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Subject Code:- ACSBS0501

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: V - CARRY OVER THEORY EXAMINATION - APRIL 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-a. Which case indicate the minimum time required for program execution? [CO1] 1

(a) best case

(b) average case

(c) worst case

(d) None of the above

1-b. The complexity of linear search algorithm is [CO1] 1

(a) O(n)

(b) O(log n)

(c) $O(n^2)$

(d) O(n log n)

1-c. If a problem can be broken into subproblems which are reused several times, the problem possesses ____________ property. [CO2] 1

(a) Overlapping subproblems

(b) Prim's algorithm

.

(c) Kruskal algorithm

(d) Bellmen Ford Shortest path algorithm

1-d. In fractional knapsack problem, what will happen if maximum capacity of knapsack is not reached and no item can be completely inserted into the knapsack? [CO2] 1

(a) A whole item can be added

(b) Fraction of item can be added

(c) No item can be added

(d) None of the options

1-e. Which of the following is false in the case of a spanning tree of a graph G?. [CO3] 1

(a) It is tree that spans G

(b) It is a subgraph of the G

(c) It includes every vertex of the G

(d) It can be either cyclic or acyclic

1-f. For a directed graph, the sum of the lengths of the lists is.[CO3] 1

(a) E = 2 |V|

(b) E = 2 |V2|

(c) E = |V|

(d) V = |E|

1-g. _________ is the class of decision problems that can be solved by non-deterministic polynomial algorithms. [CO4] 1

(a) NP

(b) P

(c) Hard

(d) Complete

1-h. What does NP stands for in complexity classes' theory? [CO4] 1

(a) Non polynomial time

(b) Non-deterministic polynomial time

(c) Both (a) and (b)

(d) None of the mentioned

1-i. .Assuming P != NP, which of the following is true ? [CO5] 1

(a) NP-complete = NP

(b) NP-complete intersection P = phi

(c) NP-hard = NP

(d) P = NP-complete

1-j. Basic principle in Rabin Karp algorithm. [CO5] 1

(a) Hashing

(b) Sorting

(c) Augmenting

(d) Dynamic Programming

2. Attempt all parts:-

2.a. State the difference between Program, Algorithm and Pseudocode . [CO1] 2

2.b. Write short note on Strassen's Method. [CO2] 2

2.c. Write about Topological Sorting ? [CO3] 2

2.d. Differentiate between Decidable and undecidable Problem with the help of an example. [CO4] 2

2.e. What do you understand about computability of algorithms? [CO5] 2

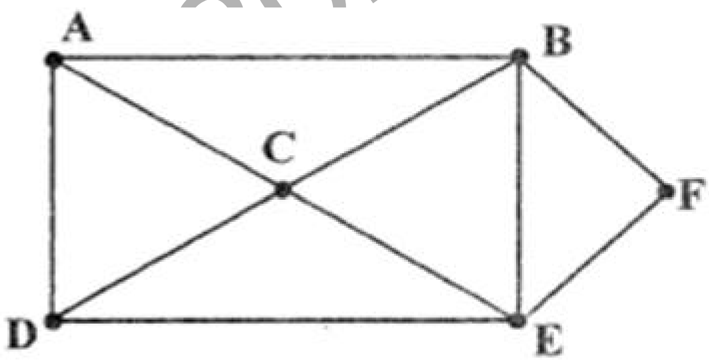
SECTION B **30**

3. Answer any five of the following:-

3-a. Explain Algorithm Design Techniques. [CO1] 6

3-b. Suppose there are 60 students in the class. How will you calculate the number of absentees in the class? Write Algorithm and the Pseudocode for above problem. [CO1] 6

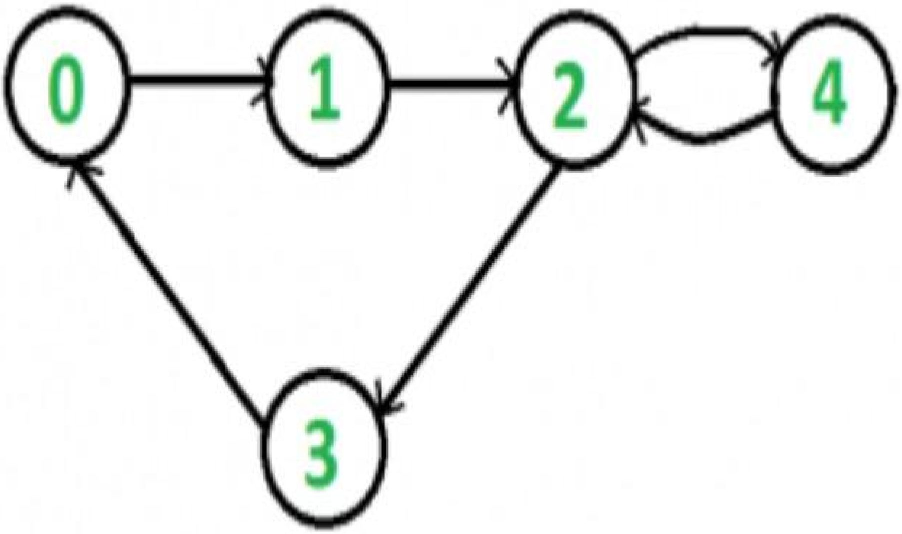
3-c. 6



Find the Hamiltonian circuit in the following graph using backtracking. [CO2]

