(Please write your Exam Roll No.) Exam Roll No 00711604422

END TERM EXAMINATION

THIRD SEMESTER [MCA] JANUARY 2024

Paper Code: MCA-201 **Subject: Design and Analysis of Algorithms**

Time: 3 Hours **Maximum Marks: 75**

Note: Attempt FIVE questions in all including Question No. 1 which is compulsory. Select one question from each unit.

Q1 Answer all the following questions briefly:- **(2.5x10=25)**

a) Define the terms Best case, Worst case and Average case time complexities.

b) What is the smallest value of n such that an algorithm whose running times is 100n2 runs faster than an algorithm whose running time is 2n on the same machine

c) Analyse the complexity of the following

```
function void function(int n)
{
 int count = 0;
for (int i=n/2; i<=n; i++)
  for (int j=1; j<=n; j = 2 * j)
    for (int k=1; k<=n; k = k * 2)
     count++;
}
```

d) Write the applications of BFS and DFS.

e) Define a B-tree. Give an example.

f) Define spanning tree of a graph. Write the total number of spanning trees possible for a complete graph with 6 vertices.

g) List and explain the characteristic properties associated with a problem that can be solved using dynamic programming.

h) Explain Divide and Conquer strategy

i) State Master Theorem

j) Implement UNION using linked list representation of disjoint sets

UNIT-I

Q2 a) Solve using Masters theorem i) $T(n)=2T(n/4)+\sqrt{n}$ **(6.5)**
ii) $T(n)=7T(n/2)+n^2$

b) Write an algorithm to merge 2 sorted arrays into a single sorted array. **(6)**

Q3 a) Analyse the complexity of the following functions **(6.5)**

i)
```
function(int n)
{ if (n==1) return;
  for (int i=1; i<=n; i++)
  { for (int j=1; j<=n; j++)
    { printf("*");
      break; }
  }
}
```

ii)
```
void function(int n)
{
int i = 1, s =1;
while (s <= n)
{i++; s += i;
printf("*");}
}
```

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b) Solve the recurrence using recursion tree method: $T(1) = 1$, $T(n) = 3T(n/4) + cn^2$ **(6)**

UNIT-II

Q4 a) Construct a Red Black tree by inserting 10,20,30,15,16 and 27 into an initially empty tree and also delete 15,16 and 30 from the tree **(6.5)**

b) Explain Strassen's matrix multiplication and analyze its complexity **(6)**

Q5 a) Give a control abstraction for Divide and Conquer method. Explain with an example. **(6.5)**

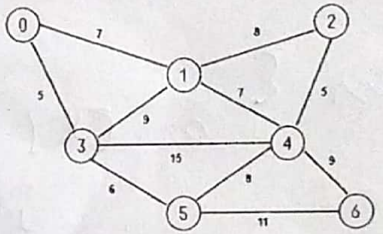
b) Explain the advantages of using height Balanced Trees? Explain AVL Rotations **(6)**

UNIT-III

Q6 a) Formulate Fractional Knapsack Problem. Write Greedy Algorithm for fractional Knapsack Problem. **(6.5)**

b) Find the optimal solution for the following fractional Knapsack problem. Given number of items(n)=4, capacity of sack(m) = 60, W={40,10,20,24} and P={280,100,120,120} **(6)**

Q7 a) Compute the Minimum Spanning Tree and its cost for the following graph using Kruskal's Algorithm. Indicate each step clearly. **(6.5)**



b) Write down Bellman Ford algorithm and analyze the complexity. What is the time complexity of Bellman-Ford single-source shortest path algorithm on a complete graph of n vertices? **(6)**

UNIT–IV

Q8 a) With examples explain polynomial time reducibility **(6.5)**

b) How Travelling Salesperson Problem can be solved using Branch and bound **(6)**

Q9 a) Draw the state space tree for 4 Queens problem.. **(6.5)**

b) Define NP-Hard and NP-complete problems. **(6)**

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