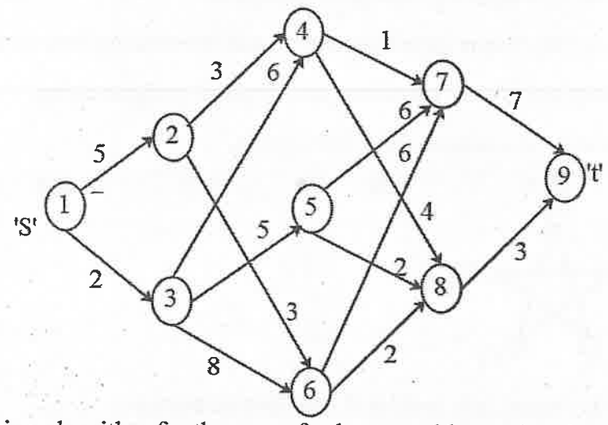
b. Find maximum and minimum value for given elements. Explain with recursive algorithm of maxmin. 22,13,−5,−8,15,60,17,31,47.

30. a. Consider the Knapsack instances n=4, weights $(\omega_1,\omega_2,\omega_3,\omega_4)=(4,3,2,5)$, profits $(P_1,P_2,P_3,P_4)=(10,20,15,25)$ and Knapsack capacity M=5. Solve the 0/1 knapsack using dynamic programing and explain with algorithm.

(OR)

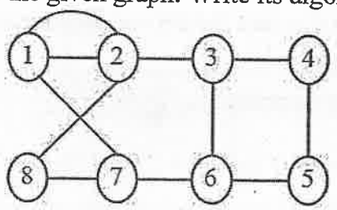
b. Find a minimum cost path from 'S' to 't' in the multistage graph using forward approach. Write its algorithm.



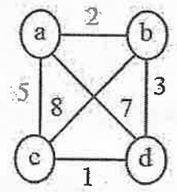
31. a. Write a backtracking algorithm for the sum of subsets problem using the state space tree. Find sum of subset for n=6, M=30 and $\omega[1:6]=\{5,10,12,13,15,18\}$.

(OR)

b. Find all Hamiltonian cycles for the given graph. Write its algorithm.



32. a. Apply branch and bound algorithm to solve the travelling salesman problem for the given graph.



(OR)

b.i. Describe randomized quick sort algorithm.

ii. Explain NP-hard and NP complete problems.

* * * * *

Reg. No.														

B.Tech. DEGREE EXAMINATION, DECEMBER 2019
First to Eighth 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. Write the order of growth for an algorithm.
(A) $O(1)<O(\log n)<O(n\log n)<O(n)$ (B) $O(\log n)<O(n\log n)<O(1)<O(n)$
(C) $O(1)<O(\log n)<O(n)<O(n\log n)$ (D) $O(1)<O(n\log n)<O(n)<O(\log n)$

2. The solution of the recurrence $T(n)=T(n/3)+n\log n$ is
(A) $O(n^2)$ (B) $O(\log n)$
(C) $O(n\log n)$ (D) $O(n^3)$

3. Let n≥m
int gcd(n,m) {if(n%m= =0)return m; n=n% m; return gcd (m,n);}how many recursive calls are made by this method?
(A) $\theta(n\log n)$ (B) $\theta(n)$
(C) $\theta(\log n)$ (D) $\theta(\sqrt{n})$

4. The notation that represents the lower bound on the growth rate of an algorithm's running time is _____.
(A) Big oh (O) (B) Big omega (Ω)
(C) Little oh (o) (D) Theta (θ)

5. The divide and conquer algorithm has the complexity
(A) $O(n)$ (B) $O(\log n)$
(C) $O(n^2)$ (D) $O(n\log n)$

6. Which of the following sorting algorithm has the lowest worst case complexity?
(A) Merge sort (B) Bubble sort
(C) Quick sort (D) Selection sort

7. The term "conquer" for the divide and conquer paradigms refer to
(A) Divide the problem into two or more number of sub problems
(B) Combine the solution of sub-problems in order to obtain solution to the original problem
(C) Solve the sub problems by applying divide and conquer recursively
(D) Obtain solution of the entire problem

8. Binary search has a huge advantage over linear search in terms of
   (A) Space consumption (B) Time complexity
   (C) Machine specifications (D) Runtime specifications

9. What algorithm technique is used in the implementation of Kruskal's solution for the Minimum Spaning Tree (MST)?
   (A) Greedy (B) Divide and conquer
   (C) Dynamic programing (D) Branch and bound

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

11. Dynamic programming is based on the principle of
   (A) Equality (B) Divisibility
   (C) Feasibility (D) Optimality

12. Time complexity for dynamic programming problem is
   (A) Quadratic (B) Logarithmic
   (C) Polynomial (D) Exponential

13. Which of the data structure is generally used to implement backtracking?
   (A) Queue (B) Stack
   (C) Tree (D) Graph

14. How many solutions exist for the four queens problem?
   (A) 2 (B) 4
   (C) 16 (D) 24

15. Which of the following is the solution of four queens?
   (A) {2,31,4,3} (B) {2,4,1,3}
   (C) {1,4,2,3} (D) {3,2,4,1}

16. Which problem is not a backtracking algorithm problem?
   (A) Knight tour problem (B) Tower of Hanoi
   (C) N-Queen problem (D) M-coloring problem

17. The branch and bound method requires which of the following constraints?
   (A) Explicit constraint (B) Ordinary constraint
   (C) Upper bound and lower bound (D) Implicit constraint

18. Which data structure is generally used to implement branch and bound?
   (A) Stack (B) Queue
   (C) Heap (D) Graph

19. Intractable problems are
   (A) Not solvable (B) Not in NP
   (C) Not in P (D) In class NP

20. The problem 3-SAT and 2-SAT are
   (A) Both in P (B) Both NP complete
   (C) NP-complete and in P respectively (D) Undecidable and NP-complete respectively

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

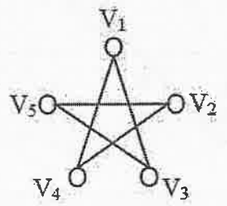
21. Write master theorems for the recurrence relation $T(n)=aT(n/b)+f(n)$.

22. State various algorithm design techniques.

23. Write an algorithm for binary search and mention its time complexity.

24. Differentiate greedy algorithm and dynamic programming.

25. Find chromatic number for given graph.



26. What is closest pair problem? Mention an example.

27. Write randomized algorithm for hiring problem.

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

28. a.i. Construct a recursion tree for the recurrence relation.
$T(n)=3T(n/4)+Cn^2$
and write its time complexity (8 Marks)

ii. Solve the recurrence $T(n)=n+2T(n/2)$ using substitution method. (4 Marks)

(OR)

b.i. Prove the recurrence relation by generating recurrence tree.

$$T(n)=\begin{cases}\theta(1) \text{ if } n=1\\ aT(n/b)+f(n) \text{ if } n=b^i\end{cases}$$

where 'i' is a positive integer, then $T(n)=\theta(n\log_b a)+\sum_{j=0}^{\log_b n-1} a^j f(n/b^j)$. (8 Marks)

ii. Apply master theorem for the recurrence, and find solution $T(n)=9T(n/3)+n$.
(4 Marks)

29. a. Explain the algorithm of merge sort. Illustrate with an example and give its recurrence relation and efficiency.

(OR)