Assignment 6

WRITEUP: Sorting

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1 Sort A

Sort A is known as Selection Sort or Min sort. What we need to do is find the No. i smallest element and insert it to its correct location i. The complexity should always be $O(n^2)$ which n is the number of elements.

2 Sort B

Sort B has a famous name, Bubble Sort. For this sorting method, we will continue compare two adjacent pairs of items and get the biggest number in the end. And then we should repeat what we did to find the second biggest number and it will be on its correct location. The time complexity could be different. In best case, it should be O(n), while it will be $O(n^2)$ when the worst case happened. Number n is the number of elements in array.

3 Sort C

Sort C is insertion sort. It will insert elements to its correct location. The time complexity of insertion sort is same as bubble sort. In best case, it should be O(n), while it will be $O(n^2)$ when the worst case happened. Number n is the number of elements in array.

4 Sort D

Sort D is a kind of shell sort. We use 701, 301, 132, 57, 23, 10, 4, 1 as gap to sort the array. Actually, I have no idea about the time complexity of shell sort by using gaps 701, 301, 132, 57, 23, 10, 4, 1. But I expect the time complexity in best case should be O(n). Number n is the number of elements in array.

5 Experience

When I run all of these functions by using a small length of array, I cannot figure out the difference of their speed because they are pretty close. But when I try to use a big number, the time on these sorting has a big different. I use100000 elements to test. Selection Sort spends 4.4s and while Bubble Sort spends about 20 seconds. We can see the number of comparisons is similar actually, but Bubble Sort will move the elements for a lot of time, which wastes a lot of time. Insertion Sort also have a bad performance when we do 100000 elements. It spends about 5 seconds. It indeed spends more time on compare elements and moves. Sort D has the best performance. It only takes 0.05 second and finished the task. Even for 1000000 elements, it spends less than 1 second. And this method uses less comparison operation than other sorting

method. So, we can conclude that Shell Sort is the best sorting method when you want to sort an array which includes numerous elements. As for small number, I prefer Selection Sort not because it is easy to understand how it works, also because it works quickly.