Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth semester B.Tech examinations (S), September 2020

Course Code: CS302
Course Name: DESIGN AND ANALYSIS OF ALGORITHMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries3 marks. Marks

1 Express the return value of the function "mystery" in $\theta - notation$. (3)

```
intmystery(int n) {
int j=0,total=0;
   for (int i=1;j<=n;i++){
      ++total;
      j+=2*i;
   }
   return total;
}
```

2 Is $2^{n+1}=O(2^n)$? Is $2^{2n}=O(2^n)$? Justify (3)

3 Define a B-tree. Give an example. (3)

4 Implement UNION using linked list representation of disjoint sets. (3)

PART B

Answer any two full questions, each carries9 marks.

5 a) Solve T(n)=2T(n/2)+2 if n>2 (4)
=1 if n=2 Using iteration method.

b) Solve T(n)=2T($\sqrt{n}$)+logn (5)

6 a) Show the red-black tree that result after successively inserting the keys 41,38,31,12,19,8 into an initially empty red-black tree. (9)

7 a) Consider the following C function (4)

```
intcheck(int n){
inti,j;
   for (i=1;i<=n;i++){
```

```
        for (j=1;j<n;j+=i){
printf("%d",i+j);
        }
    }
}
```

Find the time complexity of **check** in terms of $\theta - notation$.

b) Find the minimum and maximum height of any AVL-tree with 11nodes. Assume that height of the root is 0. (5)

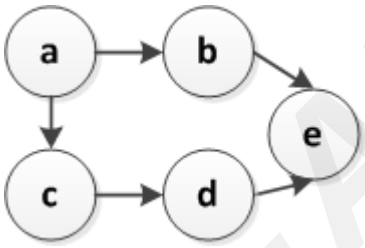
PART C

Answer all questions, each carries3 marks.

8 What is principle of optimality? (3)

9 Explain the characteristics of problems that can be solved using dynamic programming. (3)

10 Find the possible topological orderings for the following graph (3)



11 How the edges of a graph can be classified based on DFS? (3)

PART D

Answer any two full questions, each carries9 marks.

12 a) Give a control abstraction for Divide and Conquer method. Explain with an example. (5)

b) Explain the effect of negative weight edges and negative weight cycles on shortest paths. (4)

13 a) Define strongly connected components. How DFS can be used to find strongly connected components? (4)

b) Find an optimal paranthesizationof a matrix-chain product whose sequence of dimensions is 4x10,10x3,3x12,12x20,20x7. (5)

14 a) Write Dijkstra's Single Source Shortest path algorithm. Analyse the complexity. (7)

b) Is it possible to find all pairs of shortest paths using Dijkstra's algorithm? Justify. (2)

PART E

Answer any four full questions, each carries10 marks.

15 a) Compare Divide and Conquer and Dynamic programming methodologies. (4)

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

16 a) Explain Branch and bound technique. (3)

b) How Travelling Salesperson Problem can be solved using Branch and bound. (7)

17 a) Explain Kruskal's algorithm with an example. (6)

b) Derive its complexity of kruskal'salgorithm.. (4)

18 a) Explain control abstraction of greedy method. (3)

b) Write greedy algorithm for knapsack problem. (4)

c) Find an optimal solution to the knapsack instance n=7, m=15,$(p_1,p_2,.....p_7)$=(10,5,15,7,6,18,3) and $(w_1,w_2,.....w_7)$=(2,3,5,7,1,4,1). (3)

19 a) Explain the concept of backtracking. (3)

b) How backtracking can be used to solve N-queens problem. (4)

c) Draw the state space tree for 4 Queens problem. (3)

20 a) Define NP-Hard and NP-complete problems. (4)

b) With examples explain polynomial time reducibility. (4)

c) What do you mean by intractable problems? (2)

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