Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2023
Fourth Semester

18CSC204J – DESIGN AND ANALYSIS 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. What is the solution to the recurrence $T(n) = T(n/2) + n$? (A) O (n) (B) O (2n) (C) O (n^2) (D) O (n log n)	1	1	1	1
2. Which of the following cases does not exist in complexity theory? (A) Average case (B) Null case (C) Worst case (D) Best case	1	1	1	1
3. Which sorting algorithm is faster? (A) O (n^2) (B) O (n^3) (C) O (n log n) (D) O (n + k)	1	1	1	1
4. The big O analysis of the running time for the following program is for (i = 0; i < n * n; i++) A[i] = i (A) O (n–1) (B) O (n^3) (C) O (log n) (D) O (n^2)	1	2	1	1
5. The process of checking whether the given algorithm gives correct output for valid inputs or not is called (A) Algorithm verification (B) Algorithm design (C) Algorithm validation (D) Algorithm debugging	1	1	1	1
6. The time complexity of the conventional algorithm for finding maximum and minimum elements in a given array is (A) O (n) (B) O (2n) (C) O (n^2) (D) $O\left(\frac{3n}{2}\right)$	1	2	2	1
7. The worst case complexity of quick sort is (A) O (n^3) (B) O (n^2) (C) O (n!) (D) O (n^n)	1	2	2	1

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

	Marks	BL	CO	PO
28. a. Write an algorithm to perform quick sort on a sorted list of elements. Analyze the algorithm for best case and worst case.	12	4	2	2
(OR)				
b. Discuss the following algorithms for constructing a convex hull (i) Quick hull (ii) Merge hull	6+6	2	2	2
29. a. Solve the equations using recursive tree method (i) $T(n) = 3T(n/4) + Cn^2$ (ii) $T(n) = 2T(n/2) + n$	6+6	3	1	1
(OR)				
b.i. Write a recursive program to calculate Fibonacci series. Find the recurrence relations for the same and solve it by substitution method.	8	5	1	1
ii. Using Master's theory, solve $T(n) = 8T(n/2) + n^4$.	4	4	1	2
30. a. Find the solution for placing 8 Queens in an 8×8 matrix using back tracking process. Provide proper algorithm and necessary justification for your findings.	12	4	4	4
(OR)				
b. Design an algorithm for finding Hamiltonian cycle in a graph. Explain with suitable example.	12	5	4	4
31. a. Write short notes on		4	5	4
(i) Traceable problems	3			
(ii) NP-complete	3			
(iii) Reducibility	3			
(iv) Deterministic algorithms	3			
(OR)				
b. Explain in detail about randomized algorithm for 'Hiring Problem' and analyse the time complexity.	12	5	4	3
32. a. Solve the following using branch and bound method with Knapsack capacity W = 6.	12	4	4	3

Items	W_i	F_i
1	2	9
2	3	6
3	2	4

(OR)				
b. Explain 0/1 knapsack problem with greedy method and dynamic programming method with examples.	12	5	3	4

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8. When compared to traditional matrix multiplication, how many multiplications are reduced in Strassen matrix multiplication taking into account the matrices are 2 × 2. 1 2 2

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

9. Merge sort is ideal for combining two 1 2 2

(A) Linked list (B) Arrays
(C) Null values (D) Graphs

10. Consider the problem of computing min-max in an unsorted array where min and max are identified in A1 comparison using transitional method. With divide and conquer it takes A2 comparison to find min and max. Find the relation between A1 and A2 in worst case? 1 1 2

(A) Depends on input (B) A1 = A2
(C) A1 < A2 (D) A1 > A2

11. Four matrices M1, M2, M3 and M4 of dimensions p×q, q×r, r×s, and s×t respectively can be multiplied in several ways with different number of total scalar multiplications. It can be done as ((M1×M2) × (M3×M4)) or as ((M1×M2)×M3×M4), if p = 10, q = 100, r = 20, s = 5, t = 80. Find number of scalar multiplications. 1 2 3

(A) 19000 (B) 44000
(C) 248000 (D) 25000

12. Consider two strings A = "qpqrr" and B = 'pqprqrp". Let 'X' be the length of longest common subsequence between A and B and let Y be the number of such longest common subsequences between A and B. Then X + 20Y = _____. 1 1 3

(A) 64 (B) 34
(C) 23 (D) 43

13. Consider the following two sequences X = (B, C, D, C, A, B, C), Y = (C, A, D, B, C, B) 1 1 3

(A) 5 (B) 3
(C) 4 (D) 2

14. Consider a sequence F_{00} defined as: 1 2 3

$F_{00}(0)=1, F_{00}(1)=1, F_{00}(n)=10*F_{00}(n-1)+100, F_{00}(n-2)$ for $n \geq 2$.

Then what shall be the set of values of the sequences F_{00}?

(A) (1, 110, 1200) (B) (1, 110, 600, 1200)
(C) (1, 2, 55, 110, 600, 1200) (D) (1, 55, 110, 600, 1200)

15. The time complexity of an efficient algorithm to find the longest monotonically increasing subsequences of N numbers is 1 1 3

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

16. Which among the following statement is (are) false?

(i) Greedy best – first search is not optimal but is often efficient
(ii) A^* is complete and optimal provided is admissible or consistent
(iii) h(n) = θ is an admissible heuristic for the '8' puzzle

(A) (i) only (B) (i) and (ii) only
(C) (ii) only (D) (ii) and (iii)only

17. Let in a file the frequency or letters index are 16, 7, 17, 25, 20 respectively. Which of the following is the Huffman code of the letter 'E'? 1 2 4

(A) 11 (B) 01
(C) 10 (D) 00

18. Tower of Hanoi is not an example of _____ design strategy. 1 1 4

(A) Back tracking (B) Recursion
(C) Stack (D) Iteration process

19. Assuming P! = NP which of the following is true? 1 1 5

(i) NP-complete = NP
(ii) NP-complete ⌈ ⌉ P = Φ
(iii) NP-hard = NP
(iv) NP-complete = P

(A) (i) (B) (ii)
(C) (iii) (D) (iv)

20. Let S be an NP-complete problem and Q and R be two other problems not known to be in NP. Q is polynomial time reducible to 'S' and 'S' is polynomial time reducible to 'R'. Which one of the following statements is true? 1 2 5

(A) R is NP-complete (B) R is NP-hard
(C) Q is NP-complete (D) Q is NP-hard

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

21. Solve the recurrence equation using substitution method. 4 3 1 1

$$T(n)=2T(n/2)+2 \text{ if } n>2$$
$$=1 \quad \text{if } n=2$$
$$=0 \quad \text{if } n=0$$

22. Multiply the following two matrices using Strassen's multiplication method 4 3 2 1

$$A=\begin{bmatrix} a_{00} & a_{01} \\ a_{10} & a_{11} \end{bmatrix} \quad B=\begin{bmatrix} b_{00} & b_{01} \\ b_{10} & b_{11} \end{bmatrix}$$

23. Write algorithm for sum of subsets. 4 4 4 3

24. Compute Huffmann coding for the set of symbols shown in the below table using the given frequencies 4 3 3 3

Symbol	A	B	C	D
Frequency	16	3	4	12

25. Distinguish P, NP and NP complete problems. 4 4 5 6

26. Solve recurrence relation using Master's theorem 4 3 2 4

$$T(n)=\delta T\left(\frac{n}{2}\right)+10n^2, T(0)=0$$

27. Distinguish between randomized and deterministic algorithms. 4 4 5 4