CS2023 - Data Structures and Algorithms

In-class Lab Exercise - Week 3

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Terminal Outputs

1. **Insertion Sort**

```
Insertion Sort
Total elements in the array: 500
Time taken is 0.000000 s
Total elements in the array: 2000
Time taken is 0.002000 s
Total elements in the array: 7500
Time taken is 0.033000 s
Total elements in the array: 12000
Time taken is 0.072000 s
Total elements in the array: 20000
Time taken is 0.198000 s
```

2. **Bubble Sort**

```
Bubble Sort
Total elements in the array: 500
Time taken is 0.001000 s
Total elements in the array: 2000
Time taken is 0.007000 s
Total elements in the array: 7500
Time taken is 0.103000 s
Total elements in the array: 12000
Time taken is 0.280000 s
Total elements in the array: 20000
Time taken is 0.861000 s
```

3. **Optimized Bubble Sort**

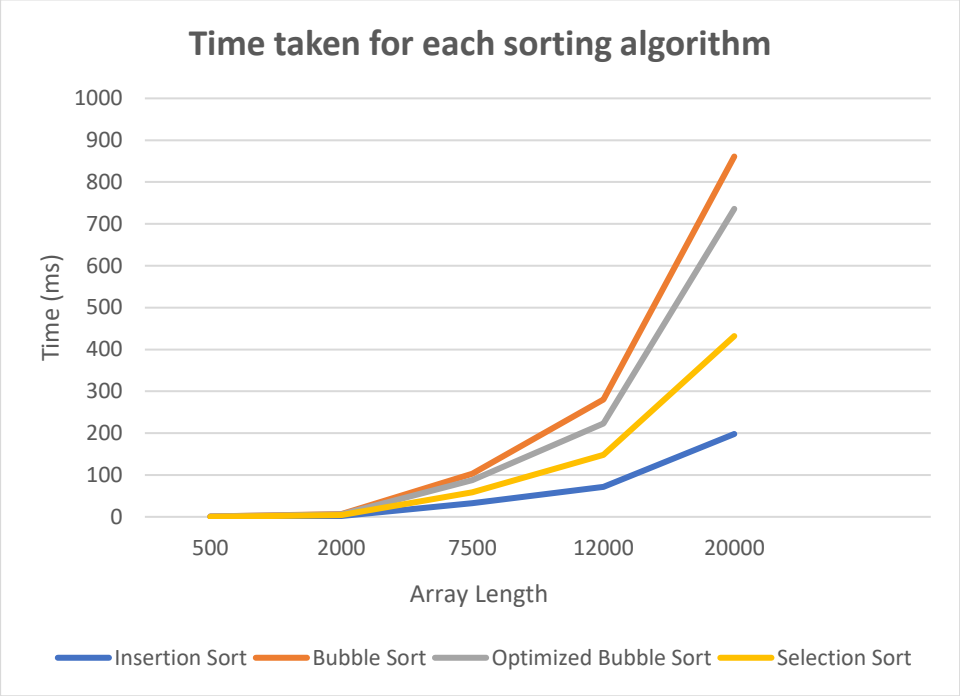
```
Optimized Bubble Sort
Total elements in the array: 500
Time taken is 0.001000 s
Total elements in the array: 2000
Time taken is 0.006000 s
Total elements in the array: 7500
Time taken is 0.088000 s
Total elements in the array: 12000
Time taken is 0.223000 s
Total elements in the array: 20000
Time taken is 0.736000 s
```

4. **Selection Sort**

```
Selection Sort
Total elements in the array: 500
Time taken is 0.000000 s
Total elements in the array: 2000
Time taken is 0.004000 s
Total elements in the array: 7500
Time taken is 0.059000 s
Total elements in the array: 12000
Time taken is 0.148000 s
Total elements in the array: 20000
Time taken is 0.432000 s
```

Array Size	Time taken (ms)			
	Insertion Sort	Bubble Sort	Optimized Bubble Sort	Selection Sort
500	0	1	1	0
2000	2	7	6	4
7500	33	103	88	59
12000	72	280	223	148
20000	198	861	736	432

Time taken for each sorting algorithm with array length



Discussion

- All 4 sorting algorithms have a similar growth pattern when array length increases. This is because the time complexity is $O(n^2)$ for all the algorithms.
- Comparatively, Bubble Sort has taken the longest amount of time.
- Optimized bubble sort has only provided a slight decrease in the run time.
- Insertion sort can be observed as the most efficient algorithm out of the 4 algorithms.