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Algorithms
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Analysis: Assignment 3, Sorting Algorithms

The comparisons of times are shown below for Bubble sort vs. the STL sort method. The bubble sort runs at $O(n^2)$, while the STL appears to be much faster, though without the code we can't conduct formal analysis of it. For 80,000 data points, STL took 74 time units to execute, while at 8000 data points, it took 6 time units to execute. This is nearly $O(n)$ time for the STL sort, since:

$$\frac{80000}{8000} = 10 \text{ and } \frac{74}{6} = 12.33$$

$\frac{12.33}{10} = 1.233 \approx 1$ meaning the change in time is essentially directly proportional to the change in the size of *n*, so O(n) makes sense.

For the worst case formal analysis of the bubble sort, the algorithm can be written as such:

$$\sum_{i=1}^{N}\sum_{j=0}^{N-i} 1$$

$$\sum_{i=1}^{N}(N-i-0+1)$$

$$\sum_{i=1}^{N}(N-i+1)$$

$$\sum_{i=1}^{N}(N+1) - \sum_{i=1}^{N} i$$

$$[(N+1)(N-1+1)] - [\frac{(N)(N+1)}{2}]$$

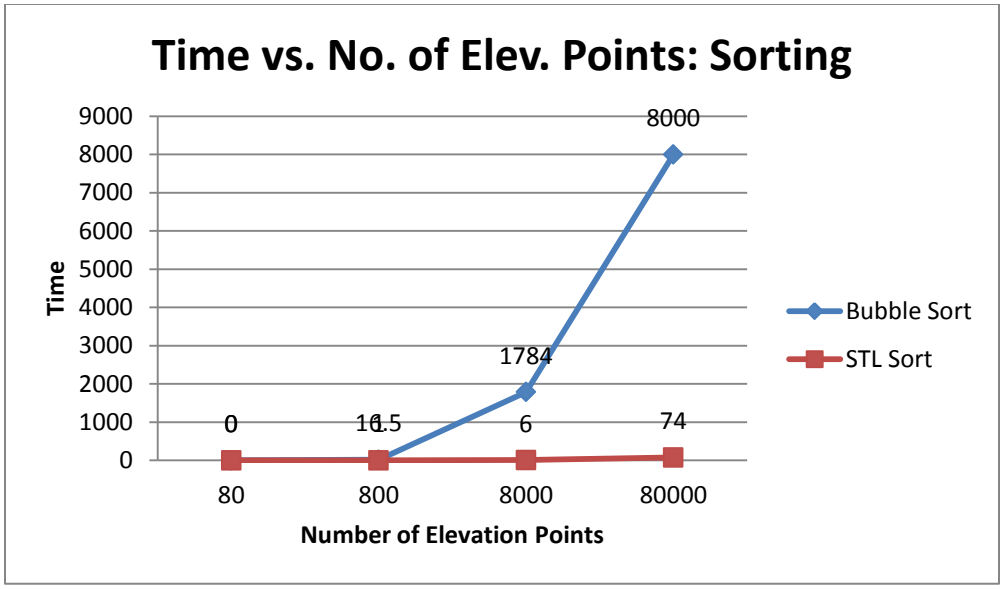
$$(N^2+N) - \frac{(N^2+N)}{2}$$

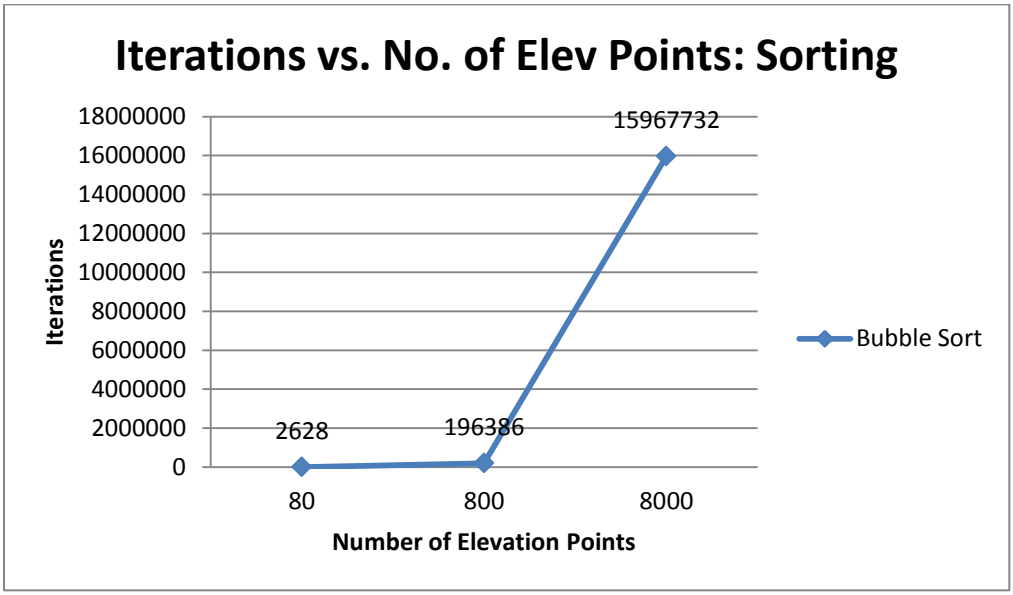
$$\frac{N^2+N}{2} = O(N^2)$$

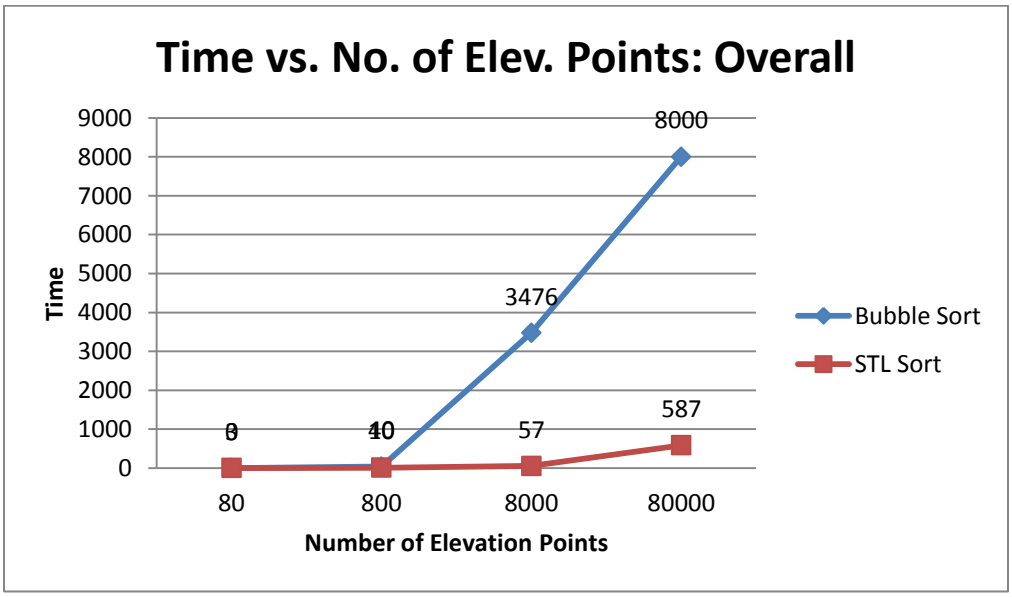
According to the data collected, this is about right. Judging by the number of iterations of the bubble sort, ad following the same logic as for the STL sort, we have:

$$\frac{15967732}{8000} = 1995.9665 \approx \frac{1}{4}8000 \text{ and } \frac{196386}{800} = 245.4825 \approx \frac{1}{4}800$$

So it seems that T(n)= n*$T(n) \approx n * \frac{1}{4}n = \frac{1}{4}n^2$, so $O(n^2)$ seems to be an accurate representation of the efficiency seems to be an accurate representation of the efficiency of this algorithm.


Time vs. No. of Elev. Points: Sorting
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Time
8000
1784
0
1.5
6
74
80
800
8000
80000
Number of Elevation Points
Bubble Sort
STL Sort


Iterations vs. No. of Elev Points: Sorting
18000000
16000000
14000000
12000000
10000000
8000000
6000000
4000000
2000000
0
Iterations
15967732
2628
196386
80
800
8000
Number of Elevation Points
Bubble Sort


Time vs. No. of Elev. Points: Overall
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Time
8000
3476
0
0
1
0
57
587
80
800
8000
80000
Number of Elevation Points
Bubble Sort
STL Sort