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Question Paper Code : 10293

M.C.A. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Elective

(Bridge Course)

BX 4001 – DATA STRUCTURES AND ALGORITHMS

(Regulations 2021)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the need for abstract data types (ADT).

2. Define Big-O Notation for algorithm analysis.

3. Enlist the differences between Queue and Circular Queue.

4. Write push ( ) and pop ( ) operations for a two way stack.

5. Differentiate Circular Linked List and Linear Linked List.

6. Identify any four applications of linked lists.

7. Enlist the differences between linear search and binary search.

8. Write time complexities of insertion sort

   (a)   When elements are given in ascending order?

   (b)   When same elements are given?

9. Write the algorithm for breadth first traversal of a Binary Search tree.

10. Differentiate Binary Trees and Binary Search Trees.

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PART B — (5 × 13 = 65 marks)

11. (a) Explain the different techniques/algorithmic methods to solve a problem.

Or

(b) Compute the time complexity of the following codes

```
int a = 0;
for (i = 0; i < N; I++) {
        for (j = N; j> i; j--) {
                a = a + i + j;
        }
}
int i, j, k = 0;
for (i = n / 2; i <= n; i++) {
        for (j = 2; j <= n; j = j * 2) {
                k = k + n / 2;
        }
}
int a = 0, b = 0;
for (i = 0; i < N; I++) {
        a = a + rand ( );
}
for (j = 0; j < M; j++) {
        b = b + rand ( );
}
```

12. (a) (i) Write the procedure for conversion of infix to postfix expression. (8)

(ii) Convert the infix expression ((A + B) – C * (D / E) + F to postfix expression. (5)

Or

(b) (i) Write the procedure for enqueue and dequeue operations in a circular queue. (8)

(ii) Write the procedure for push and pop operations of a stack. (5)

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13. (a) Use singly linked list for adding two polynomials. Write procedure(s) and give suitable examples.

Or

    (b) Write procedures for insert and delete operations in a circular doubly linked list.

14. (a) Use insertion sort algorithm for sorting the numbers {4, 3, 2, 10, 12, 1, 5, 6}. Write procedure and derive the time complexity for best case, worst case and average case.

Or

    (b) Explain the following with respect to hashing

        (i)   Hash table   (3)

        (ii)   Hash Functions   (3)

        (iii) Operations   (3)

        (iv)   Collision Handling   (4)

15. (a) Prove the following statements in connection with a binary tree

        (i)   The maximum number of nodes at level 'l' of a binary tree is 2l. (4)

        (ii)   In a Binary Tree with N nodes, minimum possible height or the minimum number of levels is Log2(N+1). (4)

        (iii) In Binary tree where every node has 0 or 2 children, the number of leaf nodes is always one more than nodes with two children. (5)

Or

    (b) Write the procedure for search, insert and deletion in a binary search tree. (3.5+3.5+6)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Write a function that takes a list sorted in non-decreasing order and deletes any duplicate nodes from the list. The list should only be traversed once. For example if the linked list is 11->11->11->21->43->43->60 then removeDuplicates ( ) should convert the list to 11->21->43->60. (8)

        (ii) Given a singly linked list of characters, write a function that returns true if the given list is a palindrome else false. (7)

Or

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(b)   (i)   Write the procedure for inorder, preorder and postorder traversals in a binary search tree. Print the inorder, preorder and post order traversals for the following input.   (10)
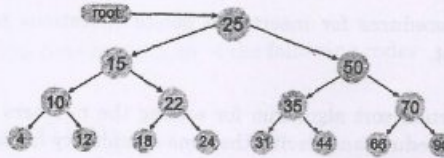
      (ii)   Given Inorder and Preorder traversals of a binary tree, construct the binary tree.   (5)

Inorder Traversal : {4, 2 1, 7, 5, 8, 3, 6}

Preorder Traversal : {1, 2, 4, 3, 5, 7, 8, 6}

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