Program Structures and Algorithms
Spring 2023(SEC –1)
Assignment 3 : Height-weighted Quick Union with Path Compression

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Task:
The task entails writing a Java class that implements a height-weighted Quick Union with Path compression (UF HWQUPC). This class should include methods for performing union and connected operations. The second step is to create a union-find client that generates random pairs of integers, then calls the connected() and union() methods until all sites are connected. The client should return the number of generated connections. To reduce the number of components from n to 1, the final step is to determine the relationship between the number of objects and the number of pairs generated. Based on the observations, the conclusion should be justified.

Relationship Conclusion:

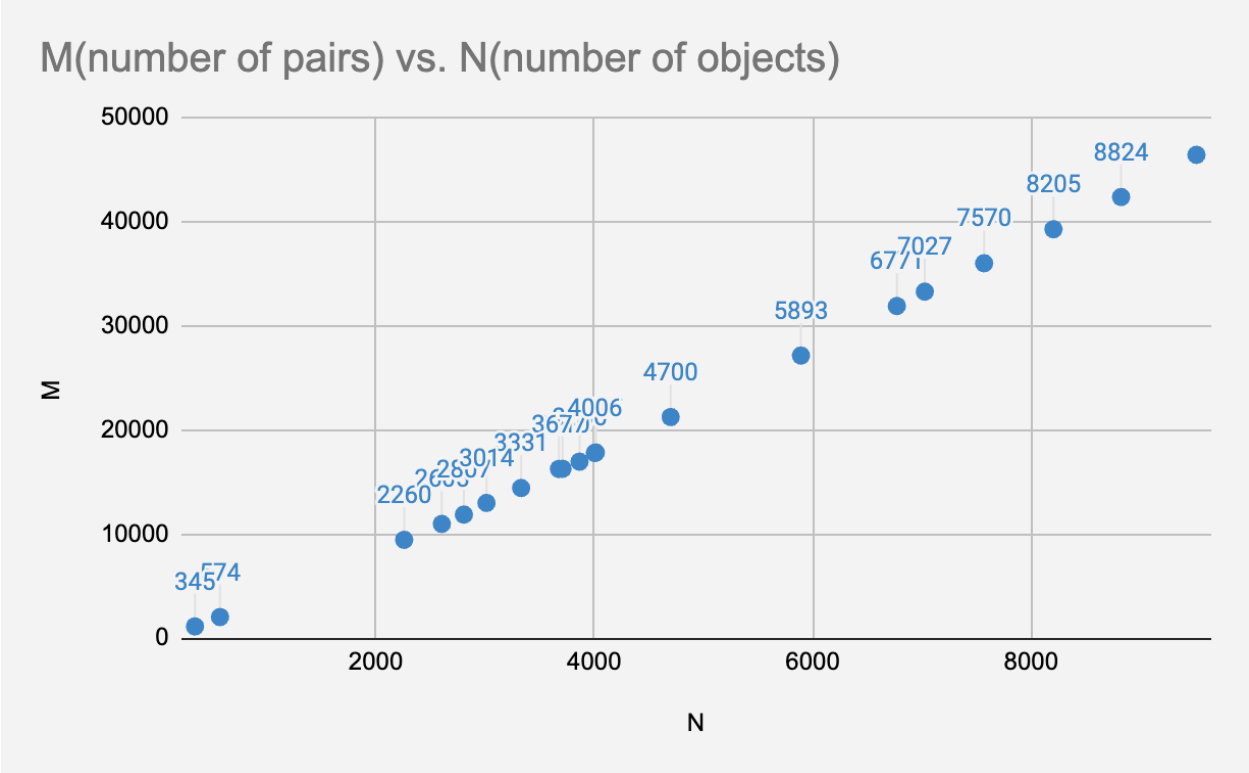
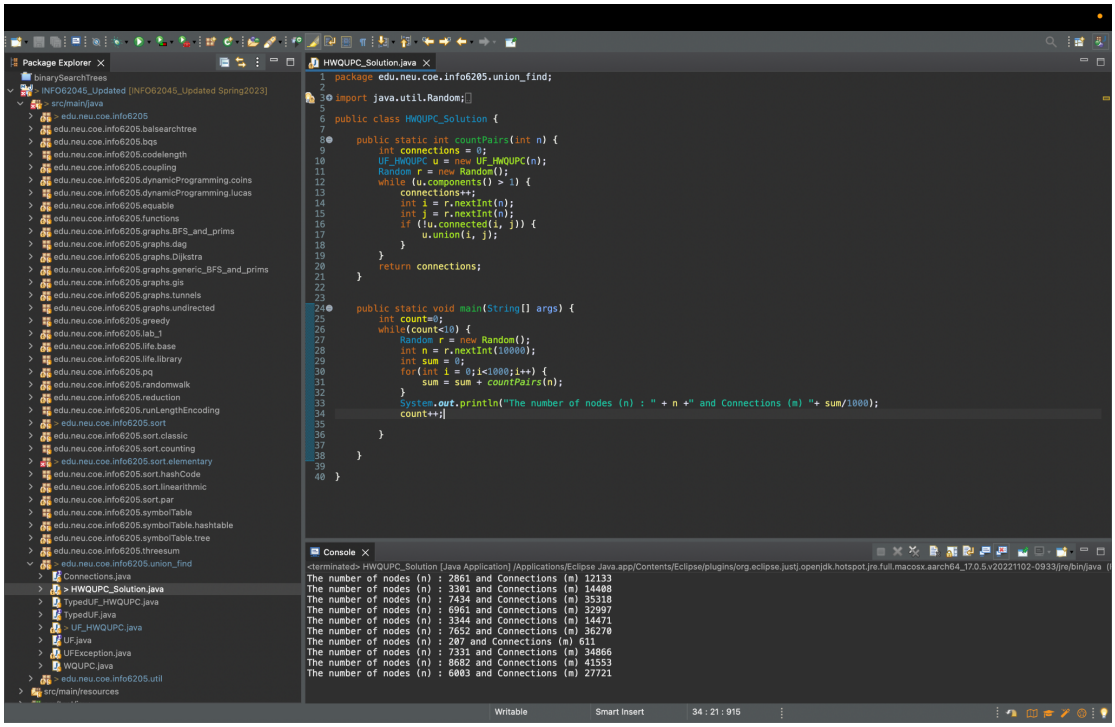
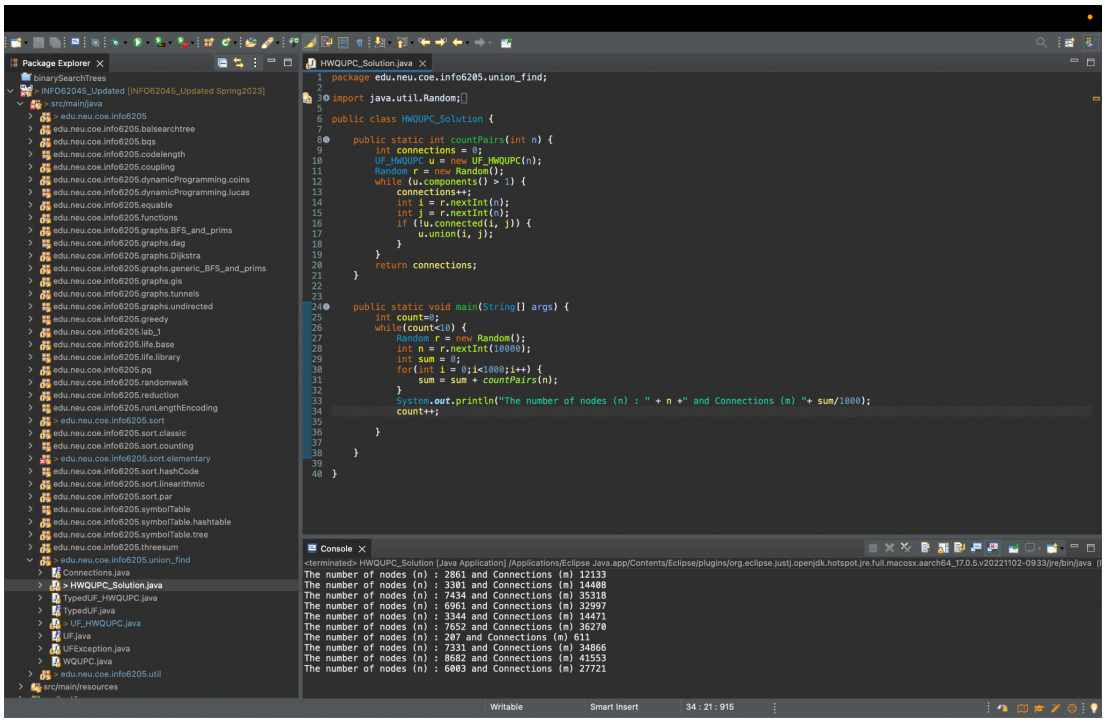
In general, the UF HWQUPC algorithm with path compression and height-weighted union has a near linear time complexity with a number of pairs proportional linearithmic.

It is important to note that this is an average-case scenario that may vary depending on the specific implementation, data structure used, and input. It does, however, provide a broad overview of the relationship between the number of nodes and the number of pairs.

Evidence to support that conclusion:

N	M
3866	16953
574	2021
6771	31910
3710	16268
4700	21240
3677	16254
4015	17830
2605	10971
345	1121
9514	46434
4006	17787
3331	14425
2260	9442
8205	39287
2807	11870
7570	36021
8824	42383
7027	33292
5893	27147
3014	12987

Graphical Representation:



Unit Test Screenshots: