample Input:

6

7

A

F

A B 4

A C 2

B D 10

B C 5

C E 3

E D 4

D F 11

Sample Output:

A -> C -> E -> D -> F

20

2. An edge in an undirected connected graph is a bridge if and only if removing it disconnects the graph. For a disconnected undirected graph, definition is similar, a bridge is an edge removing which increases number of connected components.

Find the number of bridges in a given undirected graph G(V,E), where 'V' is the set of vertices and 'E' is the set of edges. Also print all the bridges in the graph G.

Format of input file is as follows:

a. First line indicates the number of vertices i.e size of 'V' in the graph G

b. Second line indicates the number of edges i.e size of 'E' in the graph G

c. Third line onwards describe the end vertices of every edge in the following format:

vertex1 vertex2

Format of output is as follows:

a. First line: Prints the number of bridges in the given graph

b. Next line onwards, prints the end vertices of the bridges in the graph

Sample Input:

5

5

2 1

1 3

3 2

1 4

4 5

Sample Output:

2

4 5

1 4

3. A Bipartite graph is a graph whose vertices can be divided into two disjoint sets U and V such that for every edge (u, v), either u ϵ U and v ϵ V or u ϵ V and v ϵ U.

Given an undirected graph G(V,E), where 'V' is the set of vertices and 'E' is the set of edges, output YES if G is Bipartite, or NO otherwise.

Format of the input file is as follows:

a. First line indicates the number of vertices i.e size of 'V' in the graph G

b. Second line indicates the number of edges i.e size of 'E' in the graph G

c. Next line onwards describe the end vertices of every edge in the following format:

vertex1 vertex2

Format of output is as follows:

Print YES if graph is bipartite, NO otherwise

Sample Input:

4

4

1 2

1 4

2 3

3 4

Sample Output:

YES

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