Analysis Report:

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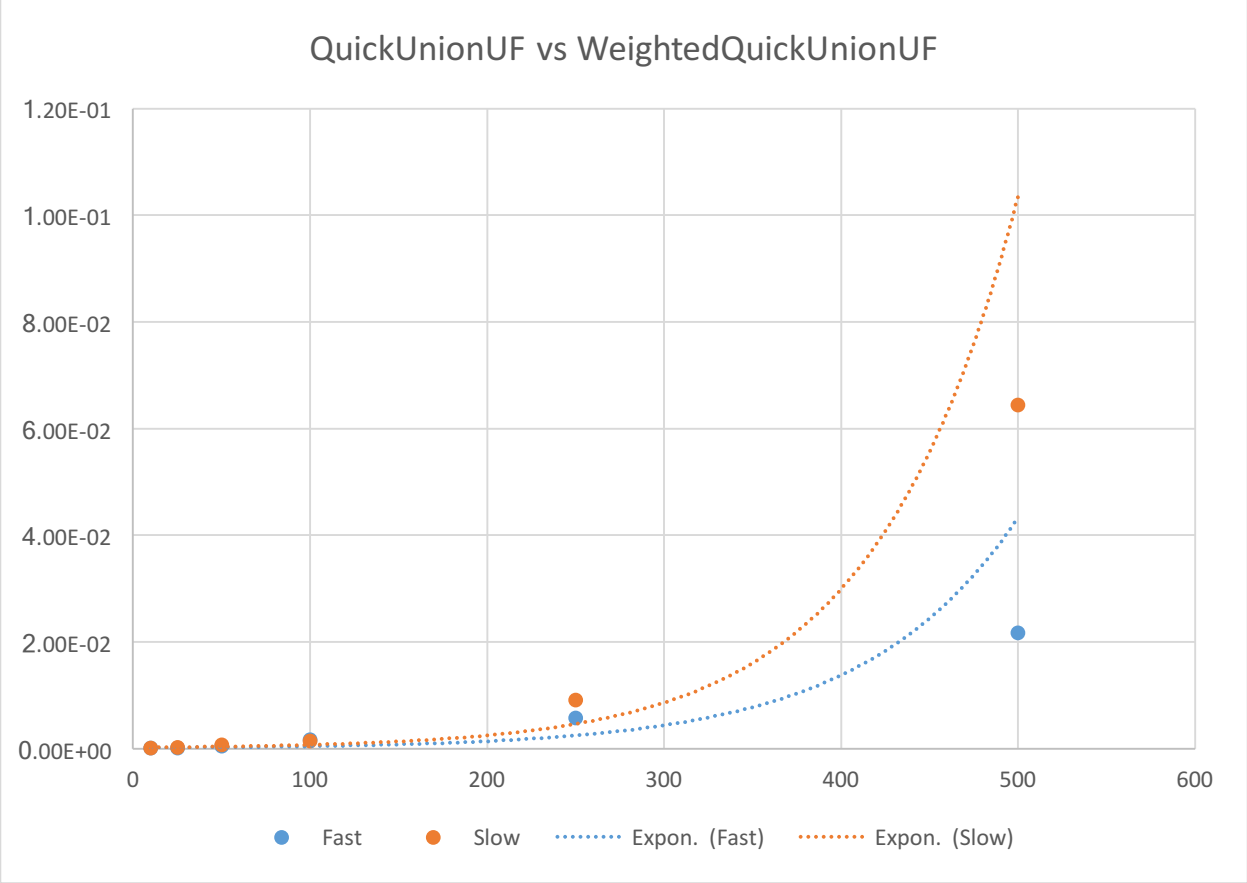
Running Time:

The following scatter plot and regression lines depict the average runtime required for N = {10, 25, 50, 100, 250, 500} size grids before they percolate using the two UnionFind APIs provided. The averages were taken over 30 iterations of percolation for each grid size provided previously:

