Reg. No.															

B.Tech. DEGREE EXAMINATION, DECEMBER 2023

Fourth Semester

18AIC206J – ANALYSIS AND DESIGN OF ALGORITHM

(For the candidates admitted from the academic year 2020-2021 & 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.	If an algorithm's time complexity is O(1), then the complexity of it is (A) Exponential (B) Polynomial (C) Constant (D) Unstable	1	1	1	1
2.	The worst case of an algorithm is O(N), when the element is present either at the last position of an array or element not present in the array. The above scenario expresses (A) Linear search (B) Binary search (C) Merge sort (D) Bubble sort	1	2	1	2
3.	Insertion sort consists of _____ passes, where N is the number of elements to be sorted. (A) n + 1 (B) N – 1 (C) N / 2 (D) N ^ 2	1	2	1	2

4.	Find the time complexity for the following code;
	int main ( )
	{
	int i, n = 10;
	for (i = 1; i < = n; i++)
	printf ("hi"); printf ("hi"); printf ("hi")
	}
	(A) O (N–1) (B) O (N+1)
	(C) O (N^1) (D) O (N)
		1	2	1	2

5.	Determine the value of A_2 for the recurrence relation $A_N = 17A_{n-1} + 30N$ with $A_0 = 3$ (A) 4387 (B) 5484 (C) 238 (D) 1437	1	1	1	2
6.	For the given array ARR = {145, 177, 189, 190, 194, 199, 200} and key = 199, what are the mid values in the first and second levels of recursion? (A) 190 and 199 (B) 190 and 194 (C) 189 and 199 (D) 189 and 194	1	2	2	2
7.	Find the maximum sub-array sum for the given elements, {5, –4, –2, 6, –1} (A) –4 (B) –2 (C) 5 (D) 6	1	1	2	2

8. Find the appropriate recurrence relation for the merge sort with N elements. 1 2 2 1

(A) $T(n) = 2T(n/2) + n \wedge 2$ (B) $T(n) = 2T(n/2) + (n-1)$

(C) $T(n) = 2T(n/2) + n$ (D) $T(n) = 2T(n/2) + 1$

9. In masters theorem, select the suitable case for $\log_B A > K$ 1 2 2 2

(A) $O\left(n^{\log_b a}\right)$ (B) $O(n \log_b a)$

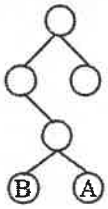
(C) $O\left(n^{\log_n}\right)$ (D) $O(n \log n)$

10. What is the time complexity for finding min and max element from an array, when the elements are arranged in descending order 1 2 2 2

(A) O (N–1) (B) O (N)

(C) O (N^2) (D) O (log N)

11. What is the code word for the character 'B'? 1 2 3 2



(A) 001 (B) 010

(C) 110 (D) 101

12. Find the length of the longest common subsequence of the given two strings, S1 = phones and S2 = stone. 1 2 3 2

(A) 4 (B) 3

(C) 2 (D) 1

13. Which of the following is correct for 0/1 knapsack and fractional knapsack problem is correct? 1 2 3 2

(A) 0/1 knapsack problem is divisible and fractional 0/1 knapsack is indivisible

(B) 0/1 knapsack problem is indivisible and fractional 0/1 knapsack is divisible

(C) 0/1 knapsack and fractional knapsack both are divisible

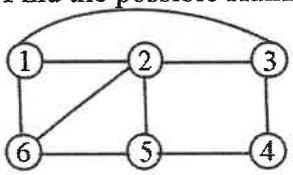
(D) 0/1 knapsack and fractional knapsack both are indivisible

14. There are three matrices A_1, A_2, A_3 and its cost is (10×100), (100×5), (5×500) respectively. The scalar multiplication is done as 1 2 3 2

(A) (A_1 A_2) A_3 (B) (A_1 A_2 A_3)

(C) A_1 (A_2 A_3) & (A_1 A_2)A_3 (D) A_1 (A_2) A_3

15. Find the possible Hamilton circuit for the given circuit. 1 2 4 2



(A) 1, 2, 3, 4, 5, 6, 1 (B) 1, 2, 4, 5, 6, 2, 1

(C) 1, 5, 4, 3, 2, 6, 1 (D) 1, 2, 3, 1

16. _____ is used to build a solution part by part. Choosing the next part in such a way, that it gives an immediate benefit. This approach is used to solve optimization problems. 1 2 4 2

(A) Greedy algorithm (B) Dynamic programming

(C) Knapsack approach (D) Divide and conquer

17. _____ is the expected running time of randomized quick sort 1 2 5 2

(A) O(n) (B) O (n^2)
(C) O ($n^2 \log^2 n$) (D) O (n log n)

