Program Structures and Algorithms
Spring 2024

NAME: Meet Karnik
NUID: 002795334
GITHUB LINK: https://github.com/karnikmeet/INFO6205_meet

Task: Assignment 4 (WQPUC)

Relationship Conclusion: The number of generated pairs(m) is directly proportional to the number of elements(n). Based on the findings of this experiment, the relation can be expressed as follows:
m = 5.15n -176

Evidence to support conclusion: Here is a screenshot of the generated pairs(represented by connection) for different number of elements(represented by n).This output has been generated by the following main function used to run this experiment.

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

import java.util.Random;

public class UFClient {

    public static int count(int n) {
        UF_HWQUPC uf = new UF_HWQUPC(n);

        int connections = 0;
        int pairs = 0;
        Random random = new Random();

        while (uf.components() > 1) {
            int p = random.nextInt(n);
            int q = random.nextInt(n);
            pairs++;

            if (!uf.connected(p, q)) {
                uf.union(p, q);
                connections++;
            }
        }
        System.out.println("Number of generated pairs: " + pairs);
        return connections;
    }

    public static void main(String[] args) {
        // Fixed set of values for testing
        int[] testValues = {1000,800,600,400,100};

        for (int n : testValues) {
            int connections = count(n);
            System.out.println("For n = " + n + ", connections = " + connections);
        }
    }
}
```

```
Number of generated pairs: 4974
For n = 1000, connections = 999
Number of generated pairs: 2365
For n = 800, connections = 799
Number of generated pairs: 1585
For n = 600, connections = 599
Number of generated pairs: 1341
For n = 400, connections = 399
Number of generated pairs: 339
For n = 100, connections = 99
```

If the number of generated pairs(m) and n are substituted in the above given equation, you can see that the equation is satisfied.
From the above screenshot of the output, it is clear that as the number of elements is increased, the amount of pairs generated will increase too.

Unit Test Screenshots: