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Program Structures & Algorithms

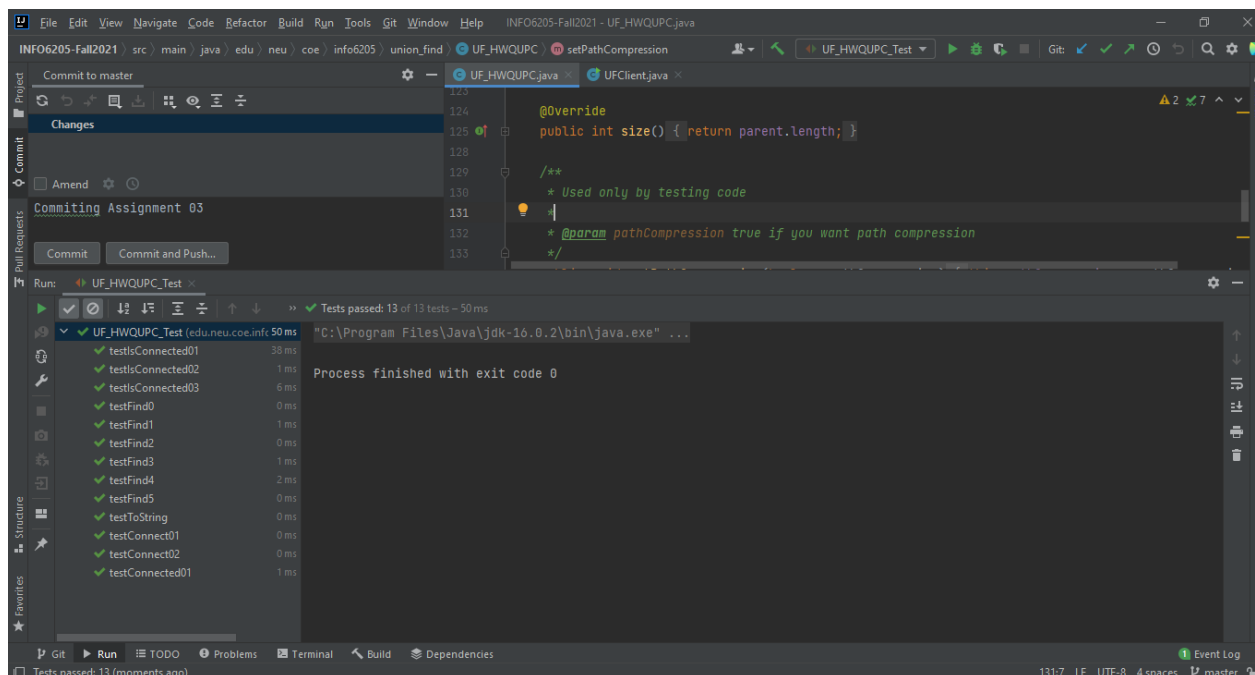
Fall 2021

Assignment No. 03

Tasks Performed :

- Implemented find, mergeComponents, pathCompression Functions in UF_HWQUPC class to implement height-weighted Quick Union with Path Compression. Successfully executed UF_HWQUPC_Test to run Unit Tests.
- Implemented the Union-Find Client class to generate random integer pairs and check if they are connected by path compression.
- From the arrived values predicted the relation between the number of objects(n) and number pairs generated(m).

