**Analyze the consequences of using different values of N and each of the two modifications to the data structure**

Time in seconds

N (dimension of grid)

|  |  |  |
| --- | --- | --- |
| N | Time Fast (s) | Time Slow (s) |
| 10 | 0.000515933166666667 | 0.000193199366666667 |
| 25 | 0.000164574466666667 | 0.000318548133333333 |
| 50 | 0.000640736300000000 | 0.001346714933333330 |
| 100 | 0.002461562933333330 | 0.014728208000000000 |
| 250 | 0.029385277266666600 | 0.511118716633333000 |
| 500 | 0.216461616966666000 | 7.929297484766660000 |

The fast UF runs a lot faster than the QuickFindUF since it eliminates the iteration in the union method which loops n times every call to union. This would lead to N\*C iterations where C is the number of cells opened before it percolates, whereas in Weighted Quick Union Find the size array that records frequency of the nodes is accessed and modified. In QuickFindUF the worst case is N^2 iterations in the union method whereas in Weighted its logarithmic complexity. As N Increases N\*C increases since there are more nodes that need to be opened.

Mean Threshold

N (dimension of grid)

|  |  |  |
| --- | --- | --- |
| N | Mean Threshold Fast | Mean Threshold Slow |
| 10 | 0.606 | 0.590666667 |
| 25 | 0.579253333 | 0.596106667 |
| 50 | 0.595653333 | 0.59436 |
| 100 | 0.597226667 | 0.596096667 |
| 250 | 0.5926416 | 0.5957856 |
| 500 | 0.592122267 | 0.593898267 |

As N increases the probability of opening a node decreases since there are more nodes that can be opened. Hence the probability that a system percolates also decreases since it is harder to open enough random nodes for it to percolate. Hence, this is visually represented in the tighter range of the value of mean threshold as N increases.