

## CO322: Data Structure and Algorithms

### Lab1: Simple sorting algorithms

Name: Rodrigo A.R.S.P.

E. Number: E/11/343

Date: 02-02-2015

---

**Discussion:** In terms of the theoretical analysis all the above algorithms are  $O(n^2)$ . Does the numbers you measure agree? Suppose for a one data set you run an algorithm; say the bubble sort; twice will you see the same time? If not why? What if you take the average by repeating the experiment?

According to the theoretical analysis all the above algorithms are  $O(n^2)$ . But the outputs of the program does not show it like that.

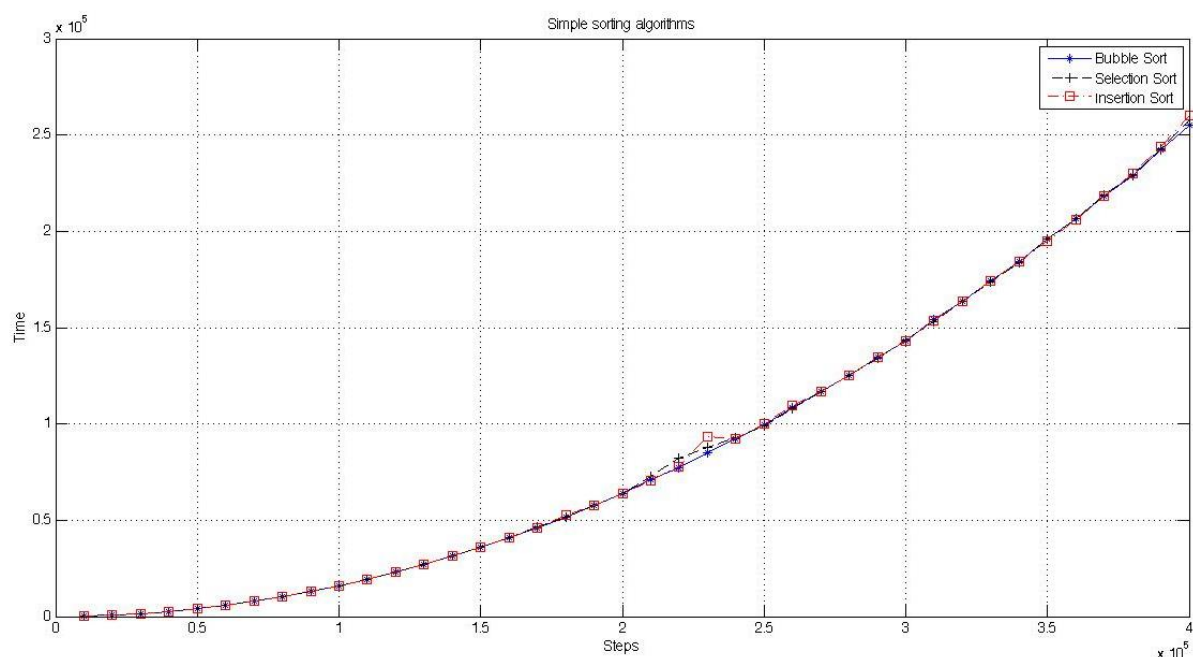


Figure 1: Simple sorting algorithms with time

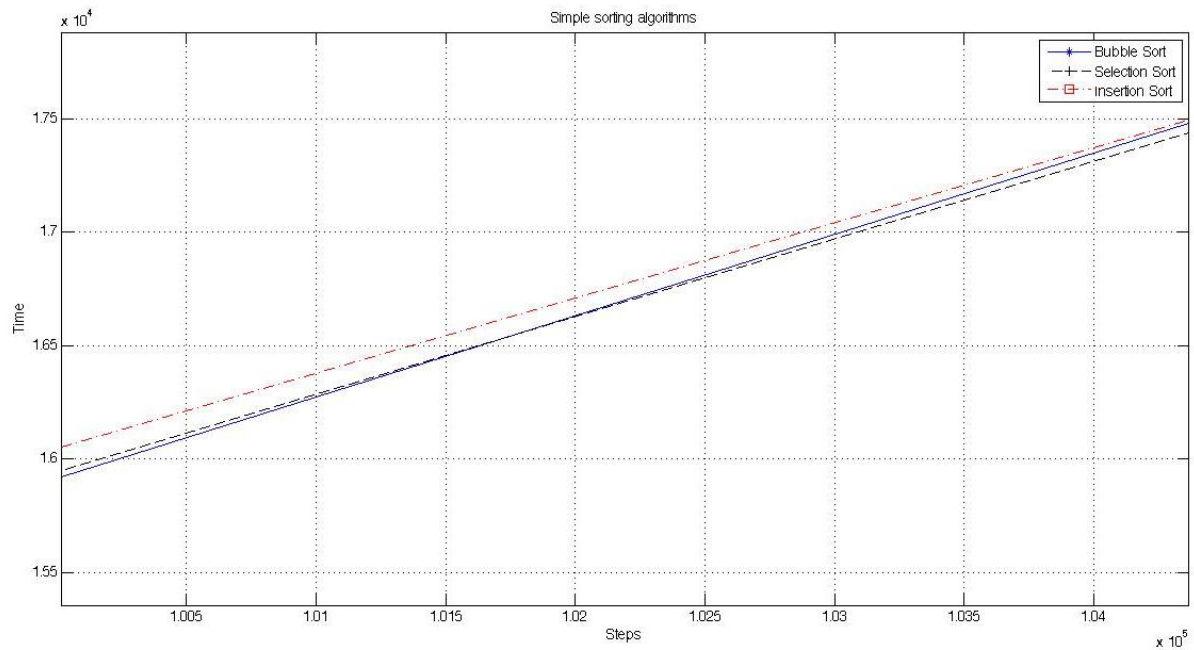


Figure 2: Simple sorting algorithms with time zoomed

These figures shows that the time complexity is not the same.

The reason is that for the theoretical analysis we only consider about the number of comparisons and the number of swaps. But actually all the assignments, comparisons, function calls are counting for the time complexity.

The results are below

Iteration with array size: 10000

time taken to bubble sort: 173

time taken to selection sort: 161

time taken to insertion sort: 150

Iteration with array size: 20000

time taken to bubble sort: 624

time taken to selection sort: 617

time taken to insertion sort: 621

Iteration with array size: 30000  
time taken to bubble sort: 1413  
time taken to selection sort: 1420  
time taken to insertion sort: 1409

Iteration with array size: 40000  
time taken to bubble sort: 2524  
time taken to selection sort: 2564  
time taken to insertion sort: 2527

Iteration with array size: 50000  
time taken to bubble sort: 3971  
time taken to selection sort: 3973  
time taken to insertion sort: 3966

Iteration with array size: 60000  
time taken to bubble sort: 5708  
time taken to selection sort: 5717  
time taken to insertion sort: 5697

Iteration with array size: 70000  
time taken to bubble sort: 7814  
time taken to selection sort: 7808  
time taken to insertion sort: 7822

Iteration with array size: 80000  
time taken to bubble sort: 10176  
time taken to selection sort: 10175  
time taken to insertion sort: 10175

Iteration with array size: 90000  
time taken to bubble sort: 12995  
time taken to selection sort: 12987  
time taken to insertion sort: 12959

Iteration with array size: 100000  
time taken to bubble sort: 15916  
time taken to selection sort: 15943  
time taken to insertion sort: 16046

Iteration with array size: 110000  
time taken to bubble sort: 19505  
time taken to selection sort: 19366  
time taken to insertion sort: 19367

Iteration with array size: 120000  
time taken to bubble sort: 23081  
time taken to selection sort: 23006  
time taken to insertion sort: 23078

Iteration with array size: 130000  
time taken to bubble sort: 27050  
time taken to selection sort: 26956  
time taken to insertion sort: 27111

