

Program Structure and Algorithms (INFO-6205 SEC01)

Assignment – 3

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TASK

Task for this assignment is in three parts.

1. Implemented height-weighted Quick Union with Path Compression.
2. Implemented doPathCompression method.
3. Implemented mergeComponents method.

OUTPUT SCREENSHOT

The screenshot displays the IntelliJ IDEA IDE interface. The top toolbar shows standard development actions like Run, Debug, and Test. The main editor window shows the code for `UF_HWQUPC.java`. The code includes a `main` method that reads the number of sites and a list of connections, then iterates through them, creating a `UF_HWQUPC` object with `pathCompression: true` and printing the results. The `UF_HWQUPC` class is also visible in the project structure on the left. The bottom panel shows the output of the program, which lists the number of sites, connections, and pairs for various input sizes, and ends with "Process finished with exit code 0".

```
System.out.println("Input no. of sites:");
int i = scanner.nextInt();
int[] inputArray = {25, 50, 100, 200, 400, 800, 1600, 3200, 6400, 12800};
for(int i=0; i<10; i++) {
    UF_HWQUPC u = new UF_HWQUPC(inputArray[i], pathCompression: true);
    countPrints(inputArray[i]);
}
```

Run: `UF_HWQUPC`

/Library/Java/JavaVirtualMachines/jdk-17.0.1.jdk/Contents/Home/bin/java ...

Number of sites: 25 conn 24 pair 46
Number of sites: 50 conn 49 pair 75
Number of sites: 100 conn 99 pair 298
Number of sites: 200 conn 199 pair 441
Number of sites: 400 conn 399 pair 1387
Number of sites: 800 conn 799 pair 2879
Number of sites: 1600 conn 1599 pair 4949
Number of sites: 3200 conn 3199 pair 13651
Number of sites: 6400 conn 6399 pair 26643
Number of sites: 12800 conn 12799 pair 61158

Process finished with exit code 0

CONCLUSION

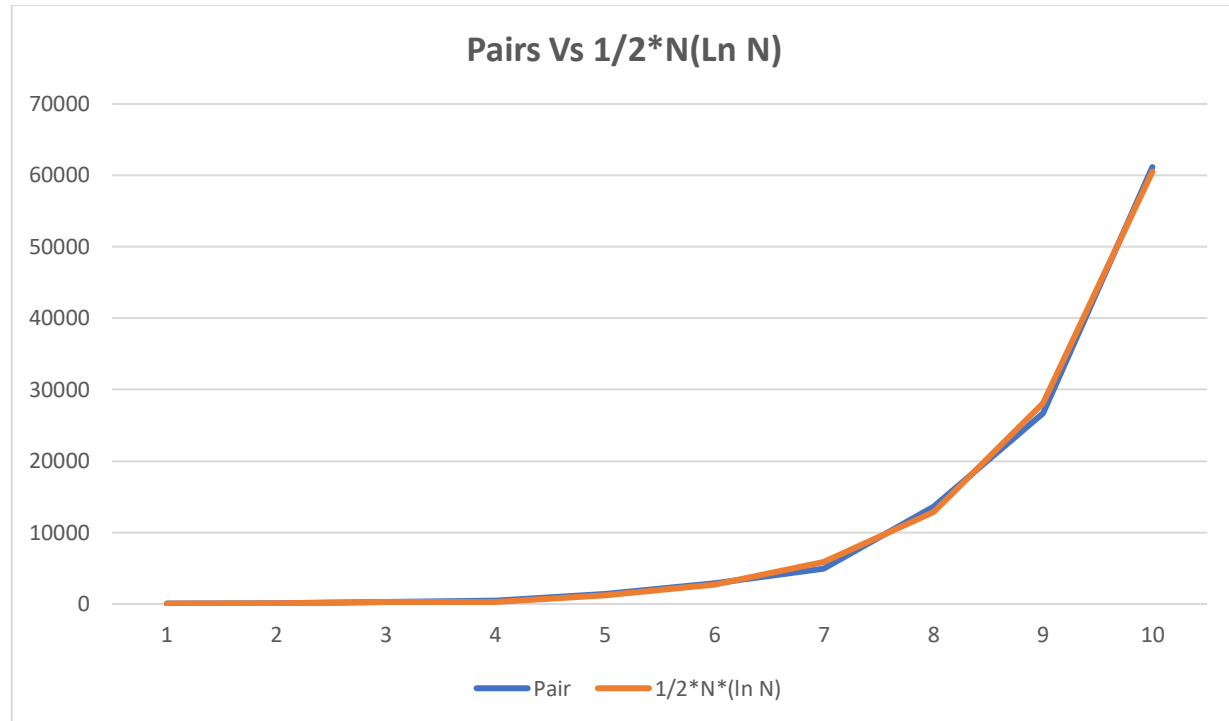
From the results, we can conclude that the relationship between number of objects(n) and numbers of pairs(m) is as follows:

$$M = (0.5) * N(\ln N)$$

i.e. M is equal to half times the product of number of pairs(N) and the log of number of pairs(N).

EVIDENCE

Objects	Pair	$1/2 * N * (\ln N)$
25	46	40.23594781
50	75	97.80057514
100	298	230.2585093
200	441	230.1029996
400	1387	1198.292909
800	2879	2673.844691
1600	4949	5902.207127
3200	13651	12913.44974
6400	26643	28044.97046
12800	61158	60526.08288



UNIT TESTS:

