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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - CARRY OVER THEORY EXAMINATION - AUGUST 2023

Subject: Data Structures and Algorithms Design

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 one of the following is not the application of the stack data structure?[CO1] 1
- (a) String reversal
 - (b) Recursion
 - (c) Backtracking
 - (d) Asynchronous data transfer
- 1-b. The necessary condition to be checked before deletion from the Queue is__.[CO1] 1
- (a) Overflow
 - (b) Underflow
 - (c) Rear value
 - (d) Front value
- 1-c. What is the main idea behind the divide and conquer approach? [CO2] 1
- (a) Solving a problem by breaking into smaller sub-problems

- (b) Generating all possible solutions and selecting the best one
- (c) Repeating the same steps over and over until a solution is found
- (d) Searching the solutions by gradually eliminating the possibilities
- 1-d. Fractional knapsack problem is solved most efficiently by which of the following algorithm?[CO2] 1
- (a) Divide and conquer
- (b) Dynamic programming
- (c) Greedy algorithm
- (d) Backtracking
- 1-e. What is the optimal time complexity to count the number of nodes in a linked list? [CO3] 1
- (a) $O(n)$
- (b) $O(1)$
- (c) $O(\log n)$
- (d) $O(n \log n)$
- 1-f. Insertion of an element at the ends of a linked list requires the modification of how many pointers?.[CO3] 1
- (a) 2
- (b) 1
- (c) 3
- (d) 4
- 1-g. The difference between the external path length and the internal path length of a binary tree with n internal nodes is: [CO4] 1
- (a) 1
- (b) n
- (c) $n+1$
- (d) $2n$
- 1-h. Which of the following is the most widely used external memory data structure?[CO4] 1
- (a) AVL tree
- (b) B-tree
- (c) Red-black tree
- (d) Both AVL tree and Red-black tree
- 1-i. Assuming value of every weight to be greater than 10, in which of the following 1

cases the shortest path of a directed weighted graph from 2 vertices u and v will never change?[CO5]

- (a) add all values by 10
- (b) subtract 10 from all the values
- (c) multiply all values by 10
- (d) in both the cases of multiplying and adding by 10

1-j. Breadth First Search algorithm uses which of the following data structures?[CO5] 1

- (a) Fibonacci Heaps
- (b) Linked List
- (c) Min-Priority Queue
- (d) Stack

2. Attempt all parts:-

- 2.a. Can we change the size of an array at run time?[CO1] 2
- 2.b. Define Knapsack Problem.[CO2] 2
- 2.c. Explain Tower of Hanoi problem.[CO3] 2
- 2.d. In tree construction which is the suitable efficient data structure?[CO4] 2
- 2.e. What is a undirected graph?[CO5] 2

SECTION B

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3. Answer any five of the following:-

- 3-a. What is sorting? How is sorting essential for Database applications?[CO1] 6
- 3-b. Write a simple C Program for a linear search or Binary Search.[CO1] 6
- 3-c. Compare divide and conquer strategy with dynamic programming.[CO2] 6
- 3-d. Write Pseudocode for 8 queen Problem?[CO2] 6
- 3.e. Explain circular queue and write program of enqueue and dequeue operations of circular queue? [CO3] 6
- 3.f. What is Binary Tree? Explain Representation of Binary tree. Also explain different operation that can be performed on Binary tree.[CO4] 6
- 3.g. Write an algorithm to test whether a given graph is connected or not.[CO5] 6

SECTION C

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4. Answer any one of the following:-

- 4-a. Using binary search, search the number 45 from the list of numbers and give the steps. 6,12,17,23,38,45,77,84,90. [CO1] 10

4-b. Give an algorithm for push and pop operations on stack using a linked list with an example.[CO1] 10

5. Answer any one of the following:-

5-a. Explain the knapsack problem using branch & bound technique with an example.[CO2] 10

5-b. Show the solution of 4 Queen problem using back-tracking approach with state space tree.[CO2] 10

6. Answer any one of the following:-

6-a. Write a C program that will split a circularly linked list into two circularly linked lists? [CO3] 10

6-b. What is need of doubly linked list ? Discuss how an array is different from linked list.[CO3] 10

7. Answer any one of the following:-

7-a. Explain B+ trees giving some of its application. Also explain method to add and delete an element to B+ tree with suitable example [CO4] 10

7-b. Construct a B-tree of order 5 created by inserting the following elements 3, 14, 7, 1, 8, 5, 11, 17, 13, 6, 23, 12, 20, 26, 4, 16, 18, 24, 25, 19 Also delete elements 6, 23 and 3 from the constructed tree.[CO4] 10

8. Answer any one of the following:-

8-a. Illustrate Kruskal's algorithm to find the minimum spanning tree of a graph. ii) Trace the algorithm for the following graph.[CO5] 10

8-b. Draw the complete undirected graphs on one, two, three, four and five vertices. Prove that the number of edges in an n vertex complete graph is $n(n-1)/2$. [CO5] 10