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**Program Structures & Algorithms**

**FALL 2021**

**Assignment No. 3**

* **Task**

Step 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).

Step 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).

Step 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.

* **Output**

电脑萤幕的截图

描述已自动生成

* **Relationship Conclusion:**

The relationship between the number of connections(m) and the number of sites (n) is shown in the formula: **m(n)=1/2n \* ln(n)**

N = number of sites. M = number of pairs generated. Each N runs 10 experiments. From the graph, we can see there is a linear relationship. Compared the resulting m values to the experimental m values. The values were approximately equal proving my formula to be accurate for this relationship.

* **Evidence**

图表, 折线图

描述已自动生成

* **Union Test**

图形用户界面, 文本, 应用程序

描述已自动生成

图形用户界面, 文本

描述已自动生成