DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY
THIRD SESSIONAL
SUBJECT: (CE-423) DESIGN & ANALYSIS OF ALGORITHMS

Examination	**: B.Tech Semester-IV**	**Seat No**	**: _____**
Date	**: 18/03/2024**	**Day**	**: Monday**
Time	**: 01:00 P.M.-02:15 P.M.**	**Max. Marks**	**: 36**

INSTRUCTIONS:

1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume suitable data, if required & mention them clearly.
4. Draw neat sketches wherever necessary.

Q.1 Do as directed. **[12]**

CO3 U (a) What is the main difference between Backtracking and Branch and Bound method? **[2]**

CO3 R (b) Write and explain the Bounding Function used to compute the Upper Bound value for the 0/1 Knapsack problem. **[2]**

CO2 A (c) Is goal state reachable from the below given initial state of 8-puzzle or not ? Show the calculation. Initial state : [5 3 2; 4 0 8; 1 6 7]. **Note: 0 denotes blank tile.** **[2]**

CO4 U (d) What is Non-Deterministic algorithm? How is it useful for determining NP problem? **[2]**

CO4 E (e) Which out of following is certainly correct and which one is not sure? Justify. **[2]**

i. P is subset of NP

ii. P is proper subset of NP

CO2 N (f) It is given that exactly one of A, B, C, D is fake(heavy/light) coin. Given following two conditions are true, identify the fake coin and classify it to heavy or light. Show your answer using Decision Tree Model. **[2]**

1. The total weight of A,B is less than that of C,D **and**
2. The total weight of A,C is greater than that of B, D

Q.2 Attempt *Any Two* of the following questions. **[12]**

CO3 C (a) Given an undirected graph, write an algorithm to check if it is k–colorable or not and print all possible configurations of assignment of colors to its vertices. **[6]**

CO3 N (b) Let w = {5, 7,10,12,15,18,20} and m = 35. Find all possible subsets of w that sum to m using backtracking method. Draw the state space search tree that is generated. **[6]**

CO3 A (c) Solve the following 4*4 instance of Travelling Sales Person problem using Least Cost Branch and Bound. Clearly show the necessary computations **[6]**

Cost Matrix = [∞ 8 3 5; 6 ∞ 4 3; 3 4 ∞ 10; 5 3 9 ∞]

Q.3 Attempt the following questions. **[12]**

CO4 A (a) Consider the following problem Y:

Y: Is there Independent Set of Size=K in the given graph G?

i. Write non-deterministic algorithm for Y and show that it is in NP. **[2]**

ii. Show that the problem Y is at-least as hard as 3-SAT by reducing following instance of 3-SAT to Y. Show each necessary step. Here ~a represents complement of a. **[3]**

F(a, b, c, d) = (~a V ~b V c) ^ (a V ~b V ~c) ^ (~a V b V ~c) ^ (a V b V d)

iii. What is the conclusion that you can make about complexity class of the problem Y after giving answers to (i) and (ii)? **[1]**

CO4 E (b) i. Use Decision-Tree Model to sort 3 distinct integers. **[3]**

ii. Determine Lower Bound for sorting n distinct numbers using Decision-Tree Model. **[3]**

OR

CO4 A (a) Consider the following problem X:

X: Is there a Clique of size K in the given graph G?

i. Write non-deterministic algorithm for X and show that it is in NP. **[2]**

ii. Show that X is at-least as Hard as the Independent Set problem by suitable example. **[3]**

iii. What is the conclusion that you can make about complexity class of the problem X after giving answers to (i) and (ii)? **[1]**

CO4 E (b) i. Use following instance F of 2-SAT problem and show that we can decide in polynomial time whether 2-SAT formula is satisfiable or not. Show each necessary steps of computation. **[4]**

Here ~a denotes complement of variable a.

F(a, b, c, d) = (~a V ~b) ^ (a V ~b) ^ (~a V c) ^ (a V b)

ii. Convert **X + Y + Z + W +P** to the 3-SAT format. **[2]**