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Program Structures & Algorithms

Spring 2021

Assignment 4

- ## Task

We mentioned two alternatives for implementing Union-Find:

- For weighted quick union, store the depth rather than the size;
- For weighted quick union with path compression, do two loops, so that all intermediate nodes point to the root, not just the alternates.

For both of these, code the alternative and benchmark it against the implementation in the repository. You have all of that available from a previous assignment.

- ## Output

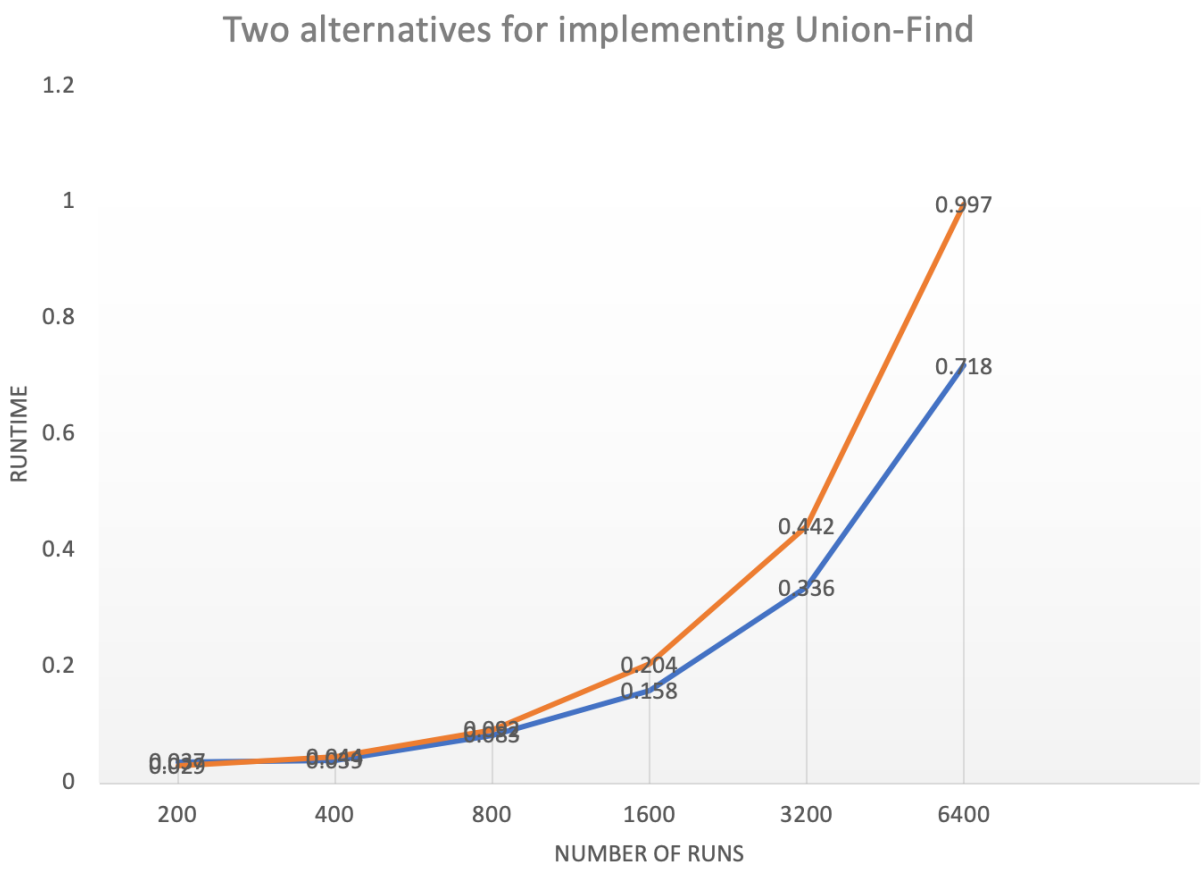
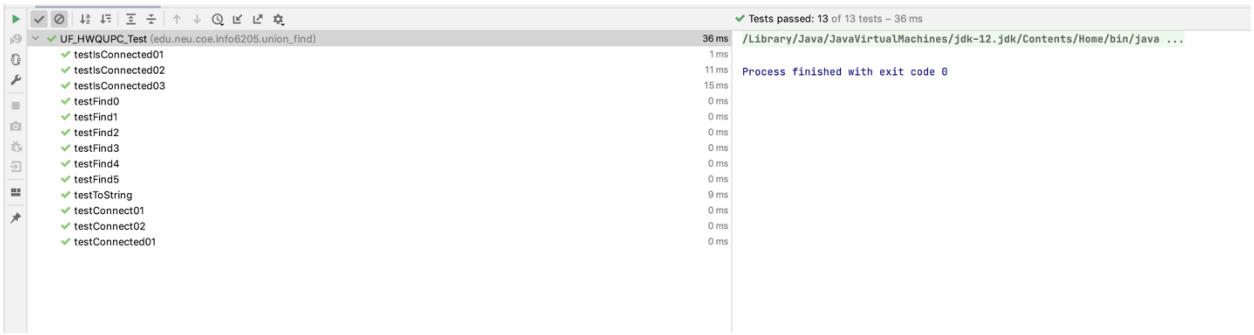
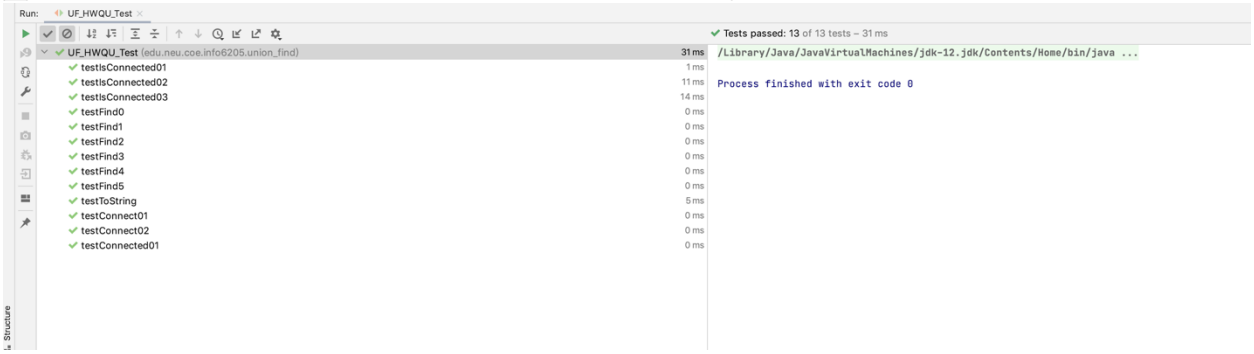
```
Run:  Benchmark_UF
/Library/Java/JavaVirtualMachines/jdk-12.jdk/Contents/Home/bin/java ...
2021-03-02 21:26:27 INFO  Benchmark_Timer - Begin run: Test UF_HWQUPC with 1,000 runs
Runtime of 200 times of HWQUPC is: 0.037
2021-03-02 21:26:27 INFO  Benchmark_Timer - Begin run: Test UF_HWQUPC with 1,000 runs
Runtime of 400 times of HWQUPC is: 0.039
2021-03-02 21:26:27 INFO  Benchmark_Timer - Begin run: Test UF_HWQUPC with 1,000 runs
Runtime of 800 times of HWQUPC is: 0.083
2021-03-02 21:26:27 INFO  Benchmark_Timer - Begin run: Test UF_HWQUPC with 1,000 runs
