Printed Page:- Subject Code:- ACSBS0501

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech.

SEM: V - THEORY EXAMINATION (2022 - 2023)

Subject: Design and Analysis of Algorithms

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.
2. Maximum marks for each question are indicated on right -hand side of each question.
3. Illustrate your answers with neat sketches wherever necessary.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.
6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A 20

1. Attempt all parts:-

1 The worst case complexity for insertion sort is (CO1) 1

(a) O(n)

(b) O(log n)

(c) O(nlog n)

(d) O(n^2)

1 On which algorithm is heap sort based on? (CO1) 1

(a) Priority queue

(b) Fibonacci heap

(c) FIFO

(d) Binary tree

1 If a problem can be solved by combining optimal solutions to non-overlapping problems, the strategy is called (CO2) 1

(a) Dynamic programming

(b) Greedy

(c) Divide and conquer

(d) Recursion

1 Which of the following methods can be used to solve the Knapsack problem? (CO2) 1

(a) Brute force algorithm

(b) Recursion

(c) Dynamic programming

(d) Brute force, Recursion and Dynamic Programming

1-e. Time complexity of Kruskal's algorithm is (CO3) 1

(a) O(V^2)

(b) O(V lg E)

(c) O(E lg V)

(d) O(V+E)

1-f. We can solve Single-Source shortest path problem using (CO3) 1

(a) Kruskal's Algorithm

(b) Prim's Algorithm

(c) Dijkstra's Algorithm

(d) Flyod-Warshal Algorithm

1-g. Problems that can't be solved by any algorithms are known as? (CO4) 1

(a) Tractable Problem

(b) intractable problem

(c) undecidable problem

(d) Decidable Problem

1-h. The sum and composition of two polynomials are always polynomials. (CO4) 1

(a) TRUE

(b) FALSE

(c) None

(d) Sometimes

1-i. Rabin and Karp Algorithm. (CO5) 1

(a) String Matching Algorithm

(b) Shortest Path Algorithm

(c) Minimum spanning tree Algorithm

(d) Approximation Algorithm

1-j. The problem 3-SAT and 2-SAT are (CO5) 1

(a) both in P

(b) both NP complete

(c) NP-complete and in P respectively

(d) undecidable and NP-complete respectively

2. Attempt all parts:-

2.a. What are the five properties of an algorithm? (CO1) 2

2.b. Explain N-Queen problem with its complexity? (CO2) 2

2.c. What are the applications of Dynamic Programming? (CO3) 2

2.d. Define halting problem. (CO4) 2

2.e. Prove that satisfiability of Boolean formula in 3CNF is NP complete. (CO5) 2

SECTION B 30

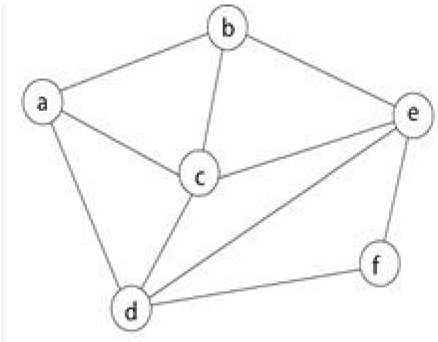
3. Answer any <u>five</u> of the following:-

3-a. Describe asymptotic notation and its type briefly. Also find the big-oh and little-oh notation for ,F(n)= $7n^3 + 50n^2 + 200$ (CO1) 6

