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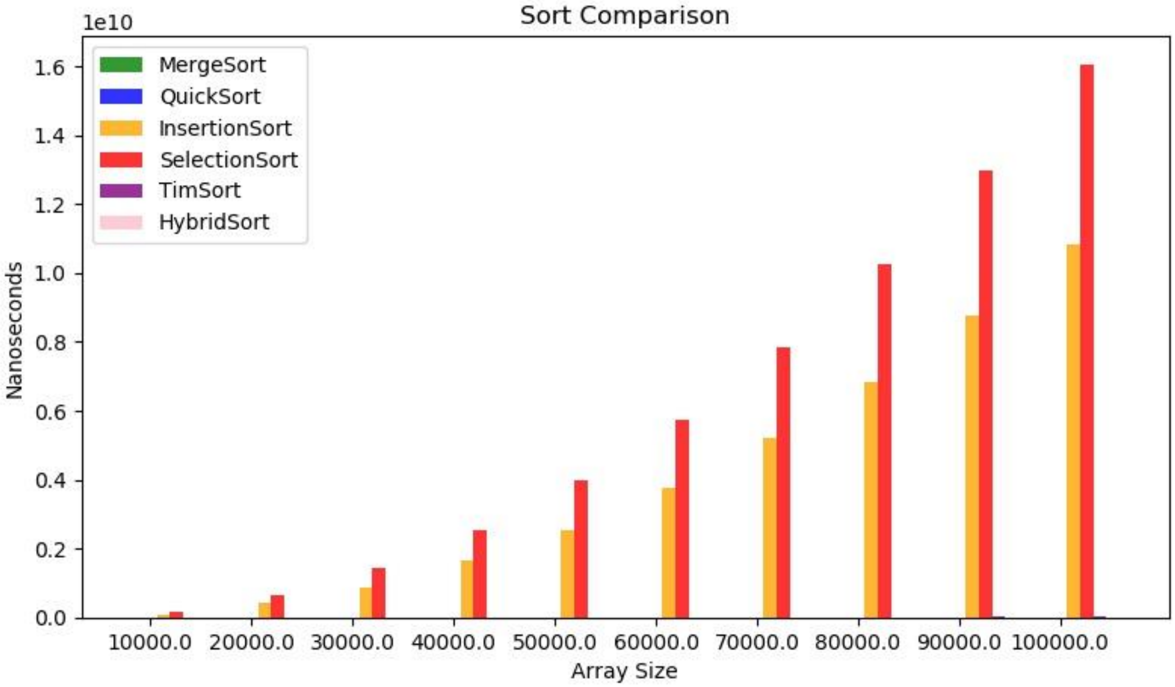
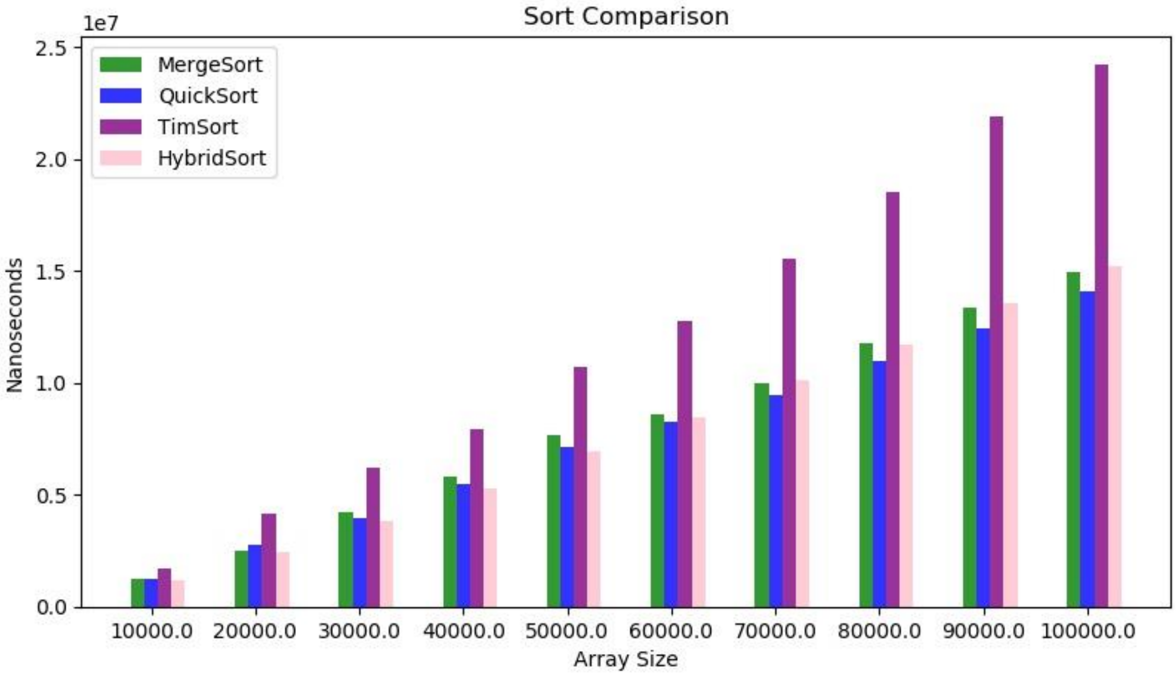
Sort Algorithm Analysis

