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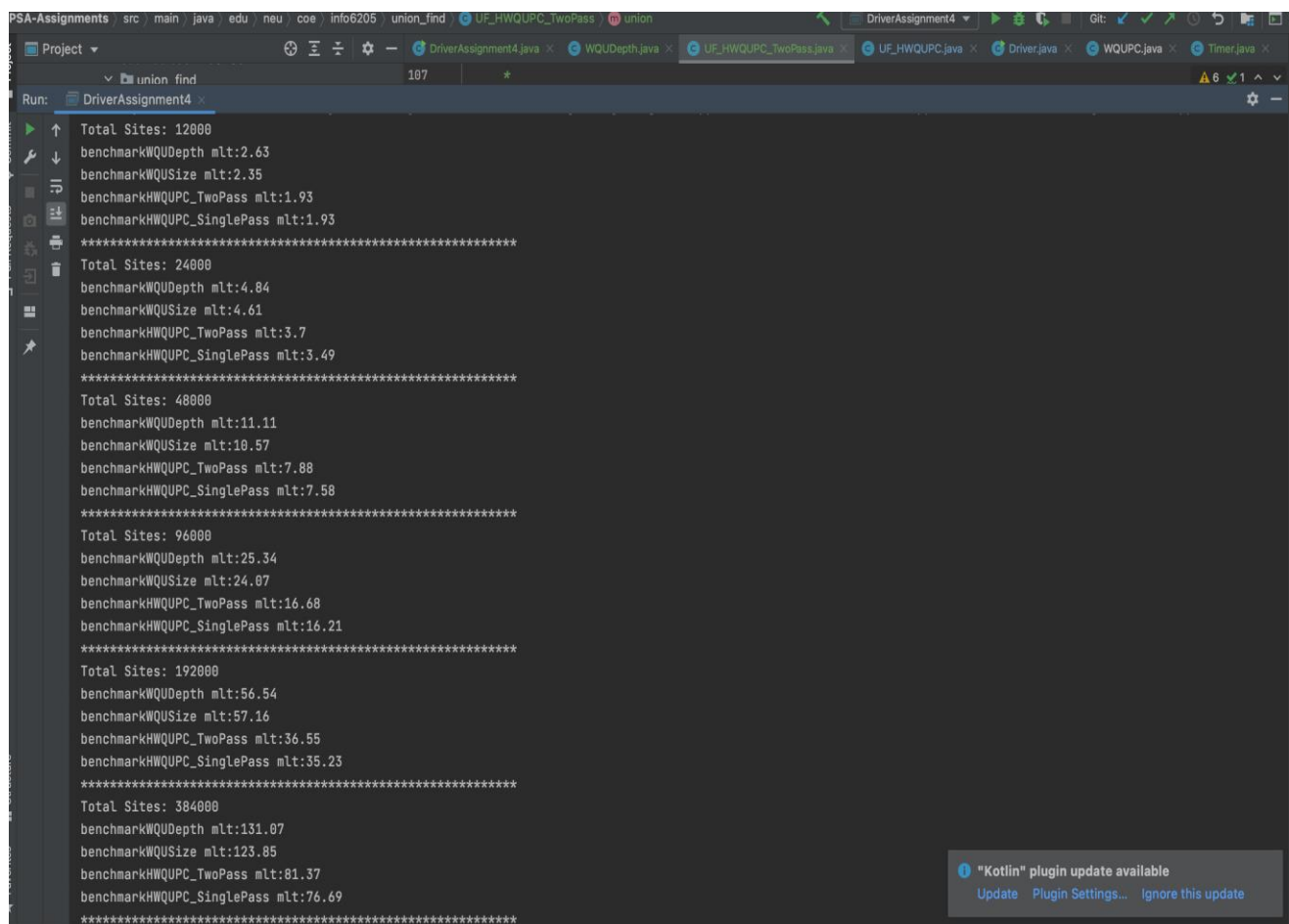
Program Structures & Algorithms

Spring 2021

Assignment No. 4

Task: Benchmark alternatives for weighted quick union find and weighted quick union find with path compression

Output:



The screenshot shows an IDE window with a run console displaying benchmark results for five different union-find algorithms across five different site counts (12000, 24000, 48000, 96000, and 192000). The algorithms compared are benchmarkWQUDepth, benchmarkWQUSize, benchmarkHWQUPC_TwoPass, and benchmarkHWQUPC_SinglePass. The results show that the SinglePass algorithm generally performs best, followed by TwoPass, while Depth and Size are the slowest. A notification for a Kotlin plugin update is visible in the bottom right corner.

```
Run: DriverAssignment4 x
Total Sites: 12000
benchmarkWQUDepth mlt:2.63
benchmarkWQUSize mlt:2.35
benchmarkHWQUPC_TwoPass mlt:1.93
benchmarkHWQUPC_SinglePass mlt:1.93
*****
Total Sites: 24000
benchmarkWQUDepth mlt:4.84
benchmarkWQUSize mlt:4.61
benchmarkHWQUPC_TwoPass mlt:3.7
benchmarkHWQUPC_SinglePass mlt:3.49
*****
Total Sites: 48000
benchmarkWQUDepth mlt:11.11
benchmarkWQUSize mlt:10.57
benchmarkHWQUPC_TwoPass mlt:7.88
benchmarkHWQUPC_SinglePass mlt:7.58
*****
Total Sites: 96000
benchmarkWQUDepth mlt:25.34
benchmarkWQUSize mlt:24.07
benchmarkHWQUPC_TwoPass mlt:16.68
benchmarkHWQUPC_SinglePass mlt:16.21
*****
Total Sites: 192000
benchmarkWQUDepth mlt:56.54
benchmarkWQUSize mlt:57.16
benchmarkHWQUPC_TwoPass mlt:36.55
benchmarkHWQUPC_SinglePass mlt:35.23
*****
Total Sites: 384000
benchmarkWQUDepth mlt:131.07
benchmarkWQUSize mlt:123.85
benchmarkHWQUPC_TwoPass mlt:81.37
benchmarkHWQUPC_SinglePass mlt:76.69
*****
```

Relationship Conclusion:

Weighted quick union find with depth marginally slower than weighted quick union find size. But nothing statistically significant, we can consider their running times equal for practical purposes

Weighted quick union find path compression Two pass is marginally slower than weighted quick union find path compression single pass. But nothing statistically significant, we can consider their running times equal for practical purposes

Evidence to support the conclusion:

| Sites | benchmarkWQUDepth | benchmarkWQUSize | benchmarkHWQUPC_TwoPass | benchmarkHWQUPC_SinglePass |
|--------|-------------------|------------------|-------------------------|----------------------------|
| 12000 | 2.63 | 2.35 | 1.93 | 1.93 |
| 24000 | 4.84 | 4.61 | 3.7 | 3.49 |
| 48000 | 11.11 | 10.57 | 7.88 | 7.58 |
| 96000 | 25.34 | 24.07 | 16.68 | 16.21 |
| 192000 | 56.54 | 57.16 | 36.55 | 35.23 |
| 384000 | 131.07 | 123.85 | 81.37 | 76.69 |

Graphical representation:

