CO322 – Lab 01

Task 3: Finding the performance of the three algorithm.

- Theoretical:
  1. Bubble Sort:

     In theoretical approach, it can be seen that

     Best case = O (N)

     Worst case = O (N^2)

     Average case = O (N^2)

  2. Selection Sort:

     Best case = O (N^2)

     Worst case = O (N^2)

     Average case = O (N^2)

  3. Insertion Sort:

     Best case = O (N)

     Worst case = O (N^2)

     Average case = O (N^2)

- Experimental:

According to the theoretical approach considered alogrithms' average time complexity is same.

Case 1: Unsorted small array

1. Bubble Sort:
   Length 100 of unsorted array,
   Execution time: 1.6392219543457031
2. Selection Sort:
   Length 100 of unsorted array
   Execution time: 0.9323812255859375
3. Insertion Sort:
   Length 100 of unsorted array
   Execution time: 0.8156583309173584

According to this, Insertion sort is better than the other sorting algorithms

Case 2: Unsorted big array

1. Bubble Sort:
   Length 1000 of unsorted array,
   Execution time: 1.6160275936126719
2. Selection Sort:
   Length 1000 of unsorted array
   Execution time: 1.9376199245452881
3. Insertion Sort:
   Length 1000 of unsorted array
   Execution time: 0.9627385139465332

According to this case, Insertion sort has obtain less execution time to sort the array. When comparing case 1 and case 2, the length of the array is also affected to the time complexity.

Case 3: Sorted big array in ascending order

1. Bubble Sort:
   Length 1000 of sorted array,
   Execution time: 0.9074137210845947
2. Selection Sort:
   Length 1000 of sorted array
   Execution time: 1.2597761154174805
3. Insertion Sort:
   Length 1000 of sorted array
   Execution time: 0.7468075752258301

When considering sorted array with 1000 element, insertion sort got less execution time.

Case 4: <u>Sorted big array in descending order</u>

4. Bubble Sort:
    Length 1000 of sorted array (descending order)
    Execution time: 1.5762569427490234
5. Selection Sort:
    Length 1000 of sorted array (descending order)
    Execution time: 1.1716845035552979
6. Insertion Sort:
    Length 1000 of sorted array (descending order)
    Execution time: 1.1530499458312988

When considering case 3 and case 4, insertion sort perform best execution time for best and the worst case.

When considering theoretical approach, complexity of those three algorithms should be same. But in experimental approach it may be same for particular occasions.

Length N of array	Bubble Sort	Selection Sort	Insertion Sort
10	0.7325326919555664	1.0384500026702885	0.0160768985748291
20	0.5626538276672363	0.8623945713043216	0.5189538478851318
40	1.2177124023437598	0.7150127887725835	0.7532827854156494
60	1.4479887485504157	1.5533866882324217	0.8471951484680176
80	1.8163270950317383	1.0002338886260981	0.8995912075042725
100	1.6392219543457031	0.9213812255859375	0.8156583309173584
150	1.1686108112335205	1.0453388690948486	0.9849309921264648
200	1.2700914859771729	0.9152941703796387	0.8849351406097412
500	1.3815822124481201	1.1616454124450684	0.9223654270172119
1000	1.6160275936126719	1.9376199245452881	0.9627385139465332

Figure 1: Execution time for different length of arrays