

**Question - 1**  
**Union Operation**

SCORE: 10 points

How many connected components result after performing the following sequence of union operations on a set of 10 items?

1-2   3-4   5-6   7-8   7-9   2-8   0-5   1-9

Assume an array of size of 10, like below.

[ 0 1 2 3 4 5 6 7 8 9 ]

- ☐ 1
- ☐ 2
- ☒ 3
- ☐ 4

**Question - 2**  
**Weighted Quick Union**

SCORE: 10 points

In Weighted Quick Union algorithm, we link the root of smaller tree to the root of larger tree at every union operation. In worst case, for N elements, what's the maximum depth of all leaf leaves?

- ☐  $O(N)$
- ☐  $O(\sqrt{N})$
- ☒  $O(\lg N)$
- ☐  $O(\lg N + 1)$

**Question - 3**  
**Worst case : Weighted Quick Union**

SCORE: 10 points

The worst-case time for weighted QU with path compression algorithm is (order of growth for M union-find operations on a set of N objects)

- ☐  $O(MN)$
- ☐  $O(N \lg M)$
- ☒  $O(N + M \lg N)$



O(N)

## Question - 4

SCORE: 70 points

Height-weighted Quick Union with Path Compression

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All of you know the concept for a weighted quick union with path compression. For this quiz you will have to implement the path compression logic as well the union logic. You will need to add your code in the 'TODO' section. You will find 2 'TODO's, one in the **find** function and the other in the **union** function. You **must** not make any changes apart from the code you have to add to the 'TODO' sections. **Make your changes in HWQUPC.java(Which will be under main folder).**

Unit test cases have also been implemented. Provide the implementation and make sure all the test cases pass. All the best!  
**Please Note: To test the code you have written click the run unit test button and NOT "Execute main()" button.**