Program Structures & Algorithms  
Spring 2022  
Assignment No. 3

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•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 screenshot

Test

文本

描述已自动生成

Step2

文本

描述已自动生成

relationship

图表, 散点图

描述已自动生成

•Relationship Conclusion

The relationship between m and n is that as n grows, so does m/n.

When n==100; m/n ≈ 2;

When n==500; m/n ≈ 3;

When n==1000; m/n ≈ 3.5

When n==2000; m/n ≈ 4