Question Paper

Exam Date & Time: 05-Jan-2024 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

THIRD SEMESTER B.TECH. DEGREE EXAMINATIONS - JANUARY 2024
SUBJECT: ICT 2121- DATA STRUCTURES
(MAKEUP)

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A)	Construct a C program, to delete the last element in a Doubly Linked List.	(5)
1B)	Develop a C program to count the total number of internal nodes of a binary search tree and illustrate the binary search tree you have considered for the program along with a sample computation of the number of internal nodes	(3)
1C)	For the Threaded Binary Search Tree shown in FIG Q1C determine inorder predecessor and successor for each node. Compute the inorder traversal and construct the threaded binary search tree after insertion of a node with value 13.	(2)

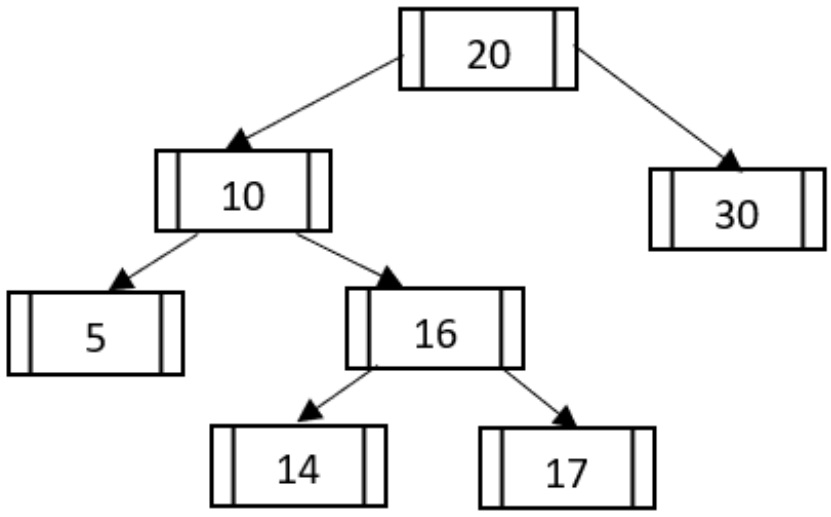

FIG Q1C

2A)	Write a C program to sort a given set of integers in a Stack using another temporary Stack.	(5)
2B)	Develop a C program to sort the given names using array of pointers.	(3)
2C)	Construct a C program to delete an element from a Circular queue using arrays.	(2)
3A)	Consider a puzzle board where each puzzle piece has a specific number value. The puzzle board is represented as a sparse matrix using a singly linked list. The 5 X 5 puzzle board is initially scattered with puzzle pieces having the following values:	(5)

0 [0, 0, 0, 0, 0]
1 [0, 0, 0, 0, 6]
2 [0, 8, 0, 0, 0]
3 [0, 0, 0, 0, 0]
4 [0, 0, 5, 0, 0]

To optimize the puzzle board representation, you decide to implement the fast transpose algorithm.
i) Provide the tabular representation of the given sparse matrix. Illustrate the fast transposition method by displaying the results with the contents of the rowTerms and startingPosition arrays at each iteration.
ii) For the given puzzle board, write a user defined function that takes the initial rowTerms and startingPosition arrays as input and returns the updated rowTerms and startingPosition arrays after performing the transpose operation using the fast transpose algorithm.

3B) An array of size 'm' is divided into 'n' number of equal sized stacks. Write the full and empty conditions for the i^{th} stack. Explain how a multiple stack is useful in checking if brackets are balanced or not in [A + {B / {(C + D) - E}}] (3)

3C) Write a user defined function to check if one binary tree is the mirror image of another binary tree or not (2)

4A) Write a complete C program to perform the following operations: (5)
i) Create an expression tree
ii) Evaluate an expression tree

4B) Create a binary search tree for the following set of elements: 100, 109, 95, 25, 45, 251, 201, 75, 67, 153, 143, 80, 105. Show each step of the construction. (3)

4C) Design a program to do the following in C: (2)
i) Read 'n' values and store them in a suitable data structure
ii) Count number of odd numbers and display odd numbers
iii) Display all the numbers ending with digit 2.

5A) Consider an adjacency matrix of the graph G having 5 vertices namely A,B,C,D,E as [[0,1,1,0,1], [1,0,1,0,0], [1,1,0,1,0], [0,0,1,0,1],[1,0,0,1,0]] (5)
i) Draw the graph G
ii) Write adjacency list representation of the graph G
iii) Find degree of each node present in the graph G

5B) Write a C code snippet to implement the following functions. Both functions take two pointers to the first node of the singly linked lists. (3)
i) *sllist_is_equal,* which should return 1 when both lists contain the same number of elements and each pair of corresponding elements in the list is also equal (as determined by the == operator), otherwise 0.
i) *sllist_is_intersection,* which points to the first node of the list containing the common elements in the input lists.

5C) Write the steps (with the necessary diagrammatic representations) for a function that returns the pointer to the resultant list for adding $6x^3 + 10x^2 + 5$ and $8x^5 - 6x^3 + 10x^2 + 6x$, using single linked lists. (2)

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