

Data Structures and Algorithms

Problem Set 1 (Fall 2022)

Deadline: September 18, 2022

Instructor: Samyan Qayyum Wahla

Office Hours:

Please note following hours for discussion of Problem Set 1.

Wednesday(September 14, 2022): 9:00 AM to 10:00PM

Insertion Sort

1. Dry run the InsertionSort on the following inputs. Use the code given in CLRS Section 2.1. Show the detailed iteration.
A= {5,43,76,2,98,23,12,32}
B= {6,7,8,9,10}

Merge Sort

2. Dry run the MergeSort on the following inputs. Use the code given in CLRS Section 2.3. Show in detail what happens in each recursive function.
A= {1,3,54,2,72,23,12,32,76,12}
3. Visualize the function calls in the memory for the above input.
4. Do you think that MergeSort always takes same number of operations in sorted and unsorted array. Justify your answer.
5. Change the pseudo code of MergeSort to arrange elements in decreasing order rather than increasing order. Write down the modified pseudo code.

Selection Sort

6. Consider the following code of SelectionSort. Provide the detailed asymptotic analysis of code similar to that of InsertionSort discussed in class.

```
1: function SELECTION-SORT(A, n)
2:   for i = 1 to n-1 do
3:     min ← i
4:     for j = i + 1 to n do
5:       if A[j] < A[min] then
6:         min ← j
7:       end if
8:     end for
9:     swap A[i], A[min]
10:  end for
11: end function
```

7. Discuss the Loop Invariant of SelectionSort.

Bubble Sort

8. Write down one paragraph description of Bubble Sort in your own words.
9. Provide pseudo code of BubbleSort.
10. Run your algorithm on the following input.
A= {9,8,7,6,4,3,2,1}

What to submit: All solutions should be typed in MS word document PS1.docx. For diagrams, use a proper tool, do not add snapshots of handwritten working. PDFs are not allowed.