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For this assignment, I had to implement 7 different type of sorts and compare the time complexity. Here are the following:

1. Selection Sort
2. Quick Sort
3. Heap Sort (Without using heap initialization)
4. Heap Sort (With heap initialization)
5. Using a BST
6. Using a Splay Tree
7. Merge Sort

I could not implement number 4, because I really could not understand what heap initialization meant…

Anyway, here is the result I got.

- 1 ms BST Sort
- 29 ms Selection Sort
- 64 ms QuickSort
- 0 ms Heap Sort Without Initialization
- 4 ms Splay Tree Sort
- 1 ms Merge Sort

For a reference, I looped each sort 100 times using an input file containing 10,000 randomly generated integers ranged from 0 - 99,999.

BST Sort =
- Best = O(n(log(n)))
- Worst = O(n(log(n)))

Selection Sort =
- Best = O(n^2)
- Worst = O(n^2)

Quick Sort =
- Best = O(n(log(n)))
- Worst = O(n^2)

Heap Sort =
- Best = O(n(log(n)))
- Worst = O(n(log(n)))

Splay Sort =
- Best = O(n(log(n)))
- Worst = O(n(log(n)))

Merge Sort =
- Best = O(n(log(n)))
- Worst = O(n(log(n)))

Starting with BST Sort, it took 1 ms going through the algorithm 100 times, which is really fast. Referencing to the time complexity chart above, BST Sort takes O(n(log(n))) time. Therefore, it should be faster than Selection and Quick Sort, which can take up to O(n^2) time. Also, BST Sort, Heap Sort, Splay Sort, and Merge Sort have a similar time complexity, O(n(log(n))). Therefore, these four sorts should take a similar amount of time. Im fact, by looking at the result, we can see these four sorts take 1ms, 0ms, 4ms, and 1ms, respectively. This explains how that their time complexities are similar.

Comparing Selection and Quick Sort, We can see they took 29 ms and 64 ms, respectively. I am not sure why Quick Sort took a twice more time than Selection Sort. However, it is explainable that these two sorts took a significant more time than other sorts that have O(n(log(n))) time complexities. Since Selection and Quick Sort have a polynomial time complexities, thus takes way more time than other sorts.