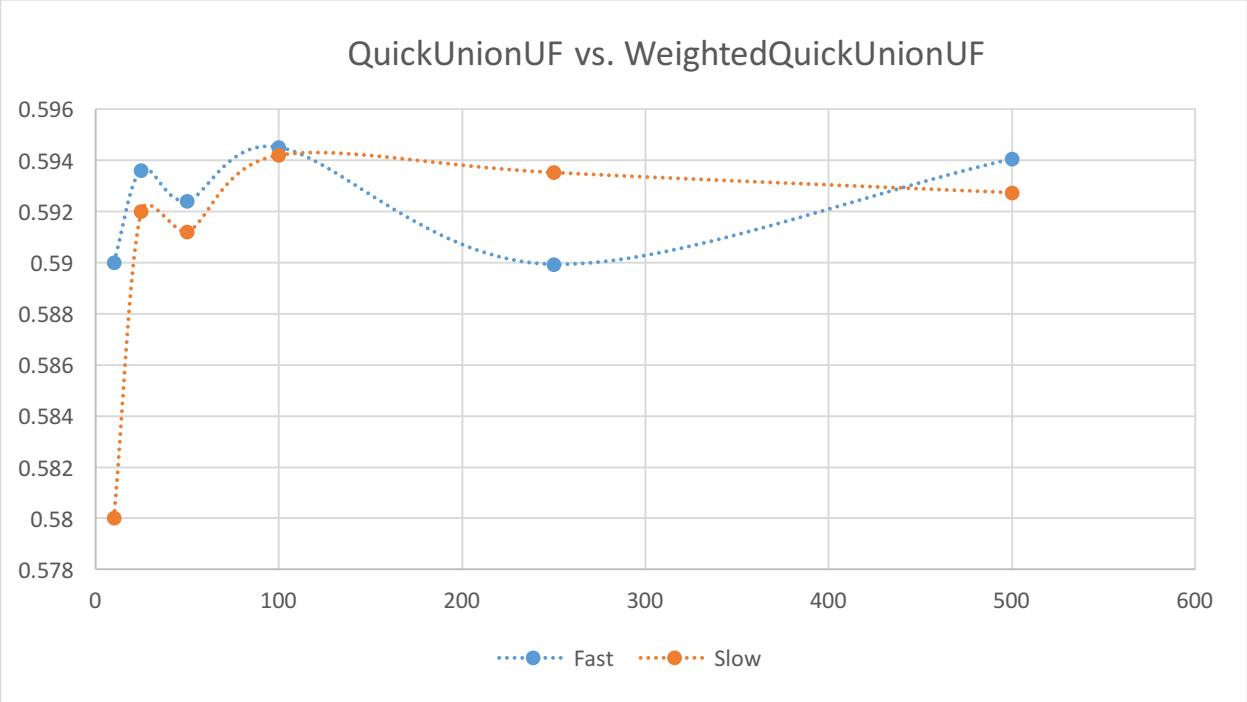


The above plot indicates, as expected, that the QuickUnionUF implementation (red line) of the Union Find data structure is less efficient in terms of time in comparison to the

WeightedQuickUnionUF (blue line). This is because the weighted implementation orders the values in its data structure in sequential order, cutting down on computation and time. The quick union implementation does not do this, and, therefore, takes a great time to effectively do calculations on grids of large dimensions when using union, is connected, and find.

P* Estimate:

The following scatter plot and regression lines depict a proportion of the average number of cells that are opened for N = {10, 25, 50, 100, 250, 500} size grids before they percolate and the total number of cells in each grid in question. That is, this plot displays p*, such that $p^* = \frac{\mu_p}{N^2}$, where μ_p is the average number of cells opened before percolation, and N^2 is the N value of the grid squared (total number of cells). The averages were taken over 30 iterations of percolation for each grid size provided previously:



The above plot indicates that the general value for p* among all of the given grid sizes over the 30 iterations is approximately 0.59.

Additional Discussion:

In reference to the elapsed time required for percolation for both the Quick Union and Weighted Quick Union, all times recorded are extremely fast in reference to the size of grids and computational power required in generating unique coordinates for these systems. In practice, it was relatively difficult to physically detect a noticeable difference between the performance of the two applied implementations, but, as seen by the data plot, the differences are quite stark.