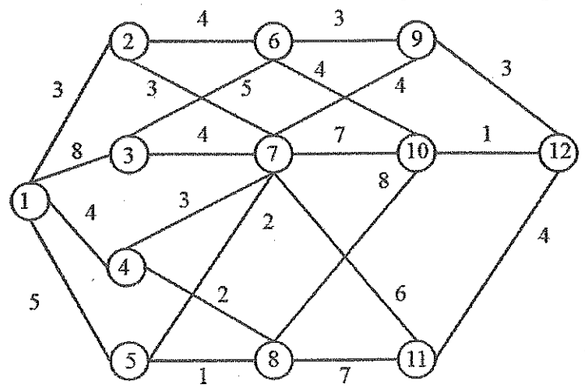
b. Solve the following multistage graph problem using dynamic programming. Find the shortest path between nodes 1 and 12 and also evaluate the cost of finding the shortest path.



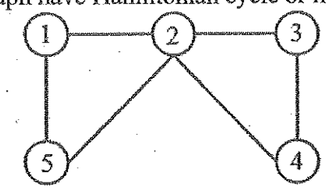
31. a.i. How sum of subsets problem is solved using Backtracking? Discuss with an algorithm. (8 Marks)

ii. Let $w = \{5,10,12,13,15,18\}$ and m = 30. Find all possible subsets of 'w' that sum to 'm'. Draw the portion of the state space tree. (4 Marks)

(OR)

b.i. Discuss the algorithm to find Hamiltonian cycles of a graph using recursive formulation of backtracking. (8 Marks)

ii. Justify whether the following graph have Hamiltonian cycle or not? (4 Marks)



32. a. The cost matrix for the travelling salesperson problem is given by

$$\begin{bmatrix} \infty & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 4 & 2 \\ 3 & 5 & \infty & 2 & 4 \\ 19 & 6 & 18 & \infty & 3 \\ 16 & 4 & 7 & 16 & \infty \end{bmatrix}$$

Apply branch and bound technique and show the reduced cost matrix and construct the state space tree.

(OR)

b.i. Differentiate between randomized and deterministic algorithms. (4 Marks)

ii. Elaborate the formal algorithm for performing quick soft using randomized method. Discuss the time complexity. (8 Marks)

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Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2019
3rd to 8th Semester

15CS204J – ALGORITHM DESIGN AND ANALYSIS
(For the candidates admitted during the academic year 2015 – 2016 to 2017 – 2018)

Note:
(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer ALL Questions

1. The process of checking whether the given algorithm gives correct outputs for valid inputs or not is called
(A) Algorithm verification (B) Algorithm validation
(C) Algorithm debugging (D) Algorithm design

2. Let number of disks in a tower of Hanoi problem is 4. Calculate the number of moves
(A) 15 (B) 16
(C) 7 (D) 8

3. Let there be a limit of maximum 5 hours for performing a task. How many inputs can be processed by an algorithm that has complexity as 2^n?
(A) 20 (B) 100
(C) 35 (D) 50

4. The recurrence equation of merge sort is
(A) $T(n) = 2T(n/2) + n - 1$ (B) $T(n) = T(n/2) + n$
(C) $T(n) = T(n/2) + 1$ (D) $T(n) = 3T(n/2) + n$

5. The time complexity of strassen matrix multiplication is
(A) $\theta(n^{2.81})$ (B) $\theta(n^2)$
(C) $\theta(n^3)$ (D) $\theta(n^{3.25})$

6. The time complexity of the conventional algorithm for finding the maximum and minimum elements in a given array is
(A) O (n) (B) O (n^2)
(C) O (2^n) (D) O (n log n)

7. The worst case time complexity of quick sort is
(A) O (n^3) (B) O (n^2)
(C) O (n!) (D) O (n^n)

8. The brute force algorithm for examining all possible distances in a closest pair problem can be given as
(A) $n(n+1)/2$ (B) $n(n-1)/2$
(C) $n(n+1)(2n+1)/6$ (D) $n(n-1)(n-2)/8$

