**LEBANESE AMERICAN UNIVERSITY**

**Department of Computer Science and Mathematics**

**CSC 310: Algorithms and Data Structures**

Fall 2013

**Lab V**

**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

**Good Luck!**

**Problem 1: [Tree]**

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 if the graph is a tree.

**Sample Input: Sample Output:**

2 no

**5 5** no

0 1

0 2

1 3

2 3

3 4

**5 5**

0 1

0 2

1 2

1 3

2 4

**Problem 2: [Number of Connected Components]**

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 the number of connected components in the graph.

**Sample Input: Sample Output:**

2 2

**5 4** 4

0 1

0 2

1 2

3 4

**8 4**

0 1

1 2

2 3

4 5

**Problem 3: [Dijkstra]**

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 the minimum distance between u and v given as the last input, and output the weight to reach it.

**Sample Input: Sample Output:**

2 2

**7 6**  5

0 1 4

0 2 3

0 3 2

1 4 2

2 5 4

3 6 3

0 3

**4 5**

0 1 3

0 3 2

1 2 4

1 3 2

2 3 3

0 2

**Problem 4: [MST]**

The ancient kingdom of Antarctica consisted of a large number of islands. Before

they disappear miraculously, the islands were inhabited by the ACM tribe

(Antarctica’s Creative Minds). The tribe used to worship trees, so it was not

possible to build boats, which were anyway not discovered at that time. In-land

transportations heavily depended on donkeys. To go from one island to another,

one had to swim... Unfortunately, this was the only way out! The king finally

decided to solve this problem by building bridges to connect the islands. His

priests took permission from the Gods to cut some trees to build the bridges,

but they are supposed to minimize tree cuttings, otherwise the tribe will be

cursed and the islands will disappear (and this is what happened).

Just in case a time machine is built in the future and one can go back in time to

save the ACM tribe, you are asked to write a program that takes a number n of

islands numbered 0, 1, · · · , (n − 1) with a list of all pair-wise distances between

the islands. Your program computes the cost of bridges needed to connect the

islands. The said cost is the sum of lengths of the bridges used in a solution.

As usual, the input consists of a number of test cases: the first line contains the

number T of test cases. Each test case starts with the number of islands on a

line, followed by triples of the form: u v w, where u and v are islands and w is

the cost of building a bridge between u and v (i.e., the length of such bridge).

Each such triple is on a separate line. How many lines are there per test case?

**Sample Input: Sample Output:**

2 5.2

**5**  2.4

0 1 2.5

0 2 1.0

0 3 2.0

0 4 8.9

1 2 0.5

1 3 2.8

1 4 1.7

2 3 3.0

2 4 5.0

3 4 7.8

**3**

0 1 1.3

0 2 2.7

1 2 1.1