

# INFO6205 - Height-weighted Quick Union with Path Compression

Here is the screenshot of unit test for “UF\_HWQUPC” class:

```
package edu.neu.coe.info6205.union_find;

import java.util.*;

public class UF_HWQUPC_Test {

    @Test
    public void testToString() {
        Connections h = new UF_HWQUPC(10, 2);
        assertEquals("UF_HWQUPC:\n" +
            "count: 2\n" +
            "path compression? true\n" +
            "parents: [0, 1]\n" +
            "heights: [1, 1]", h.toString());
    }

    @Test
    public void testIsConnected() {
        Connections h = new UF_HWQUPC(10, 2);
    }
}
```

Run: UF\_HWQUPC\_Test

Tests passed: 13 of 13 tests - 31ms

Test	Time
testIsConnected01	1ms
testIsConnected02	13ms
testIsConnected03	9ms
testFind0	0ms
testFind1	0ms
testFind2	0ms
testFind3	1ms
testFind4	0ms
testFind5	0ms
testToString	7ms
testConnect01	0ms
testConnect02	0ms
testConnect03	0ms

Here is the screenshot of “HWQUPC\_Solution” class to get number of connections of n sites:

```
package edu.neu.coe.info6205.union_find;

import java.util.*;

public class HWQUPC_Solution {

    public static int count(int n) {
        UF_HWQUPC uf = new UF_HWQUPC(n, true);
        Random rd = new Random();

        int cnt = 0;
        while(uf.components() > 1) {
            int a = rd.nextInt(n), b = rd.nextInt(n);
            if(uf.connected(a, b)) continue;
            uf.union(a, b);
            cnt++;
        }
        return cnt;
    }

    public static void main(String[] args) {
        Scanner input = new Scanner(System.in);
        System.out.print("Input Number n: ");
        int n = input.nextInt();
        while(n >= 1) {
            System.out.println("n = " + n + ", Number of connections generated: " + count(n));
            n--;
        }
    }
}
```

Run: HWQUPC\_Solution

Input Number n: 100

n = 100, Number of connections generated: 99  
n = 99, Number of connections generated: 98  
n = 98, Number of connections generated: 97  
n = 97, Number of connections generated: 96  
n = 96, Number of connections generated: 95  
n = 95, Number of connections generated: 94  
n = 94, Number of connections generated: 93  
n = 93, Number of connections generated: 92

/src/main/java/edu.neu.coe.info6205/union\_find/HWQUPC\_Solution.java

Output:

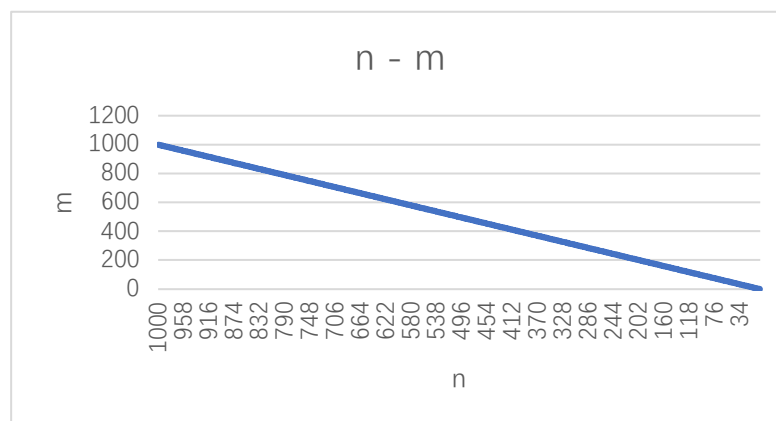
Input Number n: 100

n = 100, Number of connections generated: 99  
n = 99, Number of connections generated: 98  
n = 98, Number of connections generated: 97  
n = 97, Number of connections generated: 96  
n = 96, Number of connections generated: 95  
n = 95, Number of connections generated: 94  
n = 94, Number of connections generated: 93  
n = 93, Number of connections generated: 92  
n = 92, Number of connections generated: 91  
n = 91, Number of connections generated: 90  
n = 90, Number of connections generated: 89  
n = 89, Number of connections generated: 88  
n = 88, Number of connections generated: 87  
n = 87, Number of connections generated: 86  
n = 86, Number of connections generated: 85  
n = 85, Number of connections generated: 84  
n = 84, Number of connections generated: 83  
n = 83, Number of connections generated: 82  
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 n = 13, Number of connections generated: 12  
 n = 12, Number of connections generated: 11  
 n = 11, Number of connections generated: 10  
 n = 10, Number of connections generated: 9  
 n = 9, Number of connections generated: 8  
 n = 8, Number of connections generated: 7  
 n = 7, Number of connections generated: 6  
 n = 6, Number of connections generated: 5  
 n = 5, Number of connections generated: 4  
 n = 4, Number of connections generated: 3  
 n = 3, Number of connections generated: 2  
 n = 2, Number of connections generated: 1  
 n = 1, Number of connections generated: 0

### Conclusion:



The number of objects (n) and the number of pairs (m) generated to union n objects into only one is:

$$m = n - 1;$$