3-d. Explain TSP (travelling sales person) problem with example. Write an approach to solve T'SP problem.[CO2] 6

3.e. Implement an algorithm to find strongly connected components in a graph. Find strongly connected components for the given graph. [CO3] 6



3.f. State Hamiltonian Circuit problem.[CO4] 6

3.g. Explain Travelling Salesman Problem(TSP) with the triangle inequality. [CO5] 6

SECTION C **50**

4. Answer any one of the following:-

4-a. Solve the following recurrence using recursion tree/substitution method. [CO1] 10
T(n) = 3T (n/4) + Θ(n^2)

4-b. Find the complexity of below recurrence: [CO1] 10
T(n)= { 3T(n-1), if n>0,
T(n) = { 1, otherwise
And
T(n)= { 2T(n-1) - 1, if n>0,
T(n) = { 1, otherwise

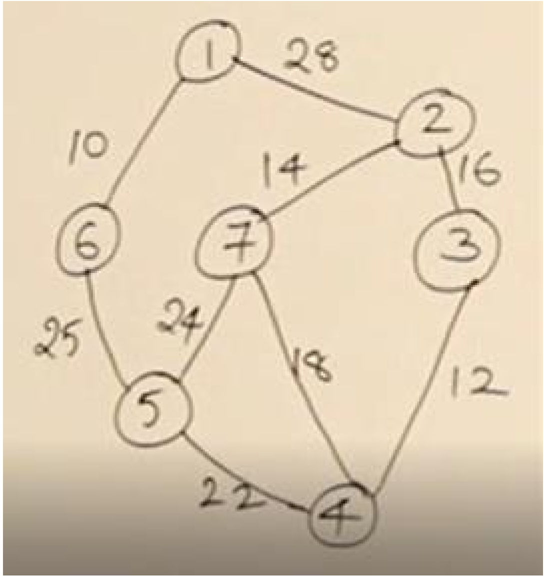
5. Answer any one of the following:-

5-a. Write algorithm to solve fractional knapsack problem. For the given items find the optimal solution: I:, W: <6, 2, 4, 3, 5>, P: <12, 10, 9, 9, 5>, capacity of knapsack = 10. [CO2] 10

5-b. Solve the instance of 0/1 knapsack problem using dynamic Programming : n = 4, M = 25, (P1, P2, P3 P4) = (10, 12, 14, 16), (W1, W2, W3, W4) = (9, 8, 12, 14). [CO2] 10

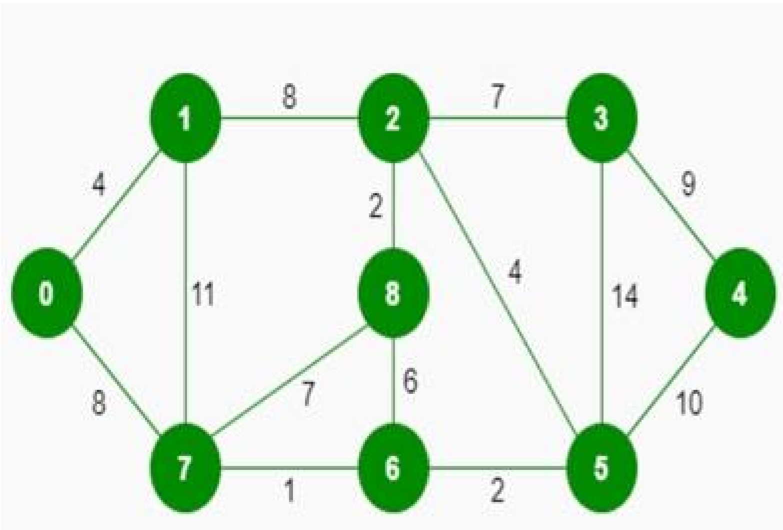
6. Answer any one of the following:-

6-a. 10



Write pseudo code for Prims Algorithm. Construct the minimum cost-spanning tree for the following graph using Prims Algorithm. [CO3]

6-b. 10



Implement Kruskal's algorithm to find the minimum spanning tree. Explain the algorithm step by step. Analyze its time complexity. Find MST of the given graph using Kruskal's algorithm. [CO3]

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

7-a. What is randomized algorithm? What is the concept behind randomized algorithms? [CO4] 10

7-b. Implement an algorithm for Knapsack problem using NP-Hard Approach. [CO4] 10

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

8-a. Can we show that the Halting problem is less than NP hard? If yes, explain with an example. [CO5] 10

8-b. What is randomized algorithms? What is the concept behind randomized algorithms? [CO5] 10