Reg. No.															

B.Tech. DEGREE EXAMINATION, MAY 2024

Fourth Semester

18AIC206J – ANALYSIS AND DESIGN OF ALGORITHMS

(For the candidates admitted during the academic year 2018-2019 to 2021-2022)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO
1. _____ serves as a tool for solving a well specified computational problem (A) Program (B) Flow chart (C) Algorithm (D) Input and output	1	1	1	1.1.2
2. Worst case time complexity of insertion sort is (A) $O(n^2)$ (B) O(n+1) (C) O(1) (D) O(log n)	1	1	1	1,2
3. Consider the given array is A = {1,2,4,3} find out how many iterations are required to sort the elements using bubble sort (A) 3 (B) 4 (C) 1 (D) 2	1	1	1	1,4

4. Derive the recurrence relation for the following code
sample (int n) {
if (n>0)
printf ("%D", n)
sample (n–1);
}
(A) $T(n) = (n–1) + n^2$ (B) $T(n) = T(n–1) + 1$
(C) $T(n) = (n) + 1$ (D) $T(n) = (n–1) + n$
	1	2	1	1,4

5. Merge sort uses (A) Divide and conquer strategy (B) Greedy approach (C) Dynamic programming (D) Brute force strategy	1	1	2	2,3
6. Time complexity of Strassen multiplication is (A) $T = \theta(N^{\log 2})$ (B) $T = \theta(7^{\log 2})$ (C) $T = \theta(N^2)$ (D) $T = \theta(N^{\log 7})$	1	2	2	2
7. How do you call the selected keys in quick sort methods? (A) Outer key (B) Pivot key (C) Partition key (D) Inner key	1	1	2	2,3

8. What is the basic operation of closest pair algorithm using brute force technique? 1 2 2 2,5

(A) Radius (B) Area
(C) Manhattan distance (D) Euclidean distance

9. Which of the following problems is not solved using dynamic programming? 1 1 3 2,5

(A) 0/1 knapsack problem (B) Fractional knapsack problem
(C) Edit distance problem (D) Matrix chain multiplication problem

10. Which is correct? 1 2 3 2,5

Algorithm		Design paradigm	
i)	Dijkstra's shortest path	a)	Greedy design
ii)	Floyd Warshall's all pair shortest path	b)	Divide and conquer
iii)	Kruskals minimum spanning tree	c)	Dynamic programming
iv)	Merge sort ALG		

(A) i) - a, ii) - b, iii) - c and iv) - c (B) i) - c, ii) - b, iii) - a and iv) - b
(C) i) - a, ii) - c, iii) - a and iv) - b (D) i) - a, ii) - b, iii) - a and iv) - c

11. Let the frequency of letters in a file is given below. Letters i, n, d, e, x are 16, 7, 17, 25, 20 respectively. Which of the following is the Huffman's code of the letter. 1 2 3 2,5

(A) 101 (B) 01
(C) 001 (D) 11

12. Which of the following problems can be solved using the longest common subsequence problem? 1 1 3 2,5

(A) Longest increasing subsequence (B) Longest palindromic subsequence
(C) Longest bitonic subsequence (D) Longest decreasing subsequence

13. In the given options, which of the following is a correct option that provides an optimal solution for 4-queens problem? 1 2 4 2,4

(A) (3,1,4,2) (B) (2,3,1,4)
(C) (4,3,2,1) (D) (4,2,3,1)

14. If a graph G can be colored with the minimum number of colors (N colors) subjected to the constraints of the problem, the graph is known as 1 2 4 2,4

(A) N-coloring (B) G-color
(C) M-chromatic (D) Chromatic coloring

15. The complexity of Hamiltonian cycle algorithm is 1 2 4 2,4

(A) $(n-1)^n - \frac{1}{n-2}$ (B) $(n-1)^2 - \frac{1}{n-2}$
(C) $(n-1) - \frac{1}{n-2}$ (D) $(n-1) - \frac{2}{(n-2)^n}$

16. Which of the problems cannot be solved by backtracking method? 1 1 4 2,4

(A) Subset sum problem (B) N-queen problem
(C) Hamiltonian circuit problem (D) Travelling salesman problem

