Union-Find-Set 并查集数据结构 p151
运用搜索合并两个运算
https://www.cnblogs.com/yoke/p/6697013.html
https://www.cnblogs.com/meihao1203/p/9243103.html
不然只能用dfs来检查是否有回路

Homework 4 Instructions

The goal of this homework is to implement Kruskal's algorithm in the *Algorithm Design* book detailed starting on page 142. The pseudo code is as follows:

Kruskal's Algorithm

```
KRUSKAL(G):
A = ∅
For each vertex v ∈ G.V:
     MAKE-SET(v)
For each edge (u, v) ∈ G.E ordered by increasing order by weight(u, v):
     if FIND-SET(u) ≠ FIND-SET(v):
     A = A ∪ {(u, v)}
     UNION(u, v)
return A
```

1. Create a python file named "msp_ID.py", with **ID** corresponding to your student id number. For example, if my student id is 1234567, I would create a python file named

   msp_1234567.py

2. Your program should be able to run from the console using the command

   python msp_ID.py input.txt > output.txt

   where the arguments are your program and the input file. Your program should be able to write to an output file. For your own testing purposes, your program can print to stdout, **but upon submission it should be able to write to an output file.** I will be using Python 3.6 to grade your assignments.

3. Your program should read in an input text file that contains a matrix of the cost of the edges between two given nodes.

   0 4 4 0 0
   4 0 5 0 0
   4 5 0 0 1
   0 0 0 0 4
   0 0 1 4 0

   For example, in this graph, there are 5 nodes. The cost of adding an edge from 0 to node 1 is 4. The cost of adding an edge from node 2 to node 4 is 1. *Note: Edges with cost of 0 are not valid edges to be included in the tree, and should not be considered for the algorithm. Also, these are undirected graphs, so cost(i,j) = cost(j,i)*

4. The program should take in the costs of the edges between nodes and performs one of the minimum spanning tree algorithms listed above on the nodes. The program should output the edges in the order that they are included in the tree. For the edge cost matrix above, the **msp** program would output the following:

   2 4
   0 1
   0 2
   3 4

5. You can further test your program by creating input text files following the format of the sample input text files provided.

6. Please submit your assignment in the appropriate location on Blackboard. If you get stuck or have any questions, please feel free to email me at romoore@ku.edu. I will try to get back to you as quickly as possible. It is better to contact me during the week, as I am less responsive on the weekend because, well, it is the weekend. This does not mean that I will not respond to your emails on the weekend, it only means that the response time will be longer than it would be during the week. However, I will do the best I can to respond as quickly as possible.