Iteration with array size: 140000  
time taken to bubble sort: 31350  
time taken to selection sort: 31366  
time taken to insertion sort: 31374

Iteration with array size: 150000  
time taken to bubble sort: 35942  
time taken to selection sort: 36028  
time taken to insertion sort: 36023

Iteration with array size: 160000  
time taken to bubble sort: 40960  
time taken to selection sort: 41057  
time taken to insertion sort: 40887

Iteration with array size: 170000  
time taken to bubble sort: 46282  
time taken to selection sort: 46387  
time taken to insertion sort: 46230

Iteration with array size: 180000  
time taken to bubble sort: 51777  
time taken to selection sort: 51767  
time taken to insertion sort: 52545

Iteration with array size: 190000  
time taken to bubble sort: 57599  
time taken to selection sort: 57885  
time taken to insertion sort: 57780

Iteration with array size: 200000  
time taken to bubble sort: 64051  
time taken to selection sort: 63879  
time taken to insertion sort: 63872

Iteration with array size: 210000  
time taken to bubble sort: 70862  
time taken to selection sort: 72899  
time taken to insertion sort: 70547

Iteration with array size: 220000  
time taken to bubble sort: 77481  
time taken to selection sort: 82134  
time taken to insertion sort: 77990

Iteration with array size: 230000  
time taken to bubble sort: 85006  
time taken to selection sort: 87629  
time taken to insertion sort: 93520

Iteration with array size: 240000  
time taken to bubble sort: 92388  
time taken to selection sort: 92864  
time taken to insertion sort: 92191

Iteration with array size: 250000  
time taken to bubble sort: 99707  
time taken to selection sort: 99073  
time taken to insertion sort: 100143

Iteration with array size: 260000  
time taken to bubble sort: 108474  
time taken to selection sort: 107844  
time taken to insertion sort: 109328

Iteration with array size: 270000  
time taken to bubble sort: 116733  
time taken to selection sort: 117017  
time taken to insertion sort: 116769

Iteration with array size: 280000  
time taken to bubble sort: 125004  
time taken to selection sort: 125229  
time taken to insertion sort: 125247

Iteration with array size: 290000  
time taken to bubble sort: 134714  
time taken to selection sort: 134315  
time taken to insertion sort: 134395

Iteration with array size: 300000  
time taken to bubble sort: 143183  
time taken to selection sort: 143366  
time taken to insertion sort: 143303

Iteration with array size: 310000  
time taken to bubble sort: 153994  
time taken to selection sort: 153058  
time taken to insertion sort: 153578

Iteration with array size: 320000  
time taken to bubble sort: 163721  
time taken to selection sort: 163467  
time taken to insertion sort: 163637

Iteration with array size: 330000

time taken to bubble sort: 174074

time taken to selection sort: 173761

time taken to insertion sort: 174006

Iteration with array size: 340000

time taken to bubble sort: 184289

time taken to selection sort: 183994

time taken to insertion sort: 184125

Iteration with array size: 350000

time taken to bubble sort: 196246

time taken to selection sort: 196252

time taken to insertion sort: 195091

Iteration with array size: 360000

time taken to bubble sort: 206405

time taken to selection sort: 206614

time taken to insertion sort: 205951

Iteration with array size: 370000

time taken to bubble sort: 218225

time taken to selection sort: 218983

time taken to insertion sort: 218033

Iteration with array size: 380000

time taken to bubble sort: 228909

time taken to selection sort: 229642

time taken to insertion sort: 229820

Iteration with array size: 390000

time taken to bubble sort: 242489

time taken to selection sort: 242570

time taken to insertion sort: 243803

Iteration with array size: 400000

time taken to bubble sort: 255258

time taken to selection sort: 258016

time taken to insertion sort: 259908

If we run the same function twice it will not show the same time, because the array will not be the same and different arrays will take different times because of the change of comparisons and swaps.