Printed Page:- **Subject Code**:- **ACSE0501**

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. The Θ notation in asymptotic evaluation represents −(CO1) 1

(a) Worst Case

(b) Average Case

(c) Best Case

(d) Null Case

1-b. If for an algorithm time complexity is given by O(1) then the complexity of it is (CO1) 1

(a) Exponentail

(b) Polynomial

(c) Constant

(d) None

1-c. Time taken in decreasing the node value in a binomial heap is (CO2) 1

(a) O(n)

(b) O(1)

(c) O(log n)

(d) O(n log n)

1-d. Which of the following is the most widely used external memory data structure? (CO2) 1

(a) AVL tree

(b) B-tree

(c) Red-black tree

(d) Both AVL tree and Red-black tree

1-e. Time complexity of Breadth First Search algorithm is (CO3) 1

(a) O(E+V)

(b) O(V lg E)

(c) O(lg V)

(d) O(E lg E)

1-f. Time complexity of Bellman-Ford algorithm is (CO3) 1

(a) O(V lg E)

(b) O((V+E) lg V)

(c) O(E V)

(d) O(E lg E)

1-g. If a problem can be broken into subproblems which are reused several times, the problem possesses _____ property. (CO4) 1

(a) Overlapping subproblems

(b) Optimal substructure

(c) Memoization

(d) Greedy

1-h. In dynamic programming, the technique of storing the previously calculated values is called (CO4) 1

(a) Saving value property

(b) Storing value property

(c) Memoization

(d) Mapping

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. If the expected number of valid shifts is small and modulus is larger than the length of pattern what is the matching time of Rabin Karp Algorithm? (CO5) 1

(a) Theta(m)

(b) Big-Oh(n+m)

(c) Theta(n-m)

(d) Big-Oh(n)

2. Attempt all parts:-

2.a. Write down the characteristics of algorithm.(CO1) 2

2.b. Define the properties of B-Tree.(CO2) 2

2.c. Explain Negative weighted cycles. (CO3) 2

2.d. What is 0/1 knapsack problem? (CO4) 2

2.e. Define NP- hard problem . (CO5) 2

SECTION B **30**

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

3-a. Explain asymptotic notations with example. (CO1) 6

3-b. Write an algorithm of Quick sort.Explain with example. (CO1) 6

3-c. Insert the following keys into empty B-tree:- 86, 23, 91, 4,67, 18, 32, 54,46, 96, 45 with degree t=2 and delete 18, 23 from it. (CO2) 6

3-d. Discuss the rotation operation of RB- Tree. With example (CO2) 6

3.e. Consider the following instances of the fractional knapsack problem: n = 3, M = 20, V = (24, 25, 15) and W = (18, 15, 20) find the feasible solutions. (CO3) 6

3.f. Write an algorithm for solving n-queen problem. (CO4) 6

3.g. Define Approximation algorithms for Traveling sales man problem. (CO5) 6

SECTION C **50**

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

4-a. Solve the recurrence relation ? By using recusion tree Method (CO1) 10

$T(n)=1 \quad n=1$

$T(n)=2T(n/2)+n \quad n>1$

4-b. Solve the recurrence relation ? By using recusive tree Method or Back Substitution methord . (CO1) 10

$T(n)=1 \quad n=0$

T(n)=T(n-1)+n n>0

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

5-a. Explain deletion algorithm in red black tree in detail. Write down it's complexity (CO2) 10

5-b. Explain the Properties of Binomial Heap. Write an algorithm to perform uniting two binomial Heaps. And also to find the Minimuim Key (CO2) 10

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

6-a. Implement Merge sort algorithm. Step by Step sort the following sequence in increasing order using merge sort algorithm <1,2,3,4,5,6,7,8>. Analyze the algorithm for worst-case time complexity. (CO3) 10

6-b. Explain Strassen matrix multiplication along with an example? Why and when do we prefer it over normal matrix multiplication. (CO3) 10

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

7-a. What is the graph coloring problem ? What do you mean by optimal coloring of a graph ? Show that every bipartite graph is 2-colorable. (CO4) 10

7-b. State the Sum-of-Subset problem. Explain the dynamic approach for the same problem and apply same approach on following instance The Set: {10, 7, 5, 18, 12, 20, 15}
The sum Value: 35 (CO4) 10

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

8-a. (a) How do we prove that a given problem is in NP? (CO5)
(b) How do we prove that a given problem is in NPC? (CO5) 10

8-b. What is class NP? Discuss about any five problems for which no polynomial time algorithm has been found. (CO5) 10