

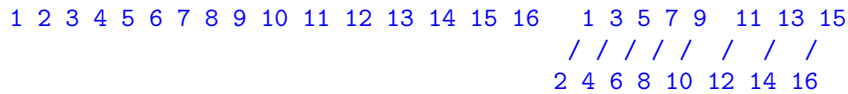
EC 504  
Spring, 2022  
HW 3A

**Due Friday, March 4, 8PM on Gradescope.**

This is a short homework (2 problems, no quiz) to give you practice with the disjoint set data structure.

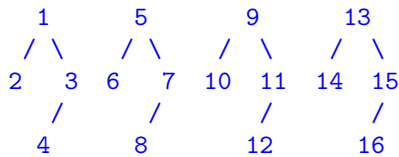
1. (10 points) Show the data structure that results by the disjoint set operations for the following programs.
- (a) Assume we will do union by rank, and that, when we do a find operation, we will do path compression. Insert nodes  $1, 2, 3, \dots, 16$ . Add relations between nodes 1-2, 3-4, ..., 15-16, and form the unions, where we merge by rank. When it is a tie of ranks, make the root the smaller of the two root numbers.

**Solution:**



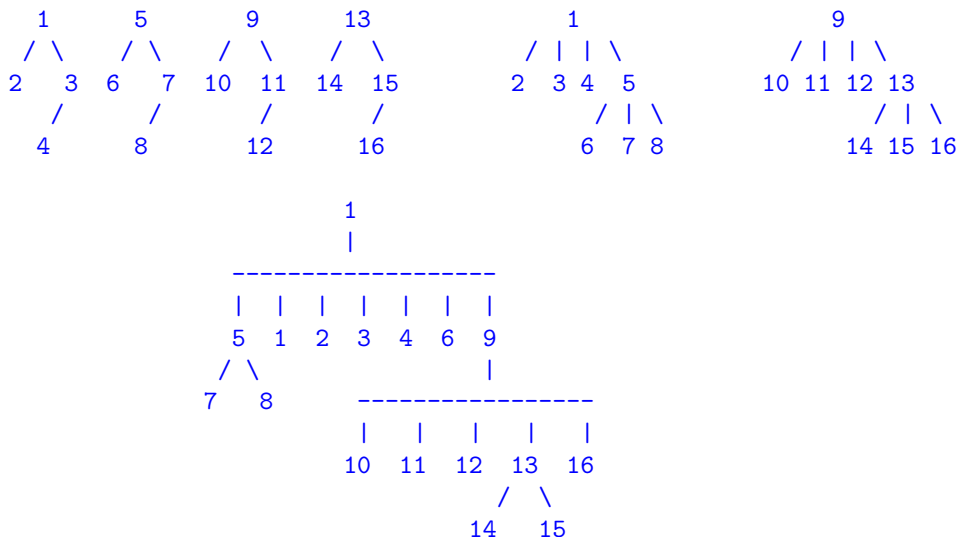
- (b) add relations 1-3,5-7, 9-11, 13-16 and show the disjoint sets that result from the unions using these relations.

**Solution:**

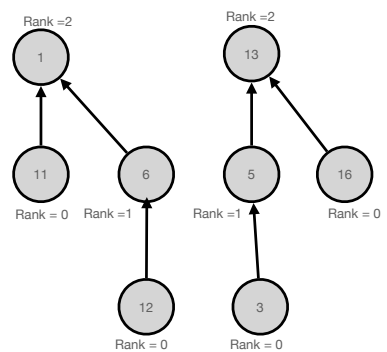


- (c) Add relations 4-8, 12-16, 6-16 in that order and show the disjoint sets that result.

**Solution:**



2. (6 pts) Old midterm question: Consider the two trees, shown on the right, that are part of a disjoint set forest. Suppose we find a relation between keys 12 and 3. Show the disjoint set tree that results from the union operation using merge by rank and path compression, where, if two roots have the same rank, merge the larger value root under the smaller value root.



**Solution:**

