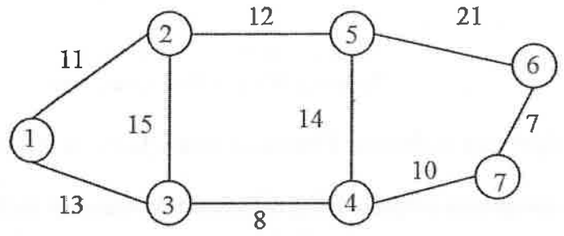
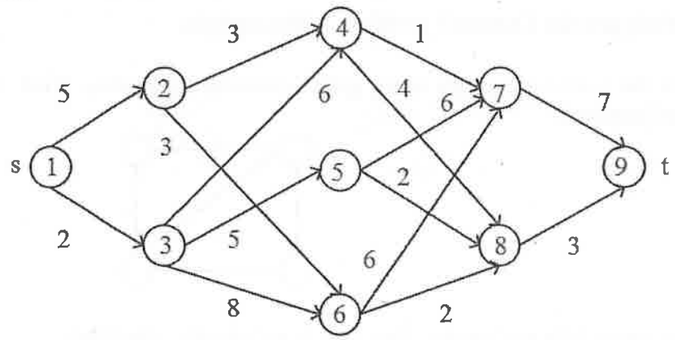
30. a. Compute the minimum cost spanning tree for the following graph using Kruskal algorithm.



(OR)

b. Find the minimum cost path from 's' to 't' in the multistage graph given below. Apply forward approach.



31. a. Write and analyze algorithm for n-queen problem using backtracking technique.

(OR)

b. Devise an algorithm to find all the Hamiltonian cycles of a graph. The graph is stored as an adjacency matrix $G[1:n][1:n]$.

32. a.i. Write a randomized algorithm for hiring problem.

ii. Analyze the complexity of randomized hiring problem.

(OR)

b. Write and explain randomized quick sort algorithm. Compare randomized quicksort with divide and conquer quick sort method.

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Reg. No.															

B.Tech. DEGREE EXAMINATION, NOVEMBER 2018
3rd to 7th 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. Which of the following is the notation for expressing the upper bound of an algorithm?
(A) Big-O (B) Big-Ω
(C) θ (D) Little oh

2. Apply the simplified master theorem for $T(n)=8T(n/2)+n^2$ and the complexity of this function is
(A) $\theta(n^3)$ (B) $\theta(n^2)$
(C) $\theta(n\log n)$ (D) $\theta(n^3+2)$

3. Which are the steps of divide and conquer algorithms?
(A) Divide-combine-conquer (B) Combine-conquer-divide
(C) Conquer-divide-conquer (D) Divide-conquer-combine

4. Quick sort runs in _____ worst case time.
(A) O (n^2) (B) O (n log n)
(C) O (n^3) (D) O (n !)

5. Time complexity of Strassen's matrix multiplication is
(A) $T=\theta(N^{\log 2})$ (B) $T=\theta(7^{\log 2})$
(C) $T=\theta(7^{\log n})$ (D) $T=\theta(N^{\log 7})$

6. Find the Euclidean distance between the points (4,3) and (7,5)
(A) $\sqrt{13}$ (B) $\sqrt{3}$
(C) $\sqrt{5}$ (D) $\sqrt{19}$

7. Merge sort is written without using temporary arrays, it is called _____.
(A) Two array merge (B) Stable sort
(C) In sort version of merge (D) Three way arrange

8. How do you call the selected keys in the quick sort methods?
(A) Outer key (B) Pivot key
(C) Partition key (D) Inner key

9. Suppose the letters a, b, c, d, e have probabilities 0.3, 0.3, 0.2, 0.1, 0.1, which of the following is the Huffman code for the above letters?
   (A) 100, 110, 00, 10, 01 (B) 10, 11, 00, 010, 011
   (C) 100, 110, 11, 10, 11 (D) 10, 111, 00, 01, 01

10. Which of the following standard algorithm is not a greedy algorithm?
   (A) Dijkstra's shortest path (B) Prim's algorithm
   (C) Huffman coding (D) Bellman ford shortest path

11. The time complexity of travelling salesman problem using dynamic programming is
   (A) $\theta(n!)$ (B) $\theta(n^2 2^n)$
   (C) $\theta(2^{n-1})$ (D) $\theta(n^{2n})$

12. We use dynamic programming approach when
   (A) The solution has optimal substructure (B) It provides optimal solution
   (C) The given problem can be reduced to 3-SAT problem (D) It is faster than greedy

13. The graph is said to be _____ iff it can be drawn in a plane in such a way that wo edges cross each other.
   (A) Complete (B) Clique
   (C) Isomorphic (D) Planar

14. Backtracking technique uses _____.
   (A) Binary search (B) Brute force search
   (C) Depth first search (D) Breadth first search

15. A node that is under construction in a state space tree is called
   (A) Answer state (B) Live node
   (C) Dead node (D) E-node

16. How many solutions are possible for a 8 queen problem?
   (A) 8^2 (B) 8!
   (C) 8 (D) 1

17. Assuming P! = NP, which of the following is true?
   (A) NP-complete = NP (B) NP-hard = NP
   (C) NP-completer = P (D) NP-complete $\cap$P = ϕ

18. Which of the following algorithm gives different result for a fixed input?
   (A) Deterministic (B) NP-complete
   (C) Randomized (D) Polynomial time

19. A search technique where we keep expanding nodes with least accumulated cost so far is called
   (A) Hill climbing (B) Backtracking
   (C) Branch and bound (D) Depth first search

20. A cycle is called _____ if it visits all vertices and return back to the starting vertex.
   (A) Chord less cycle (B) Hamiltonian
   (C) Peripheral cycle (D) Girth

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

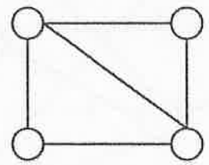
21. Write an algorithm to find the Fibonacci series. Give its recurrence relation.

22. Solve the recurrence relation using backward substitution method: $t_n = t_{n-1} + 3, t_0 = 4$.

23. Multiply $A = \begin{pmatrix} 1 & 4 \\ 4 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ using Strassen method.

24. Illustrate greedy Knapsack problem with example.

25. Color the following graph using graph coloring algorithm. What is the minimum number of colors required?



26. Distinguish between randomized and deterministic algorithm.

27. What is NP-hard problem? How to handle NP-hard problems to find solution?

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

28. a.i. Solve the following recurrence relation using master theorem $T(n) = 8T(n/2) + n^2$.

ii. Solve the following recurrence relation using backward substitution method
$T(n) = 2T(n/2) + 7$
$T(1) = 0$

(OR)

b.i. Let $t(n) = 3n^3 + 2n^2 + 3n + 4$ for an algorithm. Let $g(n) = n^3$. Prove that $t(n)$ of this algorithm in $O(n^3)$.

ii. Calculate the computing time of the step count and operation count for insertion sort.

29. a. Discuss Quicksort algorithm in detail. Solve the recurrence relation for quicksort.

(OR)

b. Given a set of points S in the plane. Partition it into two subsets S_1 and S_2. Solve the problem to find minimum distances of d_1 (for S_1) and d_2 (for S_2) using closet pair algorithm.