17. What is the basic principle in Rabin Karp algorithm? 1 2 5 1,2

(A) Hashing (B) Sorting
(C) Augmenting (D) Dynamic programming

18. What is the average time complexity of randomized quick sort? 1 1 5 1,2
(A) O(n log n) (B) $O(n^2)$
(C) $O(n^2 \log n)$ (D) $O(n \log n^2)$

19. Which of the following problems is not NP complete? 1 2 5 1,2
(A) Hamiltonian circuit (B) Bin packing
(C) Partition problem (D) Halting problem

20. A cycle is called _____ if it visits all vertices once and return back to the staring vertex. 1 2 5 1,2
(A) Chord less cycle (B) Peripheral cycle
(C) Hamiltonian (D) Girth

PART – B (5 × 4 = 20 Marks) Marks BL CO PO
Answer **ANY FIVE** Questions

21. An array consists of the 10 elements as shown [5, 11, 25, 32, 32, 45, 53, 65, 70, 80] write a recursive algorithm to search and return the index of the element 70 using divide and conquer technique. Also write it time complexity. 4 4 1 1,4

22. Multiply the following two matrices using the Strassen method 4 3 2 2,4

$$A = \begin{pmatrix} 2 & 5 \\ 5 & 2 \end{pmatrix} \quad B = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

23. Apply substitution method for the following recurrence equation and show the output. $T(n) = T(n-1) + n$ *is* $O(n^2)$ 4 3 2 2,4

24. Compute Huffman coding for the following set of symbols shown in the below table along with the frequencies. 4 3 3 4,5

Symbol	a	b	c	e	e	f
Frequency	5	9	12	13	16	45

25. Distinguish between back tracking method and dynamic programming. 4 4 4 2,4

26. Define NP-hard problem. Analyze its importance. 4 3 5 1,4

27. Differentiate quicksort and randomized quicksort. Also derive the worst case time complexity of quicksort algorithm. 4 4 5 1,4

PART – C (5 × 12 = 60 Marks) Marks BL CO PO
Answer **ALL** Questions

28. a. Assume a sequence of bottles with the following labels in unsorted order. A = {14, 7, 3, 2, 9, 6, 5, 8, 1}. Write the suitable algorithm to arrange the bottles in desired order and also write how many comparisons and swaps are required for arranging these bottles using bubble sort is this instance. Derive the time complexity analysis also. 12 4 1 1,2

(OR)

b.	Solve the following recurrence equation using recursion tree method		4	1	2,4
	(i) $T(n) = T(n/3) + T(2n/3) + n$	6			
	(ii) $T(n) = 3T(n/4) + cn^2$	6			
29. a.	Consider the array A= (9, –3, 5, 2, 6, 8, –6, 1, 3). Let V is the last element in an array and it is the pivot element. Show the sorting of elements in an array stepwise and write the suitable algorithm. Derive the best case and worst case analysis of the above algorithm.	12	3	2	3,4
	(OR)				
b.	Develop the graham's scan algorithm for finding convex hull and analyze its time complexity.	12	3	2	3,4
30. a.	Use greedy technique to design an algorithm to generate Huffman coding. Analyze its time complexity.	12	3	3	4,5
	(OR)				
b.	Consider the following instance of the knapsack problem. n = 3, m = 20 $(W_1, W_2, W_3) = 18, 15, 10$ $(P_1, P_2, P_3) = 25, 24, 15$ Find the optimal solution using dynamic programming method and write the algorithm for same.	12	4	3	4,5
31. a.	Write an algorithm for finding all pair shortest path using Floyd Warshall method and find its time complexity.	12	3	4	4,5
	(OR)				
b.	Apply back tracking technique to design an algorithm to solve 8 queens' problem. illustrate with an example.	12	3	4	4,5
32. a.	Elucidate the Rabin Karp algorithm for string matching with an example.	12	3	5	1,4
	(OR)				
b.i.	Distinguish P, NP hard, NP complete problems with example.	6	4	5	1.4
ii.	Explain satisfiability problem with an example. Analyze what would happen if polynomial time solution if found for it.	6	3	5	1,4

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