3-b. Explain Masters Methods. Elaborate on all its Conditions? (CO1) 6

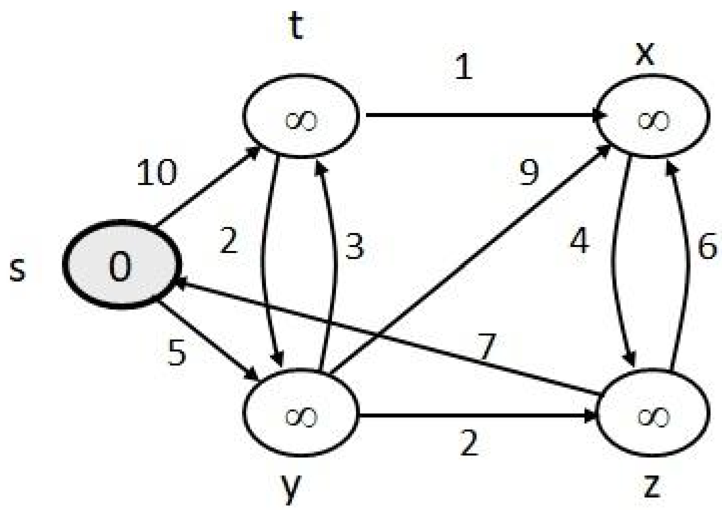
3-c. Write an algorithm of Sum-of-subset problem using backtracking approach. Find all possible solution for following instances using same if m=30 and S=< 1,2,5,7,8,10,15,20,25> (CO2) 6

3-d. 6



Consider a graph G = (V, E) shown in following figure. Find a Hamiltonian circuit using Backtracking method. (CO2)

3.e. 6



Implement the DFS algorithm. Traverse the given graph using the DFS algorithm step by step. (CO3)

3.f. Explain Clique Decision Problem and also Prove that this is NP-hard Graph problem. (CO4) 6

3.g. Define Vertex cover problem and also Prove that vertex cover Problem is NP-Complete problem. (CO5) 6

SECTION C 50

4. Answer any <u>one</u> of the following:-

4-a. Solve the following recurrences using master method. (CO1) 10

(i) T(n) = 4 T(n/2) + n^2

(ii) T(n) = 2T(n/2) + n^2 / (log ^2) n

(iii) T(n) = 2T(n/3) + n^2

4-b. From the given algorithm form a recurrence relation T(n) 10

And Solve the recurrence relation T (n) By using the recursive tree Method or Back Substitution method (CO1)

```
void test(int n)
{
   if(n>0)
   {
      for(i=0;i<n;i++)
      {
         printf("%d",n);
      }
   test(n-1);
   }
}
```

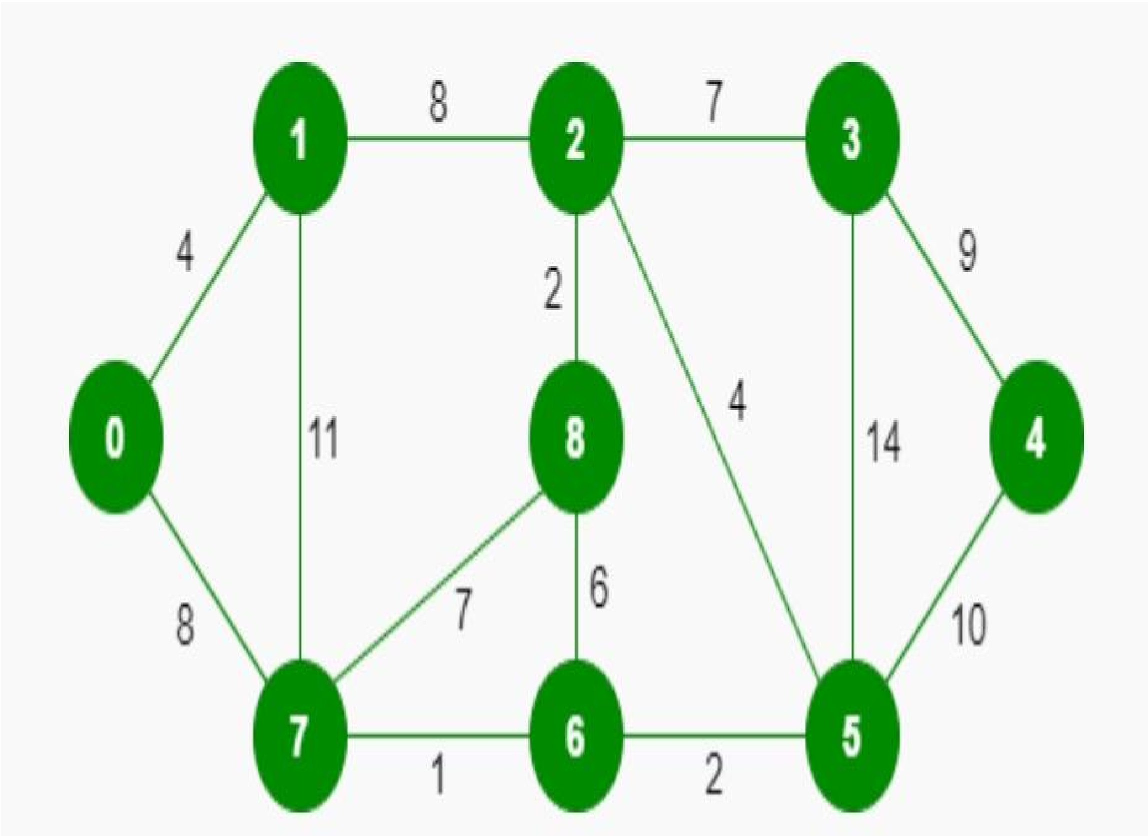
5. Answer any <u>one</u> of the following:-

