Assignment 9: Disjoint sets

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.
   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
   ```