KUMARAGURU
college of technology
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B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

Third Semester

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

U18AII3202: Algorithms and Optimization of Programs

COURSE OUTCOMES

CO1: Understand techniques for effective problem solving in computing.

CO2: Design different paradigms of problem solving to illustrate clever and efficient ways to solve a given problem.

CO3: Identify and apply for rigorously proving correctness of the algorithm for a variety of problems.

CO4: Implement to show the efficiency of the algorithm over the naïve techniques.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1. Apply Master's theorem for finding the time complexity of the recurrence relation: CO1   [K3]

$$T(n) = \sqrt{2}\,T(n/2) + \log n$$

2. Find the worst case time complexity of the following code: CO1   [K2]

def list _sum (A,n)

sum = 0

for i in range(n):

sum+ =A[i]

return sum

3. In the following C function, let n >= m, what will be the time complexity?   CO1   [K2]

int gcd(n,m)

{

if (n%m ==0) return m;

n = n%m;

return gcd(m, n);

}

4. Can greedy strategy be applied for knapsack problem where items cannot be selected fractionally? — CO2 [K2]

5. In a coin denomination problem where you have infinite collection of coins with denomination 1,2 and 5 and you are asked to provide balance for any given amount with available set of coins. Here you would like to minimize the number of coins. What would be the greedy choice? — CO2 [K2]

6. How Kruskal's detect cycle upon adding an edge in a tree? — CO3 [K1]

7. Mention the significance of theta notation. — CO1 [K1]

8. Create a binary search tree using 10, 20, 30,40,50,60 and identify the height of the tree. — CO3 [K1]

9. Write a brief note on approximation algorithams. — CO2 [K2]

10. In a complete graph with 5 vertices, Find the total number of distinct spanning trees that can be formed? — CO3 [K2]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. a) Explain in detail about the working of quick sort algorithm with your own example and implementation. — 10 CO1 [K2]

b) In what order the vertices of the graph should be visited whose adjacency list is given below. — 6 CO1 [K3]
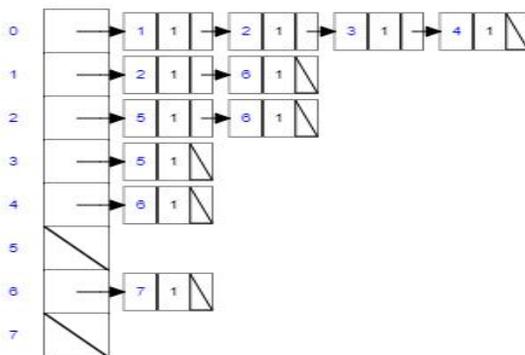

12. a) Danny is preparing for his competitive exam. After a tiresome day, he sits for studying during the night before the exam. He finds that he is having only a limited time left but has lots of topics to be covered. So he decides to go through — 8 CO2 [K2]

the previous year question papers so that he will get an idea about the topics which contains the maximum weightage. Based on his analysis, he prepares the following chart, studies according to that and finally cracks the exam. Show how Danny wisely chose the topics. Assume he was left out with 8 hours to study.

Chapter name	Weightage	Hours taken to complete
General Aptitude	15	1
GK	10	5
Technical	9	3
History	5	4

b)   Illustrate and explain 8 Queens problem with example code.   8   CO2   [K₂]

13. a)   Identify the shortest distance between a-c, d-f, b-e, c-f, e-c using Floyd-   8   CO1   [K₃]
           Warshall's algorithm
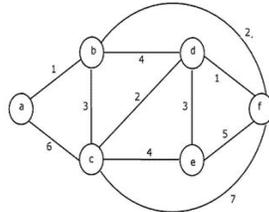
b)   Apply Dijkstra's algorithm to find the shortest distance between the source Denver and   8   CO3   [K₃]
      destination Miami. Provide the cost of the shortest path
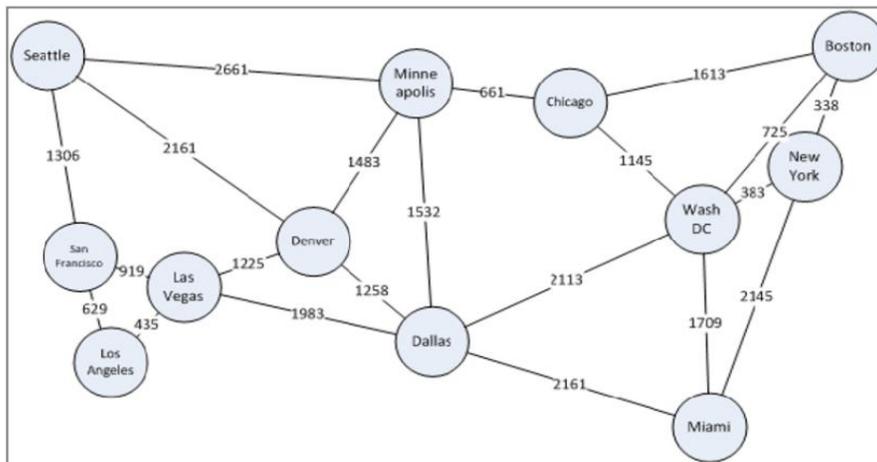
14. a) Construct the hash table for the following data 358, 253, 750, 310, 565, 188 with hash function as h1 = key % 8. If collision occurs, apply linear, quadratic probing, double hashing, separate chaining and show the resultant table. Find out the number of buckets examined during a successful and unsuccessful search in the resultant hash table   8   CO2   [K₃]

b) Consider the following graph. Make use of the Depth First Search Approach to calculate the order of visiting the vertices by considering the source vertex as'2':   8   CO3   [K₃]
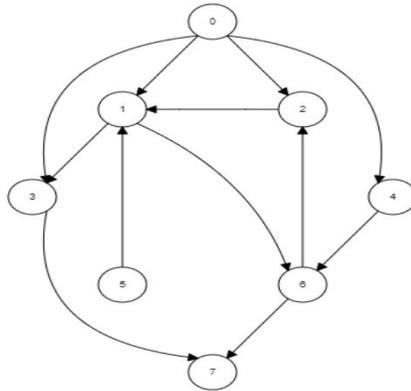
15. a) Given an array of integers of size 2n, devise a divide and conquer algorithm to arrange the array in such a way that the first n elements and last n elements are set up in alternative manner. If n = 2 and 2n elements are {x1, x2, y1, y2}, then result should be {x1, y1, x2, y2}. For example if A [] = {1, 3, 5, 7, 2, 4, 6, 8}, n= 4 then the output is {1, 2, 3, 4, 5, 6, 7, 8}   8   CO4   [K₃]

b) Write code to create binary tree,compute sum of elements and traverse the tree in inorder   8   CO4   [K₃]

16. a) Consider weight [ ] = {1,2,3},profit [ ] ={10,15,40},capacity = 6. Identify the approach to solve above problem. Illustrate the approach with the above problem and write down the code.   8   CO4   [K₃]

b) Analyze the time complexity of the N-Queen's problem. Which class does this belongs to? Provide justification for P or NP or NP-complete problems.   8   CO4   [K₄]

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