Reg. No.														

B.Tech. DEGREE EXAMINATION, JUNE 2024
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 worst case for linear search?	1	1	1	1,2

1. What is the worst case for linear search?
  (A) $O(1)$ (B) $O(\log n)$
  (C) $O(n)$ (D) $O(n \log n)$

[Marks: 1, BL: 1, CO: 1, PO: 1,2]

2. Which of the following recurrence relations can be used to find the nth Fibonacci number?
  (A) $f(n) = f(n) + f(n-1)$ (B) $f(n) = 2f(n-1)$
  (C) $f(n) = f(n-1)$ (D) $f(n) = f(n-1) + f(n-2)$

[Marks: 1, BL: 1, CO: 1, PO: 1,2]

3. If $f(n) = O(g(n))$ then $g(n) = O(h(n))$ then _____ .
  (A) $f(n) = \theta(h(n))$ (B) $f(n) = \Omega(h(n))$
  (C) $f(n) = O(h(n))$ (D) Either (B) or (C)

[Marks: 1, BL: 1, CO: 1, PO: 1,2]

4. _____ notation is useful for specifying the lower bound on time complexity.
  (A) O big oh   (B) Ω
  (C) Ⓗ   (D) o little oh

[Marks: 1, BL: 1, CO: 1, PO: 1,2]

5. The best case time complexity of binary search in an unsuccessful search is
  (A) $O(n)$ (B) $O(1)$
  (C) $O(\log n)$ (D) $O(n \log n)$

[Marks: 1, BL: 1, CO: 2, PO: 2,3]

6. The disadvantage of divide and conquer method is _____ .
  (A) Difficult to understand   (B) Huge recursive stacks needed
  (C) Slow in programming   (D) High time complexity

[Marks: 1, BL: 1, CO: 2, PO: 2,3]

7. The worst case running time of quick sort is
  (A) $O(n^2)$ (B) $O(n \log n)$
  (C) $O(n)$ (D) $O(n^3)$

[Marks: 1, BL: 1, CO: 2, PO: 2,3]

8. The number of comparisons required in finding minimum and maximum using divide and conquer strategy is
  (A) $2n-2$ (B) $2n-1$
  (C) $3(n+1)$ (D) $3n/2 - 2$

[Marks: 1, BL: 1, CO: 2, PO: 2,3]

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9. Which algorithmic technique is the best approach for solving Huffman codes?
   (A) Brute force
   (B) Divide and conquer
   (C) Greedy
   (D) Backtracking

10. What is the time complexity of fractional Knapsack problem in greedy approach?
    (A) $O(n \log n)$
    (B) $O(n)$
    (C) $O(\log n)$
    (D) $O(1)$

11. Which of the following design technique uses memoization?
    (A) Greedy
    (B) Divide and conquer
    (C) Dynamic programming
    (D) Brute force

12. The principal of optimality holds goods for the design technique.
    (A) Greedy
    (B) Divide and conquer
    (C) Dynamic programming
    (D) Brute force

13. Choose the searching method which is helpful in a backtracking algorithm for state-space time construction.
    (A) Depth-first search
    (B) Breadth first search
    (C) FIFO search
    (D) LIFO search

14. What is the time complexity of depth first search?
    (A) $O(V + E)$
    (B) $O(E)$
    (C) $O(V)$
    (D) $O(V * E)$

15. A node is said to be _____ it if has a possibility of reaching a complete solution.
    (A) Non-promising
    (B) Promising
    (C) Succeeding
    (D) Preceding

16. Consider the sum-of-subnet problem, n = 4, sum = 35 an weights = {5,7,10,12,15,18,20}. How many number of solutions available for the given problem?
    (A) 4
    (B) 3
    (C) 2
    (D) 1

17. Let us assume the problem of 3-SAT and 2-SAT are belongs to the complexity classes. Choose the correct statement from the following
    (A) Both in P
    (B) NP complete and P respectively
    (C) Both NP complete
    (D) P-complete only

