Diksha Godse (002116411)

**Program Structures & Algorithms**

**Spring 2022**

**Assignment No. 3**

Name- Diksha Godse

NUID - 002116411

**TASK 1**

* (a) Implement height-weighted Quick Union with Path Compression. For this, you will flesh out the class UF\_HWQUPC. All you have to do is to fill in the sections marked with // TO BE IMPLEMENTED ... // ...END IMPLEMENTATION.
* (b) Check that the unit tests for this class all work. You must show "green" test results in your submission (screenshot is OK).

**Output Screenshot:**

* + **UF\_HWQUPC\_Test**

**Graphical user interface, application

Description automatically generated**

**TASK 2**

Using your implementation of UF\_HWQUPC, develop a UF ("union-find") client that takes an integer value n from the command line to determine the number of "sites." Then generates random pairs of integers between 0 and n-1, calling connected() to determine if they are connected and union() if not. Loop until all sites are connected then print the number of connections generated. Package your program as a static method count() that takes n as the argument and returns the number of connections; and a main() that takes n from the command line, calls count() and prints the returned value. If you prefer, you can create a main program that doesn't require any input and runs the experiment for a fixed set of n values. Show evidence of your run(s).

Text

Description automatically generated

**TASK 3**

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). Justify your conclusion in terms of your observations and what you think might be going on.

* **EVIDENCE**

|  |  |  |
| --- | --- | --- |
| **Column 1** | **Column 2** | **Column 3** |
| **number of Objects (n)** | **Number of connections (m)** | **Approx to n\* ln(n)/2** |
| 50 | 113 | 97 |
| 100 | 257 | 230 |
| 200 | 591 | 529 |
| 300 | 964 | 855 |
| 400 | 1301 | 1198 |
| 500 | 1682 | 1553 |
| 600 | 2100 | 1919 |

**Graphical Representation**

**Chart, line chart

Description automatically generated**

**Conclusion**

1. From the number of experiments carried out It is observed that, relationship

between the number of objects (*n*) and the number of pairs (*m*) is ***m*** is

equivalent to ***n* \*ln(*n*)/2**. Evidence provided above clearly shows that,

cloumn2 and column 3 are equivalent.

2. In theory, Weight Quick-Union with Path Compression is not quite linear.

3. In practice, Weight Quick-Union with Path Compression is linear.