Each sorting algorithm was run on unsorted arrays with a size between 10,000 to 100,000 and was repeated 50 times. Insertion Sort and Selection Sort are slow sorting algorithms, with Selection Sort being the slowest. For an array with a size of 100,000, Selection Sort took an average time of 16.07 seconds and Insertion Sort took an average time of 10.84 seconds. Insertion Sort was 32.51% faster than Selection Sort at this array size. Quick Sort, Merge Sort and Hybrid Sort are relatively similar. At lower array sizes such as a size of 40,000, Hybrid Sort was the fastest being 9.41% faster than Merge Sort. At higher array sizes such as a size of 100,000, Quick Sort was the fastest being 7.07% faster than Hybrid Sort. The average times for Quick Sort, Merge Sort, and Hybrid Sort for an array with a size of 100,000 are: 0.01411, 0.01498, and 0.01519 seconds, respectively. Quick Sort was 41.80% faster than Tim Sort for an array size of 100,000 at 0.02425 seconds, which was the slowest out of the four sorting algorithms. Overall, Quick Sort is 99.99% faster than Selection Sort for an array size of 100,000. Benchmarking was performed on a 4-core processor with 4.0 GHz core frequency.

```
N, MergeSort, QuickSort, InsertionSort, SelectionSort, TimSort, HybridSort
10000,1235500,1267598,99273284,160993842,1735432,1166308
20000,2496194,2759422,430159080,643633634,4141444,2467438
30000,4227342,3958242,872435024,1431588938,6232444,3864112
40000,5826546,5468742,1667724698,2548622016,7940824,5278168
50000,7687406,7174824,2556439392,3991739864,10746838,6936652
60000,8573778,8263896,3766172084,5755486668,12742758,8438442
70000,9977152,9472504,5196400290,7848458804,15528514,10096178
80000,11758636,10996614,6842935864,10270999608,18509402,11695582
90000,13337732,12433276,8749230720,12989703412,21880816,13576638
100000,14979296,14114670,10843594084,16066445710,24251658,15187930
```


Sort Comparison
1e10
MergeSort
QuickSort
InsertionSort
SelectionSort
TimSort
HybridSort
Nanoseconds
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
10000.0
20000.0
30000.0
40000.0
50000.0
60000.0
70000.0
80000.0
90000.0
100000.0
Array Size


Sort Comparison
1e7
MergeSort
QuickSort
TimSort
HybridSort
Nanoseconds
0.0
0.5
1.0
1.5
2.0
2.5
10000.0
20000.0
30000.0
40000.0
50000.0
60000.0
70000.0
80000.0
90000.0
100000.0
Array Size