9. Assume the given Knapsack that can carry a maximum weight of 60. There are 4 items with weights {20, 30, 40, 70} and values {70, 80, 90, 200}. What is the maximum value of the items can be filled using Knapsack?
(A) 200 (B) 170
(C) 90 (D) 160

10. What is the time complexity of Huffman coding?
    (A) O (n) (B) O (n(log n)^2)
    (C) O (n log n) (D) O (n^2)

11. The dynamic programming approach is used when
    (A) It's faster than greedy (B) It provides optimal solution
    (C) The given problem can be reduced to the 3-SAT problem (D) The solution has optimal substructure

12. What is the time complexity of travelling salesman problem using brute force search and dynamic programming methods?
    (A) O (2^n) and O (n) (B) O (n) and O (2^n)
    (C) O (n!) and O (n^2.2^n) (D) O (2^n) and O (n^2)

13. The time complexity of sum of subsets is
    (A) O (n) (B) O (2^n)
    (C) O (n^2) (D) O (n!)

14. If a graph G can be colored with the minimum number of colors (M colors) subjected to the constraints of the problem, the graph is known as
    (A) N-coloring (B) M-chromatic
    (C) G-color (D) Chromatic coloring

15. The time complexity of generating permutation problem is
    (A) O (n) (B) O (nn!)
    (C) O (n!) (D) O (n^2)

16. If a node in a state space tree satisfies all the constraints for Hamiltonian, then the node is _____.
    (A) Promising (B) Non promising
    (C) Adjacent (D) Bounding

17. _____ function that are used to limit the growth of state space tree
    (A) Dynamic (B) Heuristic
    (C) Bounding (D) Increment

18. A tool for finding the relative hardness of problem is
    (A) Minimization (B) Reduction
    (C) Avoidance (D) Correction

19. If an NP hard problem can be solved in polynomial time, then all _____ problems can be solved in polynomial time.
    (A) NP-problem (B) NP-complete
    (C) N-complete (D) N-hard

20. What is the time complexity of randomized quicksort when the elements are already sorted?
    (A) O (n) (B) O (n^2)
    (C) O (log n) (D) O (n log n)

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

21. Solve the recurrence relation $C_n = C_{n-1} + n, n >= 1, C_0 = 0$ by substitution method.

22. Write an algorithm for finding sum of n natural numbers. Derive the time complexity using line count (step count).

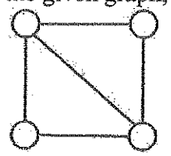
23. Multiply the following two matrices using the strassen method.

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

24. Compute Huffman coding for the set of symbols shown in the below table along with the frequencies.

Symbol	A	B	C	D
Frequency	16	12	3	4

25. Find the minimum chromatic number for the given graph, and write its algorithm.



26. Justify how branch-bound technique is better than backtracking method.

27. What is NP hard and NP complete problems? Give examples.

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

28. a.i. Write a recursive program to calculate Fibonacci series. Find the recurrence relation for the same and solve it by substitution method.

ii. Solve the following recurrences using master theorem
    (1) $T(n) = 8T(n/2) + n^2$
    (2) $T(n) = 2T(n/2) + n^4$

(OR)

b.i. List out the steps involved in solving a recurrence equation using recurrence tree method. (4 Marks)

ii. Solve the following recurrence equation using recurrence tree method $T(n) = 2T(n/2) + n$. (8 Marks)

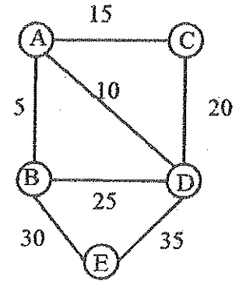
29. a. Discuss the algorithm for finding maximum and minimum elements in a given array using divide and conquer approach. Solve the recurrence relation for the same.

(OR)

b. Discuss the following algorithms for constructing a convex hull
    (i) Quick hull
    (ii) Merge hull

30. a.i. Let there by a Knapsack with capacity W = 15. Let there be three items whose profits are {24, 18, 20} and weights are {8, 9, 5}. Find the optimal order for loading the items in a given Knapsack.

ii. Construct the minimum cost spanning tree for the following graph using Kruskal's method.



(OR)