Total number of printed pages: 02 **UG/4th Semester/UCSE403**

2023

Design And Analysis of Algorithm

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

Answer any five(5) 20×5=100

1. (a) Define and differentiate asymptotic notations(O, Θ, Ω). [6+7+7]

   (b) Draw the recursive tree for the recurrence relation:

   $T(n)=T(n/10)+T(9n/10)+n$

   (c) Solve the recurrence relation.
   $T(n)=2T(n/2)+1$, $T(1)=1$.

2. (a) Prove that if $f(n) = a_m n^m + a_{m-1} n^{m-1} + \cdots\cdots + a_1 n + a_0$ then $f(n) = O(n^m)$. [5+3+12]

   (b) Prove that $n! = O(n^n)$.

   (c) Write down the algorithm for Binary search and analyze its complexity for successful as well as unsuccessful search considering average, best and worst case situations.

3. (a) Illustrate the operation of Partition in the context of the quicksort algorithm on the array: [12+8]

   A = (13,19,9,5,12,8,7,4,21,2,6,11)

   Assuming that the last element (that is, 11) is chosen as the pivot element, show the steps involved in one pass of the partitioning process that places the pivot element in its final position in the sorted list.

   (b) Write the algorithm(including partition) of Quick sort

4. (a) Illustrate the operation of buildMaxHeap(A,9) on the array A=<5,3,17,10,84,19,6,22,9> to make a max heap tree. [10+10]

(b) Show how the **merge sort** algorithm will sort the following array in increasing order:

70, 80, 40, 50, 60, 12, 35, 95, 10

5. (a) How are graphs represented in computer? [2+9+9]

(b) Show steps of Kruskal's and Prim's algorithm to find a minimum spanning tree of the graph shown in the Figure 2.

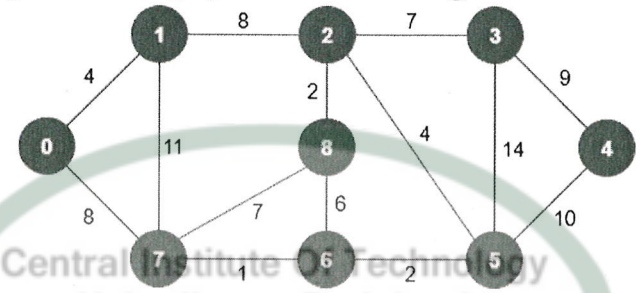

Figure 2

6. (a) Write an algorithm of n-queen's problem and find time complexity of the algorithm. Explain the algorithm using an example [10+10]

(b) Solve the following 0/1 knapsack problem by Dynamic programming (weight limit W=11):

Item	Weight(w_i)	Value(v_i)
1	1	1
2	2	6
3	5	18
4	6	22
5	7	28

7. Find the minimum number of operations required for the following matrix chain multiplication using dynamic programming: [16+4]

$$A(10\times 20) * B(20\times 50) * C(50\times 1) * D(1\times 100)$$

(b) Let X be a problem that belongs to the class NP. Then explain if the following is TRUE with diagram:

"If X is NP-hard, then it is NP-complete "