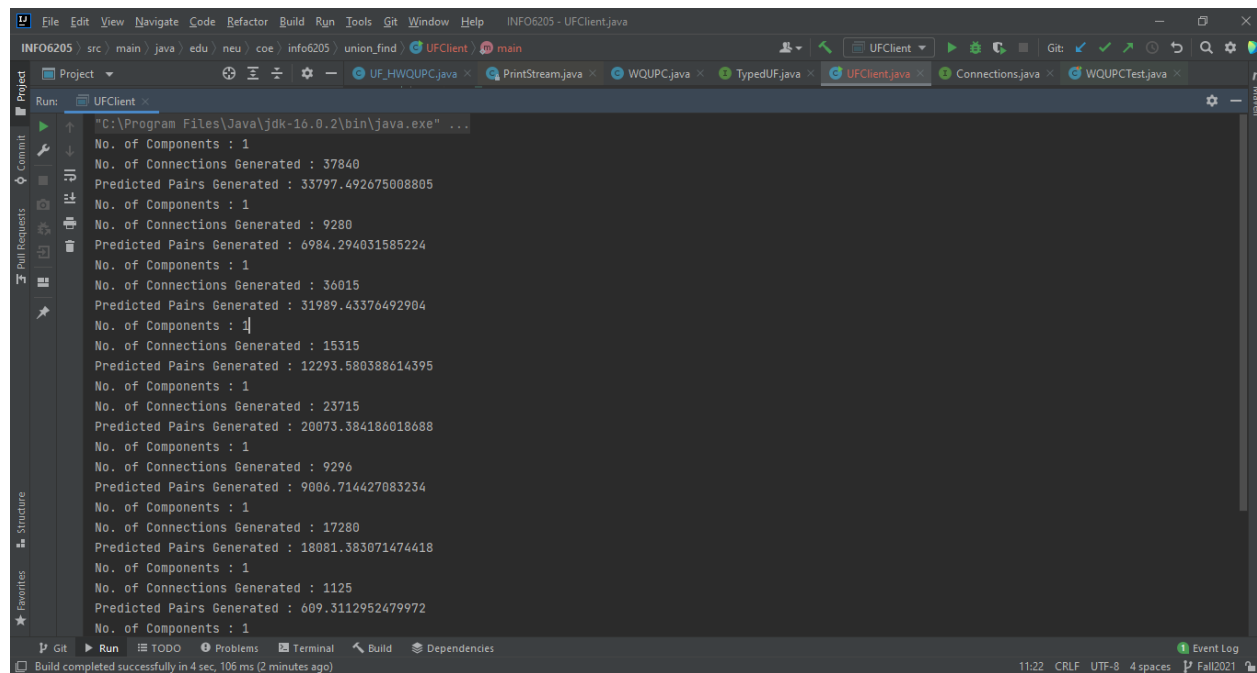
Successful Execution of UnitTests of UF_HWQUPC_Test



The screenshot displays an IDE window with the following components:

- Top Bar:** Shows the file path `INFO6205-Fall2021 - UF_HWQUPC.java` and various menu options like File, Edit, View, etc.
- Left Panel:** Contains a 'Commit' section with 'Commit to master' and 'Changes' (Amend, Commit, Commit and Push...). Below it is a 'Run' section showing 'UF_HWQUPC_Test' with a green checkmark and 'Tests passed: 13 of 13 tests - 50 ms'.
- Editor:** Displays the source code for `UF_HWQUPC.java`. The visible code includes an `@Override` method `public int size() { return parent.length; }` and a Javadoc comment: `/** * Used only by testing code * @param pathCompression true if you want path compression */`.
- Bottom Panel:** Shows the 'Run' output. It lists 13 tests with their durations: `testIsConnected01` (38 ms), `testIsConnected02` (1 ms), `testIsConnected03` (6 ms), `testFind0` (0 ms), `testFind1` (1 ms), `testFind2` (0 ms), `testFind3` (1 ms), `testFind4` (2 ms), `testFind5` (0 ms), `testToString` (0 ms), `testConnect01` (0 ms), `testConnect02` (0 ms), and `testConnected01` (1 ms). The output concludes with 'Process finished with exit code 0'.

Execution of UFClient.java



```
INFO6205 - UFClient.java
INFO6205 | src | main | java | edu | neu | coe | info6205 | union_find | UFClient | main
Run: UFClient
"C:\Program Files\Java\jdk-16.0.2\bin\java.exe" ...
No. of Components : 1
No. of Connections Generated : 37840
Predicted Pairs Generated : 33797.492675008805
No. of Components : 1
No. of Connections Generated : 9280
Predicted Pairs Generated : 6984.294031585224
No. of Components : 1
No. of Connections Generated : 36015
Predicted Pairs Generated : 31989.43376492904
No. of Components : 1
No. of Connections Generated : 15315
Predicted Pairs Generated : 12293.580388614395
No. of Components : 1
No. of Connections Generated : 23715
Predicted Pairs Generated : 20073.384186018688
No. of Components : 1
No. of Connections Generated : 9296
Predicted Pairs Generated : 9006.714427083234
No. of Components : 1
No. of Connections Generated : 17280
Predicted Pairs Generated : 18081.383071474418
No. of Components : 1
No. of Connections Generated : 1125
Predicted Pairs Generated : 609.3112952479972
No. of Components : 1
Build completed successfully in 4 sec. 106 ms (2 minutes ago)
```

Evidence : It is observed that, from the values obtained from the execution of height-weight quick union graph with path compression, the relationship between the number of objects(components) n and the number of pairs generated m can be deduced as $m = (0.5) n (\ln n)$