Runtime of 1600 times of HWQUPC is: 0.158
2021-03-02 21:26:27 INFO  Benchmark_Timer - Begin run: Test UF_HWQUPC with 1,000 runs
Runtime of 3200 times of HWQUPC is: 0.336
2021-03-02 21:26:27 INFO  Benchmark_Timer - Begin run: Test UF_HWQUPC with 1,000 runs
Runtime of 6400 times of HWQUPC is: 0.718
2021-03-02 21:26:28 INFO  Benchmark_Timer - Begin run: Test UF_HWQU with 1,000 runs
Runtime of 200 times of HWQU is: 0.029
2021-03-02 21:26:28 INFO  Benchmark_Timer - Begin run: Test UF_HWQU with 1,000 runs
Runtime of 400 times of HWQU is: 0.044
2021-03-02 21:26:28 INFO  Benchmark_Timer - Begin run: Test UF_HWQU with 1,000 runs
Runtime of 800 times of HWQU is: 0.092
2021-03-02 21:26:28 INFO  Benchmark_Timer - Begin run: Test UF_HWQU with 1,000 runs
Runtime of 1600 times of HWQU is: 0.204
2021-03-02 21:26:28 INFO  Benchmark_Timer - Begin run: Test UF_HWQU with 1,000 runs
Runtime of 3200 times of HWQU is: 0.442
2021-03-02 21:26:29 INFO  Benchmark_Timer - Begin run: Test UF_HWQU with 1,000 runs
Runtime of 6400 times of HWQU is: 0.977

Process finished with exit code 0
```

- Conclusion:

  The performance of ‘weighted quick union with path compression’ is better than ‘weighted quick union’.

- Graphical representation:



- Unit tests result: