

INFO 6205
Program Structures & Algorithms
Spring 2020
Assignment No: 3

- **Task:** To find out the relation between the reducing the number of components from N to 1 is almost linear ($m = n-1$)
- **Output:**
Below are the values of (m) pairs generated for 15 different values of object (n) as input:-

Value of n: 48981 Value of m: 48980
Value of n: 16318 Value of m: 16317
Value of n: 5245 Value of m: 5244
Value of n: 28545 Value of m: 28544
Value of n: 259 Value of m: 258
Value of n: 92858 Value of m: 92857
Value of n: 91302 Value of m: 91301
Value of n: 76813 Value of m: 76812
Value of n: 78952 Value of m: 78951
Value of n: 86800 Value of m: 86799
Value of n: 58761 Value of m: 58760
Value of n: 19427 Value of m: 19426
Value of n: 34006 Value of m: 34005
Value of n: 44657 Value of m: 44656
Value of n: 95517 Value of m: 95516

It is evident from the values obtained that the time required to reduce the N number of components to 1 is almost linear I.e $m = n-1$

Output :

```

11  UF_HWQUPC uf_client = new UF_HWQUPC(n);
12  Random random_conn = new Random();
13
14  while (uf_client.components() != 1)
15  {
16      int p = random_conn.nextInt(n);
17
18      int q = random_conn.nextInt(n);
19
20      if (!uf_client.connected(p, q)) {
21          uf_client.union(p, q);
22          no_of_connections++;
23      }
24  }
25  return no_of_connections;
26
27
28  public static void main(String[] args) {
29
30      Random rand = new Random();
31
32      for (int i=0; i<5; i++) {
33
34          int n = rand.nextInt(100000);
35          System.out.println("Value of n: " + n + " Value of m: " + count(n));
36      }
37  }
38
39
40

```

```

-terminated> UF_Client [Java Application] /home/vedant/eclipse/re/bin/java (Oct 5, 2020, 6:50:29 PM)
Value of n: 48981 Value of m: 48980
Value of n: 16310 Value of m: 16317
Value of n: 5245 Value of m: 5244
Value of n: 28545 Value of m: 28544
Value of n: 259 Value of m: 258
Value of n: 92838 Value of m: 92857
Value of n: 91302 Value of m: 91301
Value of n: 76813 Value of m: 76812
Value of n: 78952 Value of m: 78951
Value of n: 86880 Value of m: 86799
Value of n: 58781 Value of m: 58760
Value of n: 19427 Value of m: 19426
Value of n: 34886 Value of m: 34885
Value of n: 44657 Value of m: 44656
Value of n: 95517 Value of m: 95516

```

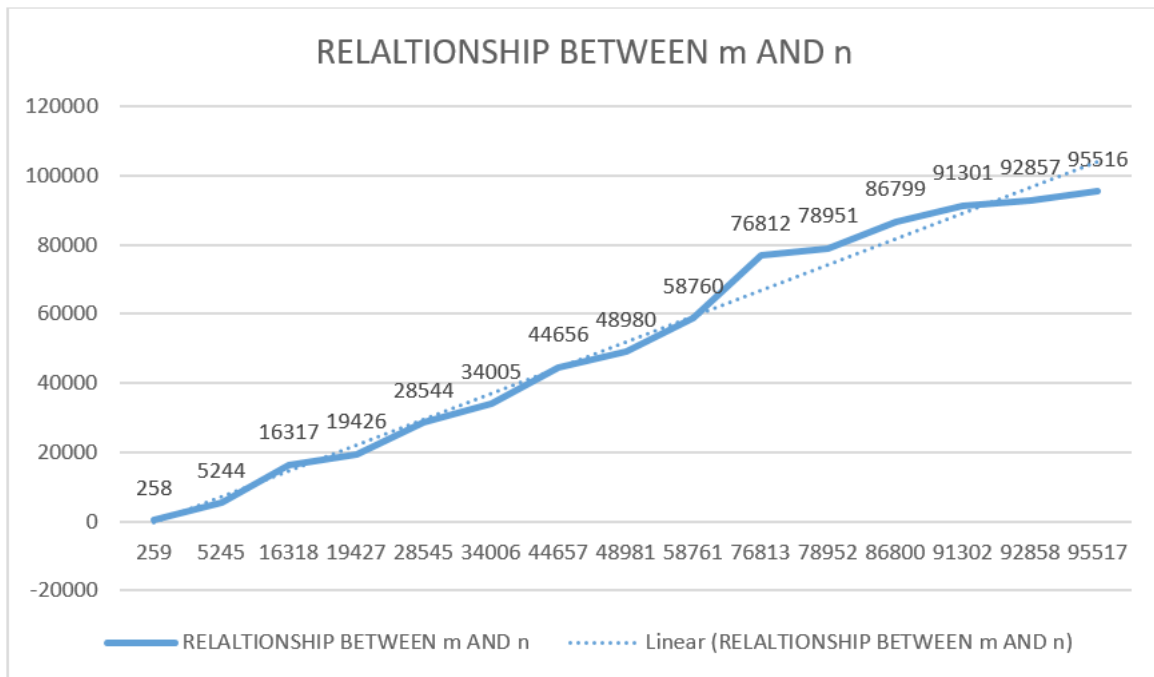
- Relationship conclusion:**

A main class is created, and it is run for the 5 different values to affirm our conclusion. It is to be noted, that the main class is created within the UF_HWQUPC.java.

From the graph also, it can be concluded that the relation between the two entities is natural logarithmic. Thereby, solidifying our conclusion.

- Evidence to support relationship** (screen shot and/or graph and/or spreadsheet)

Below are the screenshot of the output screen and a subsequent graph is formed to analyze the data acquired through our program for pictorial understanding. As expected, the graphs are in alignment of our conclusion

Graph as Evidence:

- Screenshot of Unit test passing:
Below is the test case passing of the UF_HWQUPC_Test

