**LEBANESE AMERICAN UNIVERSITY**

**Department of Computer Science and Mathematics**

**CSC 310: Algorithms and Data Structures**

Fall 2013

**Lab IV**

**Graphs**

**Input:**

All inputs are read from a file labeled “graph.in”. In the file, You read an integer **k** the number of test cases then **k test** cases follow. For each case, we read an integer **n** which is the number of nodes then **e** which is the number of edges and **e** integers follow which specifies which nodes are connected to each other.

**Input:**

k

**n e**

u1 v1

u2 v2

…

**Output:**

Output should be consistent with the output specified in each problem as specified.

**Note:**

- We always Label nodes from 0 -> n - 1.

- the first node is 0 which always the starting vertex.

- Graphs are undirected unless specified

- Graphs may contain Connected Component

**Problem 1: [BFS && DFS]**

Given an undirected graph G (V, E), where V is the set of vertices and E is the set of edges, you are

required to print the vertices of the graph using BFS and DFS.

**Sample Input: Sample Output:**

2 BFS: 0 1 2 3 4

**5 5** DFS: 0 1 3 2 4

0 1 BFS: 0 1 2 3 4

0 2 DFS: 0 1 2 4 3

1 3

2 3

3 4

**5 5**

0 1

0 2

1 2

1 3

2 4

**Problem 2: [Cycle]**

Given a directed graph G (V, E), where V is the set of vertices and E is the set of edges, you are required to check whether the graph has a cycle. If there is a cycle, you should print “**has cycle**”, else print “**no cycle**”.

**Sample Input: Sample Output:**

3 has cycle

**3 3**  has cycle

0 1 no cycle

1 2

2 0

**5 5**

0 1

1 2

2 3

3 4

4 1

**4 3**

0 1

0 2

1 3

**Problem 3: [Connected]**

Given an undirected graph G (V, E), where V is the set of vertices and E is the set of edges, you are

required to check if the graph is connected. If the graph is connected, you should print “**yes**”, else print “**no**”.

**Sample Input: Sample Output:**

2 no

**5 3**  yes

0 4

1 2

2 3

**7 6**

0 1

0 2

0 3

1 4

2 5

3 6

**Problem 4: [Bipartite]**

Given an undirected graph G (V, E), where V is the set of vertices and E is the set of edges, you are required to check if the graph is bipartite. If the graph is bipartite, you should print “**bipartite**”; else print “**not bipartite**”.

**Sample Input: Sample Output:**

2 bipartite

**7 6**  not bipartite

0 1

0 2

0 3

1 4

2 5

3 6

**4 5**

0 1

0 3

1 2

1 3

2 3

**Problem 5: [Strongly Connected]**

Given a directed graph G (V, E), where V is the set of vertices and E is the set of edges, you are required to check if G is a strongly connected graph. Print “**yes**” is G is strongly connected; else print “**no**”.

**Sample Input: Sample Output:**

2 yes

**4 5** no

0 1

1 2

2 0

2 3

3 1

**5 5**

0 1

0 2

2 4

3 2

4 3