5-a. Consider two strings A = “qpqrr” and B = “pqprqrp”. Let x be the length of the longest common subsequence (not necessarily contiguous) between A and B and let y be the number of such longest common subsequences between A and B. Then x + 10y = _?__. (CO2) 10

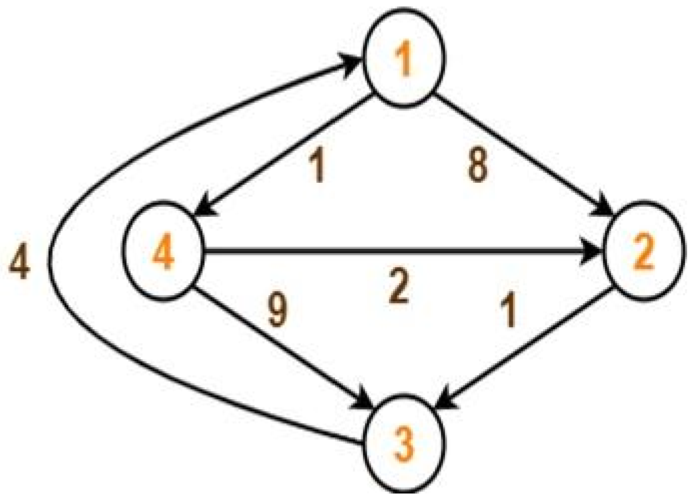
5-b. What is 0/1 knapsack problem? Solve the given instance using Dynamic Programming and write the algorithm also, knapsack capacity=8 profit<1,6,18,22,28> weight<1,2,5,6,7> (CO2) 10

6. Answer any <u>one</u> of the following:-

6-a. Explain the term "minimum spanning tree". Implement Kruskal's algorithm to find minimum spanning tree and analyze its time complexity. Find MST of the given graph using Kruskal's algorithm. (CO3) 10



6-b. 10



Consider the following directed weighted graph. Using Floyd Warshall Algorithm, find the shortest path distance between every pair of vertices. (CO3)

7. Answer any <u>one</u> of the following:-

7-a.	(a) Define approximation algorithms? Why and where they are useful? (b) Give the approximation algorithm for vertex cover and set cover problem. (CO4)	10
7-b.	Define the following problems related to NPC: (CO4) (i) Vertex Cover (ii) Clique (iii) SAT and its variants	10

8. Answer any <u>one</u> of the following:-

8-a.	What is the role of the Turing Machine in decidable and undecidable problems. Explain it with example. (CO5)	10
8-b.	What are the decision problems? How can you convert an optimization problem into decision problem? (CO5)	10