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Code No. : 14266 N/O

**VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD**

Accredited by NAAC with A++ Grade

**B.E. IV-Semester Main & Backlog Examinations, July/August-2023**

**Design and Analysis of Algorithms**

(Common to CSE & AIML)

Time: 3 hours

Max. Marks: 60

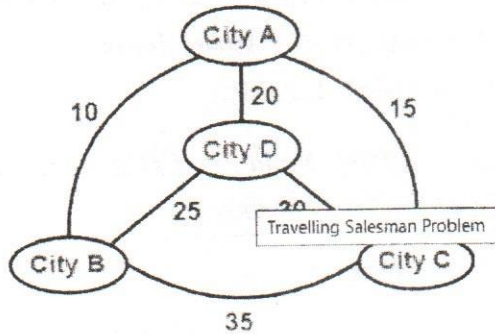
Note: Answer all questions from Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	<p>Use Step table method to find Time complexity of the algorithm given below.</p> <pre> func Find(a []int, x int) int {     switch len(a) {     case 0:         return 0     case 1:         if x &lt;= a[0] {             return 0         }         return 1     }     mid := 1 + (len(a)-1)/2     if x &lt;= a[mid-1] {         return Find(a[:mid], x)     }     return mid + Find(a[mid:], x) } </pre>	2	1	1	1,2
2.	<p>Solve the following recurrence relation using Master's theorem.</p> <p><math>T(1) = 1</math>, when <math>n=1</math></p> <p><math>T(n) = 1 + T(n/2)</math>, when <math>n &gt; 1</math>.</p>	2	1	1	1,2
3.	<p>Write the control abstraction for Divide and Conquer method.</p>	2	1	2	1,2
4.	<p>Write the Control abstraction for Greedy method.</p>	2	1	2	1,2

Contd... 2

5. Consider the graph representing the distance between cities A,B,C,D. Find the length of the tour which is starting at B.



2 1 3 1,2

6. Define principle of optimality. Give an example.

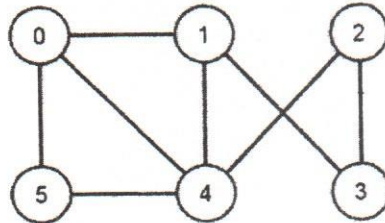
2 1 3 1,2

7. Define Explicit and Implicit constraints in Backtracking. Write the Explicit and Implicit constraints of 0/1 Knapsack problem

2 1 4 1,2

8. Find the Chromatic number of the following graph. Draw the state space tree to show an assignment of the colors.

2 3 4 1,2,3



9. Compare NP and P problems. Give appropriate examples.

2 1 5 1,2

10. Write an algorithm of complexity  $O(n)$  for Sorting  $n$  given elements.

2 2 5 1,2,3

**Part-B (5 × 8 = 40 Marks)**

11. a) Suppose  $A$  is an array of  $n$  integers (for simplicity assume that all integers are distinct). A local minimum of  $A$  is an element that is smaller than all of its neighbors. For example, in the array  $A = [1, 2, 0, 3]$ , the local minima are  $A[1] = 1$  and  $A[3] = 0$ . Design a recursive algorithm to find a local minimum of  $A$ , which runs in time  $O(\log(n))$ .

5 3 1 1,2,3

b) Explain amortized analysis with an appropriate example.

3 2 1 1,2

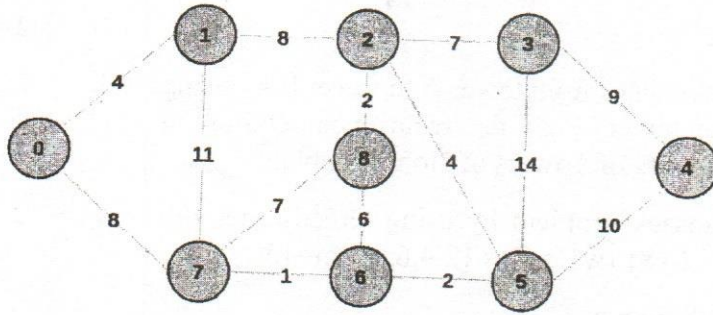
12. a) Consider the frequencies of different characters in a document are shown below. Each character is assigned one byte of memory, find the rate of compression by using Huffman coding.

4 3 2 1,2

**character Frequency**

a	5
b	9
c	12
d	13
e	16
f	45

b) Find the minimum spanning tree for the graph given below by using Kruskal's algorithm.



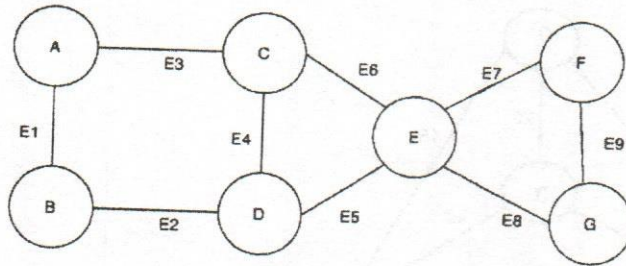
4 2 2 1,2

13. a) A sequence of matrices A, B, C, D with dimensions  $5 \times 10$ ,  $10 \times 15$ ,  $15 \times 20$ ,  $20 \times 25$  are set to be multiplied. Find the lowest cost parenthesization to multiply the given matrices using matrix chain multiplication.

4 3 3 1,2

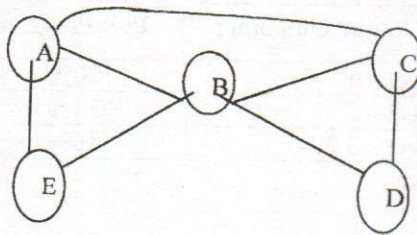
b) What is an articulation point. Find the articulation points of the graph shown below.

4 3 3 1,2



14. a) Explain the algorithm to find the next vertex to be visited in Hamiltonian cycle. Draw a portion of the state space tree generated by Hamiltonian algorithm for the following graph

4 3 4 1,2



b) Given the following 0-1 knapsack problem with the values and weights.

4 3 4 1,2

$i$	$v_i$	$w_i$
1	\$20	2kg
2	\$30	5kg
3	\$35	7kg
4	\$12	3kg
5	\$3	1kg

Draw the state space tree to show the actions step by step using FIFO BB.

R-201

15. a)	Show that the problem of determining the satisfiability of Boolean formulas in disjunctive normal form is polynomial-time solvable.	5	3	5	1,2
b)	Explain Cook's theorem.	3	2	5	1,2
16. a)	Write an algorithm to move disks from tower A to tower B by using tower C as intermediate tower. Find the recurrence relation to represent the Time complexity of Towers of Hanoi problem.	4	2	1	1,2
b)	Solve the following knapsack problem by using Greedy method. N=4, (p1..p4) = { 10,10,12,18} (w1..w4)= {2,4,6,9}, m=15	4	2	2	1,2
17.	Answer any <i>two</i> of the following:				
a)	Consider the following two sequence X and Y. Find the Longest Common Subsequence of X and Y. X: ABCBDAB Y: BDCABA	4	2	3	1,2
b)	Consider the following graph and find the least cost tour starting from vertex '1' by using Least Cost Branch and Bound.	4	3	4	1,2
c)	Prove that Clique decision problem is NP-Complete.	4	3	5	1,2,3

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level - 1	20%
ii)	Blooms Taxonomy Level - 2	34%
iii)	Blooms Taxonomy Level - 3 & 4	46%

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