Printed Page:- **Subject Code:- ACSE0401**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - CARRY OVER THEORY EXAMINATION - APRIL 2023

Subject: Design and Analysis of Algorithm

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. If for an algorithm time complexity is given by O(1) then the complexity of it is CO[1] 1

(a) Exponentail

(b) Polynomial

(c) Constant

(d) None

1-b. Which of the following is a stable sorting algorithm? CO[1] 1

(a) Merge sort

(b) Typical in-place quick sort

(c) Heap sort

(d) Selection sort

1-c. How many No. of node are their in B_k binomial heap. CO[2] 1

(a) 2*k

(b) 2^k

(c) k*k

(d) k+log k

1-d. Choose the option with function having same complexity for a fibonacci heap. CO[2] 1

(a) Insertion, Union

(b) Insertion, Deletion

(c) extract_min, insertion

(d) Union, delete

1-e. When Bellman-Ford's algorithm will fail? CO[3] 1

(a) Graph has negative weighted cycle

(b) Graph has negative weighted edges

(c) Graph is sparse

(d) Graph is dense

1-f. Binary search algorithm will fail, if CO[3] 1

(a) sequence is not sorted

(b) sequence is not finite

(c) start index of sequence is greater than it's end index

(d) All the options.

1-g. Which of the following problems is NOT solved using dynamic programming? CO[4] 1

(a) 0/1 knapsack problem

(b) Matrix chain multiplication problem

(c) Fractional knapsack problem

(d) LCS

1-h. The 0/1 Knapsack problem is an example of? CO[4] 1

(a) Greedy algorithm

(b) 2D dynamic programming

(c) 1D dynamic programming

(d) Divide and conquer

1-i. What is the basic formula applied in Rabin Karp Algorithm to get the computation time as Theta(m). CO[5] 1

(a) Halving rule

(b) Horner's rule

(c) Summation lemma

(d) Cancellation lemma

1-j. A problem which is both _______ and _________ said to be NP complete. CO[5] 1

(a) NP, P

(b) NP, NP hard

(c) P, P complete

(d) None of the mentioned

2. Attempt all parts:-

2.a. Write the complexity of linear search algorithm? CO[1] 2

2.b. Define the complexity of deletion operations in red black tree? CO[2] 2

2.c. Write short note on Dijkstra's algorithm? CO[3] 2

2.d. In Depth First Search, how many times a node is visited? CO[4] 2

2.e. Write short notes on Approximation Algorithm? CO[5] 2

SECTION B **30**

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

3-a. Write down the shell sort algorithm. Solve the following elements using shell sort: - 10, 7, 6, 3, 15, 31, 19. CO[1] 6

3-b. Sort the following elements using Merge sort algorithms and specify its complexity < 60, 20, 50, 10, 70, 90, 40, 30>. CO[1] 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. CO[2] 6

3-d. Show how the Quick sorts the following sequences of keys in ascending order 22, 55, 33, 11, 99, 77, 55, 66, 54, 21, 33). CO[2] 6

3.e. Write algorithm for the Huffman code algorithm and find the Huffman code for the character of given text file CO[3] 6
Character:
Frequency:<45, 5, 20, 15, 10, 25>

3.f. 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 = ___. CO[4] 6

3.g. Consider a set S= {5, 10, 12, 13, 15, 18} and d= 30. Solve it for obtaining sum of subset? CO[5] 6

SECTION C **50**

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

4-a. Solve the recurrence relation ? By using recusion tree Method CO[1] 10

T(n)=1 n=1

T(n)= 3T(n/4) +cn2 n>1

4-b. (a) Explain about Amortized analysis CO[1] 10

(b) Prove 3n^3 + 2n^2 = O(n)^3 ; 3^n!=O(2^n)

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

5-a. Explain left rotation algorithm in red black tree in detail. CO[2] 10

5-b. Write and explain Divide and conquer algorithm for computing the no of levels in a binary tree. CO[2] 10

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

6-a. Explain activity selection problem in detail. Write iterative algorithm to solve this problem and analyze the algorithm step by step. Solve and find compatible activities among the given activities having start time Si = <5,3,8,2,1,3,12,0,5,6,8> and finish time Fi = <7,8,12,13,4,5,14,6,9,10,11> respectively. CO[3] 10

6-b. What do you mean by minimum spanning tree? Write and explain algorithm for minimal spanning tree with an example. CO[3] 10

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

7-a. An articulation point in a connected graph is a vertex such that removing the vertex and its incident edges disconnects the graph into two or more connected components. Let T be a DFS tree obtained by doing DFS in a connected undirected graph G. find the articulation point in T and how many children it has explain with example. CO[4] 10

7-b. a) Solve the following 0/1 Knapsack problem using dynamic programming P= (11, 21, 31, 33), W= (2, 11, 22, 15), C=40, n=4. 10

b) Consider three stages of a system with r1=0.3, r2=0.5, r3=0.2 and c1=30, c2=20, c3=30 Where the total cost of the system is C=80 and u1=2, u2=3, u3=2 find the reliability design. CO[4]

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

8-a. Explain the approximation algorithm for the travelling salesman problem (TSP). CO[5] 10

8-b. a) Briefly explain n-queen problem using Backtracking. Explain its applications. 10

b) Briefly explain Hamiltonian cycles using backtracking CO[5]