Data Structures Lab Program - 2016

Lab exercise – 11

1. Perform the following operations on disjoint set:
    a. Make-set
    b. Union
    c. Find-set

2. Perform the Union by-element_value (weight) operations on 10 elements (0-9, each initially in their own set). Draw the forest of trees that result U(1,5); U(3,7);U(1,4);U(5,7); U(0,8); U(6,9);U(3,9).

3. Perform union-by-rank for disjoint sets.

4. Perform path compression in tree-based disjoint sets. Verify using Find-set operation.

5. Find out the number of connected component in a given undirected graph and display their representative. You are free to choose representative in a given set. Vertices are numbered from 1 to V.

    Input: (T, $|V_i|$, Adj_i)

```
2
10
0 1 1 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0
1 1 0 1 0 0 0 0 0 0
0 0 1 0 0 0 0 0 0 0
0 0 0 0 0 1 1 0 0 0
0 0 0 0 1 0 1 0 0 0
0 0 0 0 1 1 0 0 0 0
0 0 0 0 0 0 0 0 1 0
0 0 0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0 0
10
0 1 1 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0
1 1 0 1 0 0 0 0 0 0
0 0 1 0 0 0 0 0 0 0
0 0 0 0 0 1 1 0 0 0
0 0 0 0 1 0 1 1 0 0
0 0 0 0 1 1 0 0 1 0
0 0 0 0 0 1 0 0 1 0
0 0 0 0 0 0 1 1 0 0
0 0 0 0 0 0 0 0 0 0
```

    Output:

```
4
1 5 8 10
3
1 5 10
```

6. Check whether given graph is connected or not using disjoint sets.
   Input: (T, $|V_i|$, Adj_i)

```
2
6
0 1 1 1 0 0
1 0 1 0 1 0
1 1 1 1 0 0
0 1 0 1 0 0
0 0 0 0 0 0
6
0 1 1 1 0 0
1 0 1 0 1 1
1 1 1 1 0 0
0 1 0 1 0 0
0 1 0 0 0 1
```

   Output:

```
Disconnected
Connected
```

7. Detect cycle in a given undirected graph (adjacency matrix) using disjoint set operations. Modify the program so that it works with directed graphs as well.
   Input: (T, $|V_i|$, Adj_i)

```
2
5
0 1 1 1 1
1 0 1 1 0
1 1 0 0 1
1 1 0 0 0
1 0 1 0 0
3
6
0 1 0 0 0 0
1 0 1 0 0 0
0 1 0 1 0 0
0 0 1 0 1 0
0 0 0 1 0 1
0 0 0 0 1 0
```

   Output:

```
Yes
No
```

8. Find a Minimum Spanning Tree (MST) of a given connected, undirected and weighted graph using Kruskal's algorithm.

9. Instead of adding edges as in Kruskal's algorithms to create, write a program that deletes edges till the graph reduces to its MST.

10. Find a Maximum Spanning Tree of a given connected, undirected and weighted graph.

11. Read n 3D points $\{(x_i, y_i, z_i)\}$ in real space. Generate MST for the Euclidean graph.

12. Find if a given unweighted directed graph is arborescence. An arborescence is a directed acyclic graph in which for a given vertex *u*, there exists one and only one path to every other node *v*.