18. Randomized quick sort is identified by _____.
    (A) Quick sort with random elements
    (B) Quick sort with random input choice
    (C) Quick sort with random pivot
   (D) Quick sort with random output choice

19. A _____ of a graph is a set of vertices that includes at least one end point   1   1   5   1,2
    of every edge of the graph.
    (A) Vertex traversal   (B) Preorder traversal
    (C) Vertex cover   (D) In order cover

20. Problems that can be solved in polynomial time are known as _____.   1   1   5   1,2
    (A) Tractable   (B) Intractable
    (C) Complete   (D) Decision

21. Write short notes on the following asymptotic notations.   4   1   1   1,2
    (i) Ω (Omega)   (ii) θ (theta)

22. Solving using Masters theorem. $T(n) = 7T(n/2) + \theta(n^2)$.   4   3   2   2,3

23. Compare and contrast the brute force and Huffman method of encoding.   4   2   3   2,3

24. Find the minimum spanning tree using Kruskal's algorithm through greedy   4   3   4   1,2,3
    technique in the following graph G.
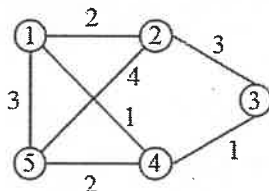
25. Explain the following terminologies of a graph with example.   4   2   4   1,2,3
    (i)   Indegree
    (ii) Cycle

26. P is a subset of NP. Comment and justify your answer on the given   4   3   5   1,2
    statement/

27. Define the satisfiability problem with example.   4   1   5   1,2

28. a. Solve the recurrence relation using recursion tree method and find its time   12   3   1   1,2
       complexity.
       $$T(n) = T(n/3) + T(2n/3) + n \ and \ T(1) = 1$$

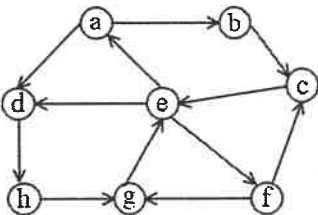**(OR)**

b.i. Prove that $f(n) \in O(g(n))$, given that   6   3   1   1,2

$$f(n) = 2n^2 + 3n + 2$$
$$g(n) = n^3 + 2n + 4$$

ii. If $f(n) = 4n^3 + 8n^2 + 11$ and $g(n) = 7n^2 + 4n + 12$, then prove that   6   3   1   1,2
    $f(n) \in \Omega(g(n))$.

29. a.i. Construct a divide and conquer algorithm to perform sorting by selecting first element as the pivot.   7   3   2   2,3

   ii. Analyze its best and worst case complexity.   5   2   2   2,3

(OR)

   b.i. Construct an algorithm to perform matrix multiplication using divide and conquer strategy.   6   3   2   2,3

   ii. Compare its time complexity analysis with the Naïve method of matrix multiplication.   6   3   2   2,3

30. a.i. Let the string = 'BCAADDCCACACAC". Encode the string using greedy approach.   8   3   3   2,3

   ii. Analyze its time complexity.   4   2   3   2,3

(OR)

   b.i. Find the longest common subsequence for the following strings using dynamic programming algorithm.   8   3   3   2,3
       str 1 = AGGTAB
       str 2 = GXTXAYB

   ii. Analyze its time complexity.   4   2   3   2,3

31. a.i. Determine the sum of subsets to make a total "9" from the given set of elements "S" using backtracking strategy. S = {3,4,5,2}   7   3   4   1,2,3

   ii. Write its algorithm.   5   1   4   1,2,3

(OR)

   b.i. Perform the traversal on the given graph 'G' using depth first search.   8   3   4   1,2,3

   ii. Analyze the depth first search algorithm and find its time complexity.   4   2   4   1,2,3

32. a. Apply Rabin-Karp algorithm to find the string matching in the following strings.   12   3   5   1,2
       str 1 = "aabbacdab"
       str 2 = "abba"

(OR)

   b. Write short notes on the following   1   5,6   1,2
       (i)   NP complete   4
       (ii)   NP hard   4
       (iii)   Vertex covering   4

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