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

28. a. Solve the equation $T(n) = 3T(n/4) + cn^2$ by recursive tree method and verify the result using master's theorem.

(OR)

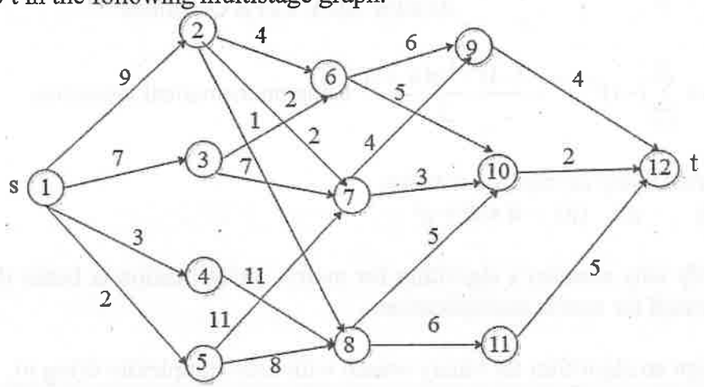
b. Analyse the best, worst and average case for merge sort. Prove the recurrence relation by substitution method.

29. a. Design an algorithm for finding closest pair points using divide and conquer technique. Derive the time complexity and justify, the merge part of the algorithm takes 7n operations.

(OR)

b. Develop the Graham's scan algorithm for finding convex hull and analyse its complexity.

30. a. Develop a pseudo code for multistage graph using forward approach and find minimum cost path from s to t in the following multistage graph.



(OR)

b. Use greedy technique to design an algorithm to generate Huffman coding. Analyse its time complexity.

31. a. Apply backtracking technique to design an algorithm to solve N-queen's problem. Give an example.

(OR)

b. Develop an algorithm to find out the round trip Hamilton cycle in graph G = (V, E). Give an example.

32. a. Develop an algorithm for randomized hiring problem and give an example.

(OR)

b. The following problems are considered as class NP problems-justify
   (i) Hamilton cycle
   (ii) 3 SAT problems
   (iii) Sub-set sum problems.

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Reg. No.														

B.Tech. DEGREE EXAMINATION, DECEMBER 2018
1st to 6th 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 average time required to perform a successful sequential search for an element in an array A(1..h) is given by
   (A) (n+1)/2 (B) n(n+1)/2
   (C) log n (D) n^2

2. Which of the following shown the correct relationship among some of more common computing times on algorithms?
   (A) $0(\log n) < 0(n)$, $0(n*\log n) < 0(2^n) < 0(n^2)$ (B) $0(n) < 0(\log n) < 0(n*\log n) < 0(2^n) < 0(n^2)$
   (C) $0(n) < 0(\log n) < 0(n*\log n) < 0(n^2)$ (D) $0(\log n) < 0(n) < 0(n*\log n) < 0(n^2) < 0(2^n) < 0(2^n)$

3. $T(n) = T(n/2) + T(n/4) + T(n/8) + n$ then $T(n) =$
   (A) $\theta(n^4)$ (B) $\theta(n^3)$
   (C) $\theta(n^2)$ (D) $\theta(n)$

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) $O(n^2)$
   (C) $O(n^3)$ (D) O(log n)

5. The sub problems in divide and conquer are combined to be
   (A) Distinct (B) Overlapping
   (C) Large size (D) Small size

6. The sorting method which is used for external sort is
   (A) Bubble sort (B) Quick sort
   (C) Merge sort (D) Radix sort

7. You need to calculate x^n where x can be any number and n is a positive integer. What can be the best possible time complexity of our power function?
   (A) 0(n) (B) 0(n log n)
   (C) $0(n^2)$ (D) 0(log n)

8. Algorithm A1 can compute min-max in a1 comparison without divide and conquer. Algorithm A2 can compute min-max in a2 comparison with divide and conquer. What would be the relation between a1 and a2 considering the wost case scenarios?
   (A) a1 < a2 (B) a1 > a2
   (C) a1 = a2 (D) Depends on the input

9. The weight and profit of 5 items are w = {5,10,20,30,40}; p = {30,20,100,90,160}. The knapsack capacity is 60. Find the solution by greedy technique
   (A) 230 (B) 260
   (C) 220 (D) 250

10. The total running time of Huffman on the set of 'n' characters is
   (A) 0(n) (B) 0(n log n)
   (C) $0(n^2)$ (D) 0(log n)

11. The total running time of knapsack problem using simple approach
   (A) 0(n) (B) 0(log n)
   (C) $0(2^n \log n)$ (D) $0(2^n)$

12. Find out the length of an optimal sales person tour

$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$

   (A) 15 (B) 25
   (C) 23 (D) 35

13. In which of the following cases n-queen problem does not exist
   (A) n = 2 and n = 4 (B) n =4 and n = 6
   (C) n = 2 and n = 3 (D) n = 4 and n = 8

14. Let G be a graph with 'h' nodes and let 'm' be the chromatic number of the graph. Then the time taken by the backtracking algorithm to color it is
   (A) 0(nm) (B) 0(n+m)
   (C) $0(mn^m)$ (D) $0(nm^n)$

15. How many edges are there in a Hamilton cycle if the edge cost is 'c' and the cost of cycle is 'cn'?
   (A) c (B) cn
   (C) n (D) 2c

16. How many nodes are there in a full state space tree with n = 6?
   (A) 65 (B) 64
   (C) 63 (D) 82

17. Name the node which has been generated but none of its children nodes have been generated in state space tree
   (A) Dead node (B) Live node
   (C) E-node (D) State node

18. Which of the following is true?
   (A) P is subset of NP (B) NP is subset of P
   (C) P and NP are equal (D) NP is subset of NP hard

19. The time complexity of the normal quick sort, randomized quick sort algorithms in worst case is
   (A) $0(n^2)$, o(n log n) (B) $0(n^2)$, $0(n^2)$
   (C) 0(n log n), $0(n^2)$ (D) 0(n log n), 0(n log n)

20. Choose the correct answer for the following
   (i) Thc thcory of NP-completeness provides a method of obtaining a polynomial time for NP algorithm
   (ii) All NP-complete problems are NP-hard
   (A) (i) is false and (ii) is true (B) (i) is true and (ii) is false
   (C) Both are true (D) Both are false

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

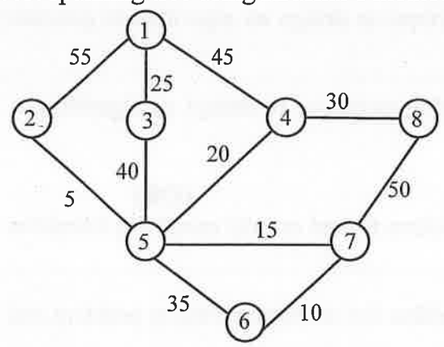
21. Solve $\sum_{i=1}^{n}(-1)^{i+1}i^2 = \frac{(-1)^{n+1}n(n+1)}{2}$ using mathematical induction.

22. Express using asymptotic notation
   (i) n! (ii) $6 * 2^n + n^2$

23. Justify why strassen's algorithm for matrix multiplication is better than divide and conquer approach for matrix multiplication.

24. Design an algorithm for binary search with time complexity 0(log n).

25. Determine the minimum cost spanning tree using Kruskal's method.



26. Determine the minimum number of colors required to color a planar graph using m-colorability decision problem.

27. Distinguish PN, NP and NP complete problems.