**CSS1051: Advanced Computing Lab - 1**

**Topic: Data Structures and Algorithms**

**Instruction:** Download the docx file, type in your response in the space provided, save in pdf and then upload the file.

**Assignment 3:** Assume that only three sorting algorithms namely, Insertion sort, Bubble sort and Selection sort exist in the universe of comparison based sorting (i.e, there is no Quick sort, Heap sort, Merge sort etc..). Design a hybrid sort by appropriately selecting two out of these three sorting algorithms to complement the advantages and disadvantages of these individual algorithms. Your objective would be to ensure that for all possible practical instances, your hybrid algorithm should perform (in terms of fundamental arithmetic and logical operations such as number of comparisons and total number of swaps) at least no worse than standalone application of any of these three algorithms.

* **Q1:** Write a clean pseudocode and explain the different steps of your algorithm.

**Your response:**

**Hybrid Sorting Algorithm(Combination of Selection and bubble sort)**

Hybrid( A,n):

For i:0 to n/2: // SCAN UPTO HALF THE LENGTH OF LIST

Small =I //ASSUME THE CURRENT INDEX IS SMALL

For j:I to n-i-1 //TRAVERSE FROM HALF TO LAST

If not Sorted:

If (A[j]>A[j+1])://SWAPPING CONDITION

A[j+1],A[j] =A[j],A[j+1]

If A[j]<A[small] : // SMALLEST INDEX

Small=j // STORE INDEX OF SMALL ELEMENT

If small !=i : // SAME ELEMENT SWAPPING PREVENT

A[small],A[i]=A[i],A[small] // SMALL ELEMENT SWAPPING

* **Q2:** Briefly explain the key points of your algorithm that ensure fulfilment of the primary objective as mentioned in the problem statement above).

**Your response:**

This sorting uses selection and bulle sort to sort an array .

The main disadvantage of the bubble sort is the fact that it does not deal well

Well a list containing a huge number of item .this is because the bubble sort require

n-squired processing steps for every n number of element to be stored .

the selection sort is good for a small list of items .similar to the bubble sort , the

selection sort require n –squared number of steps for sorting n element even in best

case.

In the following the time complexities are mentioned for the two sorting algorithms .

**Best Average Worst**

Selection Sort **Ω** (n^2) **θ** (n^2) O (n^2)

Bubble Sort **Ω** (n) **θ** (n^2) O(n^2)

In case of proposed algorithm the outer loop already reduced to half because of using

Bubble sort followed by selection sort . the tendency of bubble sort to keep the

Largest element at end and tendency of selection sort to keep the smallest element at first are applied parallel in the proposed algorithm

Total n/2 passes are needed as first half is handeled by the selection sort and the

Total length of array handeled by bubble sort .

* **Q3:** Write a program (preferably in python) to implement your algorithm. Apart from the sorted array, your program should also output the total number of comparisons and the total number of swaps done. Provide the screenshot of the input output for few sample input instances. Your sample inputs must contain boundary cases (such as already sorted in desired order, already sorted in reverse order, almost sorted, etc.) Briefly explain the key points of your algorithm that ensure fulfilment of the primary objective as mentioned in the problem statement above).

**[Upload the source code of your program along with this docx file]**

**Your response:**

def hybrid(A,n):

comp = 0

swaps = 0

alreadySorted=False

swapped=False

for i in range(n//2):

small = i

for j in range(i,n-i-1):

if not alreadySorted:

comp += 1

if(A[j]>A[j+1]):

swaps += 1

A[j+1],A[j] = A[j],A[j+1]

swapped = True

comp += 1

if(A[j]<A[small]):

small = j

if small!=i:

swaps += 1

A[small],A[i] = A[i],A[small]

if not swapped:

alreadySorted=True

print(A)

print(comp,Swaps)

**INPUT OUTPUT**

Comparision Swaps

[5,4,3,2,1,0] 18 9

[0,1,2,3,4,5] 14 0

[0,1,5,3,4,2] 18 5

**Source Code:**

**Honour pledge:**

* + The responses of the questions presents above are done by myself.
  + I haven’t taken any help from any other students of the class or any other person.
  + I haven’t referred any book, web resource or any other study materials (available offline or online).
  + I haven’t helped any other students in completing the assignment.

**Submitted by:**

**Name: Vimlesh Verma**

**Roll No. 21CS4101**