

# INFO 6205

## Program Structures & Algorithms

### Fall 2020

### Assignment 3

#### Task

Implement height-weighted Quick Union with Path Compression. Determine the relationship between the number of objects (N) and the number of pairs (m) generated to accomplish this (i.e. to reduce the number of components from N to 1).

#### Evidence

Execution of UF\_HWQUPC code using various values of components (N) and comparing output for average number of pairs (m) and calculation from formula ( $0.5 * N * \ln N$ ), respectively.

N	m	$0.5 * N * \ln(N)$
100000	642493	575646.27
200000	1155653	1220607.26
500000	2996830	3280590.84
800000	5555550	5436946.80
1000000	6989894	6907755.28

Figure 1 : Output from UF\_HWQUC code

#### Conclusion

Number of pairs (m) to reduce the number of components from N to 1 is converges to:

$$\frac{1}{2} \times N \times \ln N$$

## Screenshots



A screenshot of a unit test runner interface showing a list of tests and their execution times. The interface has a dark background with green checkmarks indicating successful tests. The tests are listed in a table-like format with a header row and several data rows. The header row is highlighted in a darker blue. The data rows are in a dark gray color. The tests are: testIsConnected01 (3 ms), testIsConnected02 (0 ms), testIsConnected03 (2 ms), testFind0 (0 ms), testFind1 (0 ms), testFind2 (0 ms), testFind3 (0 ms), testFind4 (0 ms), testFind5 (0 ms), testToString (0 ms), testConnect01 (0 ms), testConnect02 (0 ms), and testConnected01 (0 ms). The total execution time for the suite is 5 ms.

✓ UF_HWQUPC_Test (edu.neu.coe.info6205.union_find)	5 ms
✓ testIsConnected01	3 ms
✓ testIsConnected02	0 ms
✓ testIsConnected03	2 ms
✓ testFind0	0 ms
✓ testFind1	0 ms
✓ testFind2	0 ms
✓ testFind3	0 ms
✓ testFind4	0 ms
✓ testFind5	0 ms
✓ testToString	0 ms
✓ testConnect01	0 ms
✓ testConnect02	0 ms
✓ testConnected01	0 ms

Figure 2: Execution of Unit Tests