18. _____ is the collection of decision problems solved by non-deterministic machine in polynomial time. 1 2 5 2

(A) P class (B) NP class
(C) NP hard (D) NP complete

19. $F = A \wedge \overline{B}$ is a Boolean statisfiability. Find the proper values for $F, A, \overline{B}$ 1 2 5 2

(A) A = true and B = true makes F = true (B) $\overline{A}$ = true and $\overline{B}$ = true makes F = true
(C) A = true and B = false makes F = true (D) A = false and B = false makes F = false

20. What is the matching time of Rabin Karp algorithm, when the number of valid shifts and modulus is larger than the length of pattern? 1 2 5 2

(A) θ (m) (B) O(m+n)
(C) θ (n–m) (D) O(n)

PART – B (5 × 4 = 20 Marks) Marks BL CO PO

Answer **ANY FIVE** Questions

21. Write short notes on the fundamentals of algorithmic problem solving. 4 3 1 2

22. Solve the recurrence relation using backward substitution. 4 3 1 2

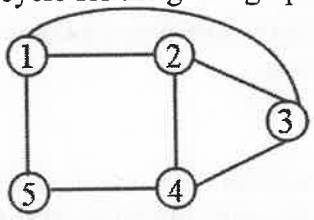
$$T(n) = 3T\left(\frac{N}{4}\right) + N^2$$

23. Calculate the maximum subarray sum for the given array using divide and conquer method. A = [8, 4, –1, 9, 6, –2, –3, 10, 2] 4 3 2 2

24. Construct a Huffman tree for the following frequency and encode the string 'ADA". 4 4 3 2

A	B	C	D	E
0.40	0.1	0.25	0.2	0.15

25. Find the possible Hamilton cycle for the given graph. 4 4 4 2



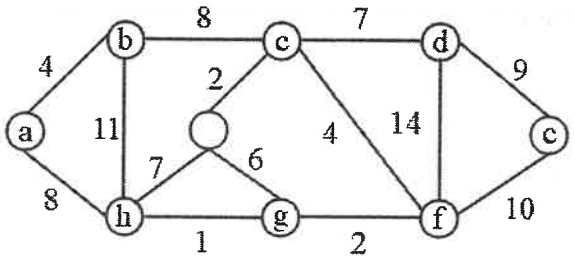
26. Summarize the concept of class P and class NP. Show the relationship between deterministic and non-deterministic polynomial time. 4 3 5 2

27. For a given graph G = (V, E) which is a subset of vertices $V' \subseteq V$, such that if edge (u, v) is an edge of G, then either u in V or v in V' or both. Discuss the vertex covering of maximum size of an undirected graph with example. 4 4 5 2

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
28. a.	A teacher has some set of marks {100, 78, 10, 55, 85, 35, 40}. Help the teacher to find the mark 35 in an unsorted array. Develop a sequential search algorithm and discuss best, worst and average time complexity.	12	5	1	2
	(OR)				
b.i.	Discuss the steps involved in finding recurrence relation. Show the solution of recurrence $T(n) = 2T\left(\frac{n}{2}\right) + n$, using substitution method.	6	3	1	2
ii.	Write note on big omega, big oh, big theta notations based on the growth function.	6	4	1	2
29. a.	Develop a straight forward and recursive algorithm using divide and conquer to find a maximum and minimum number in a set of n elements. Explain with an example.	12	3	2	2
	(OR)				
b.	Apply quick sort on the following sequence 17, 8, 7, 19, 24, 10, 14, 23 and also analyse the time complexity (Best, Worst, Average).	12	3	2	2
30. a.	Determine the minimum cost spanning tree using Kruskal's method.	12	4	3	2



	(OR)				
b.	Construct on optimal binary search tree for the given values	12	3	3	2

Key	A	B	C	D
Probability	0.1	0.2	0.4	0.3

31. a.	Construct the state space tree to place the 4 queens in their position in 4 × 4 board. Find the position of all 4 queens with coordinates, using depth first search.	12	3	4	2
	(OR)				
b.	Find the maximum profit and weight for the given set of items using branch and bound. The maximum sack capacity is 10. P = {40, 42, 25, 2} W = { 4, 7, 5, 3}	12	4	4	2
32. a.	Apply Randomized quick sort for the following set = {200, 125, 326, 500, 435}. Explain the randomized quick sort algorithm with expected running time.	12	3	5	2
	(OR)				
b.	Demonstrate the Rabin-Karp algorithm for the following strings T = {CCACCAAEDBA} the match, the patter P = {DBA}. Discuss the example with time complexity.	12	2	5	2

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