SLIIT

Discover Your Future

BSc (Hons) in Information Technology

Year 2

Data Structures and Algorithms – IT2070

Tutorial 8 – Divide and Conquer

Semester 2, 2023

Question1

The pseudo codes for the *merge sort* are given below

```
MERGESORT (A,l,r)
1.  if $l < r$
2.        then $q = \lfloor (l+r)/2 \rfloor$
3.              MERGESORT (A,l,q)
4.        MERGESORT (A,q+1, r)
5.        MERGE (A,l,q,r)
```

```
MERGE (A,l,q,r)
1.  $i$ = l
2.  $j = q+1$
3.  $k = 0$
4.  while $(i \le q)$ and $(j \le r)$ do
5.    $k = k+1$
6.    if A[$i$] $\le$ A[$j$] then
7.          TEMP [$k$] = A [$i$]
8.          $i = i + 1$
9.    else
10.              TEMP [$k$] = A [$j$]
11.              $j = j + 1$
12. if $j > r$ then
13.         for $t = 0$ to $q - i$ do
14.               A [$r-t$] = A [$q-t$]
15.  for $t = 0$ to $k-1$ do
16.        A [$l + t$] = TEMP [$t + 1$]
```

a) Illustrate operation of *merge sort* on the array A=(6,4,8,1,7,2,5,3).

b) What is the purpose of the Temp array in the *merge sort* algorithm?

c) Why do it execute line no 13 and 14?

d) Modify the above **MERGESORT** *(A, l, r)* algorithm to sort the numbers in descending order. [Only the modified line should be described]

2. Two algorithms for the Maximum Sub Sequence Sum Problem are given below. Which algorithm will be the faster one? Justify your answer with Big O notation.

Algorithm 01

```
     for (j=0;j< n ;j++)
          {    ThisSum=0;
               for (k=j;k< n ;k++)
               {    ThisSum += A[k];
                    if (ThisSum>MaxSum)
                         MaxSum=ThisSum;
               }
}
```

Algorithm 02

```
for (j=0;j< n ;j++)
     {
               ThisSum += A[j];
               if (ThisSum>MaxSum)
                    MaxSum=ThisSum;
               else if (ThisSum < 0)
                    ThisSum = 0;
     }
```

3. Fill the table entries giving the time complexity in Big O notation.

Algorithm	Time Complexity	
	Best Case	Worst Case
Insertion sorting		
Quick sort		
Merge sort		