

1. Consider the disjoint set forest above. Select all the correct facts from the list below.

☒ The rank of the node 3 is 3.

☑ **Correct**  
Correct.

☒ Calling `find(9)` yields 9.

☑ **Correct**  
Correct.

☐ The rank of the node 0 is 1.

☒ 3, 9 and 7 are the representative elements for the three subsets shown.

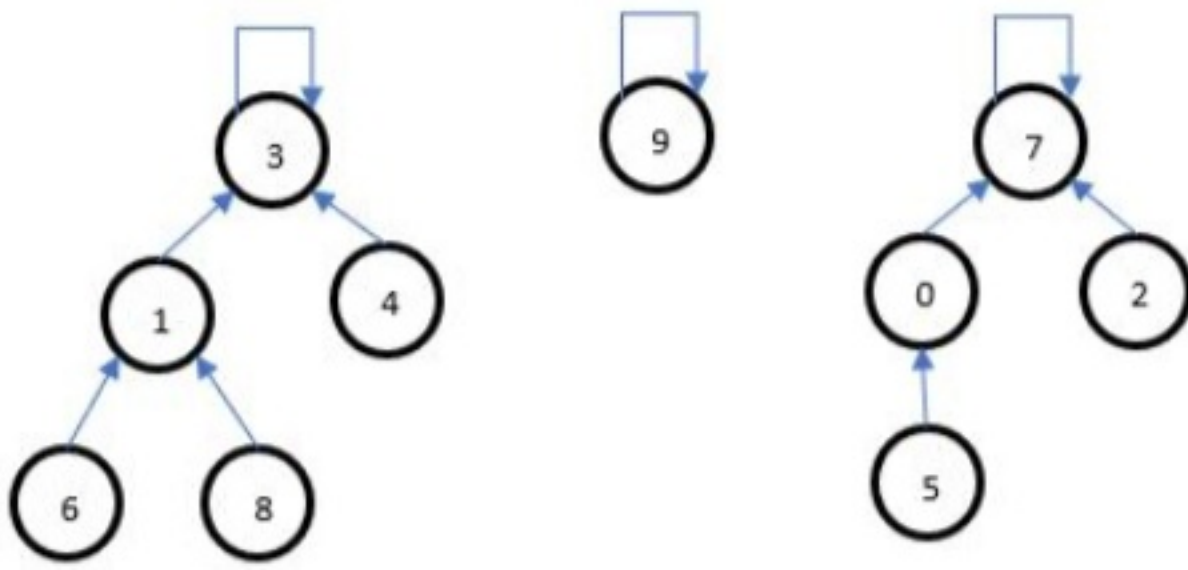
☑ **Correct**  
Correct.

☒ Calling `find(5)` and `find(4)`, we obtain 7 and 3 respectively, allowing us to conclude that 5 and 4 are not part of the same subset in the family.

☑ **Correct**  
Correct.

☐ The elements 6 and 5 belong to the same set.





2. Consider once again the disjoint set forest shown above. Suppose we perform unions using the “rank strategy” presented in the lecture: i.e, the lower ranked tree becomes the child of the higher ranked one, with ties broken arbitrarily. Select all correct facts.

- ☒ The tree with root 3 could have arisen through the following sequence of operations:

MakeSet(1), MakeSet(6), MakeSet(3), MakeSet(4),  
MakeSet(8)

Union(1,6), Union (1, 8), Union(3,4), Union(3,1)

☒ **Correct**

Correct – The first two operations could have made 6, 8 the children of the node 1 and the third operation could make 4 the child of 3. The rank of 1 and 3 at this point are both 2. The last operation makes 3 the root and 1 its child giving rise to the tree that we see.

- ☐ The tree with root 3 could have arisen through the following sequence of operations:

MakeSet(1), MakeSet(6), MakeSet(3), MakeSet(4),  
MakeSet(8)

Union(3,1), Union (1, 8), Union(1,6), Union(1,4)

- ☐ The tree with root 3 could have arisen through the following sequence of operations:

MakeSet(1), MakeSet(6), MakeSet(3), MakeSet(4),  
MakeSet(8)

Union(1,6), Union (1, 8), Union(1,3), Union(1,4)

(recommend drawing out the sequence of trees).

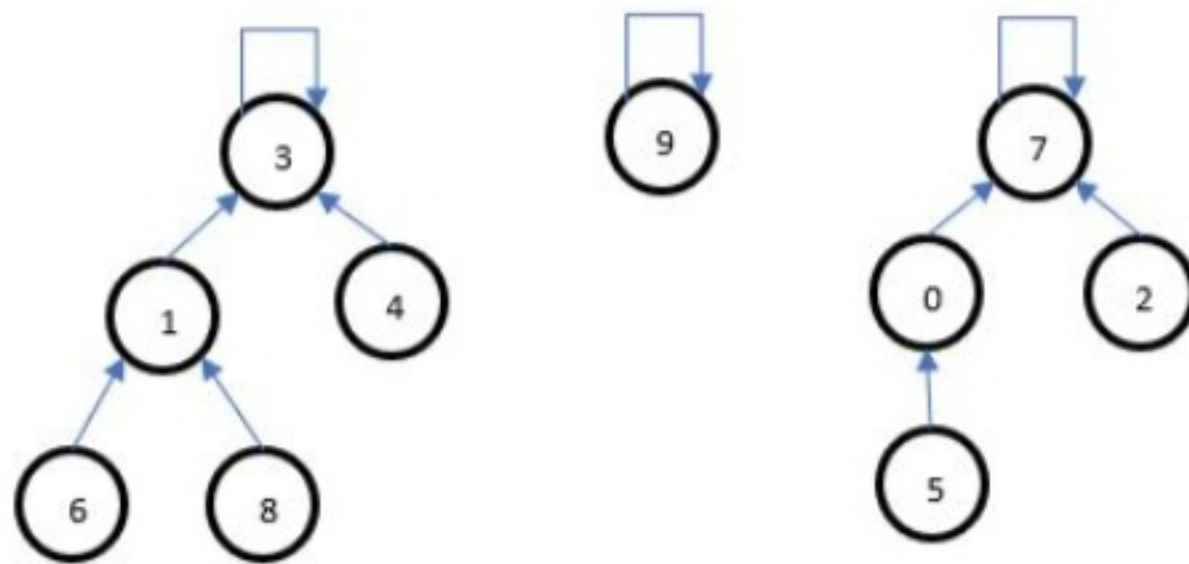
- ☒ If we were to perform Union(6,9), the node 9 will become a child of the node 3.

☒ **Correct**

Correct – according to the rank strategy 9 has a smaller rank than the node 3.



3. Consider the disjoint set forest below:



Select all the correct facts below assuming that we implement rank compression as explained in the lecture: i.e, whenever we perform a find, we connect all the nodes along the path from the query node to the root directly to the root.

- ☐ When we perform  $\text{find}(6)$ , all nodes in the corresponding tree connect to the root.
- ☒ Performing  $\text{union}(6,9)$  will involve connecting both the nodes 6 and 9 to the root 3.

☑ **Correct**  
Correct.

- ☒ When we perform  $\text{find}(5)$ , all nodes in the corresponding tree connect to the root.

☑ **Correct**  
Correct.