17594

BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – B.Tech.(CSE)-DS-2024
Course Name – Data Structure and Algorithm
Course Code - BTD30102
(Semester III)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Select the term that best describes the evaluation of the efficiency of an algorithm based on its time and space requirements.

a) Asymptotic Notations
b) Time-Space Trade Off
c) Insertion
d) Traversal

(ii) Select the correct options. At any time the position of the element to be inserted will be calculated by the relation

a) position = key % table_size
b) position = (key + 1) % table_size
c) position = key * table_size
d) position = table_size - key

(iii) Choose the node visited times in Depth First Search

a) Once
b) Twice
c) Equivalent to number of indegree of the node
d) Thrice

(iv) Choose the maximum height of an AVL tree with p nodes

a) O(log p)
b) O(p)
c) O(√p)
d) O(p log p)

(v) Discover the correct match. The complexity of Linear Search and Binary Search are____?

a) Linear Search – O(n), Binary Search – O(n)
b) Linear Search – O(log n), Binary Search – O(n)
c) Linear Search – O(n), Binary Search – O(log n)
d) Linear Search – O(1), Binary Search – O(log n)

(vi) Consider the following definition in c programming language. Determine correct c code used to create new node. struct node{ int data; struct node * next; } typedef struct node NODE; NODE *ptr;

a) ptr = (NODE*)malloc(sizeof(NODE));
b) ptr = (NODE*)malloc(NODE);
c) ptr = (NODE*)malloc(sizeof(NODE*));
d) ptr = (NODE)malloc(sizeof(NODE));

(vii) Number of total nodes in a full binary tree with n internal nodes

a) 2n
b) 2n + 1
c) n + 1
d) n^2

(viii) Choose the correct sequence/s. a) O (1) < O (log n) < O(n2) < O (n log n) b) O (1) < O (log n) < O (n) < O (n log n) c) O (n log n) < O (n2) < O (n) < O (2n) d) O (1) < O (log n) < O (n) < O (n log n) < O (n2) < O (n3) < O (2n) < O (3n)

a) Only option (b) is correct
b) Only options (b) and (d) are correct
c) Only option (d) is correct
d) Options (b), (c), and (d) are correct

(ix) Choose the odd one that is not true for the Linked List.

a) Linked list is a dynamic data structure it can grow or shrink during the execution of a program and START or Head pointer will hold the address of the 1st node.
b) Memory is not pre-allocated ; Memory is allocated whenever it is required and NULL pointer indicates the end of the linked list holds by the last node.
c) It is deallocated
d) when it is not needed and Linked List can be used to implement the data structures namely Stack and Queue. When START = NULL if there is no list

(x) Define the time complexity of searching for an element in a singly linked list.

a) O(1)
b) O(log n)
c) O(n)
d) $O(n^2)$

(xi) Select the number of passes does an insertion sort algorithm consist of

a) N
b) N-1
c) N+1
d) None of them

(xii) In a time-space trade-off, if you optimize for lower space usage, what typically happens to the execution time?

a) Execution time increases
b) Execution time decreases
c) Execution time remains unchanged
d) It depends on the specific algorithm

(xiii) Select the option where is linear searching used

a) When the list has only a few elements
b) When performing a single search in an unordered list
c) Used all the time
d) When the list has only a few elements and When performing a single search in an unordered list

(xiv) Select the correct step in searching for a value in a linked list.

a) Jump to the middle node and compare values
b) Sequentially traverse the list, comparing each node's value with the target value
c) Perform a binary search
d) Start from the last node and move backward

(xv) Consider the following code snippet; where p is a pointer to the stack, top is the index of the stack and item is going to be pushed into the stack.

a) Item is inserted in the current position of the top
b) Item is overflowed into the stack
c) Top is incremented and then item is inserted into the stack
d) Syntax error.

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Demonstrate inorder traversal on a BST with nodes 40, 20, 10, 30, 60, 50, 70 (3)
3. Write a function to Linked list Traversal . (3)
4. Predict and construct AVL tree for the following data 21,26,30,9,4,14,28,18,15,10,2,3,7 (3)
5. Discuss the short notes on Priority Queue (3)
6. Create a BST with the following nodes : JAN, FEB, MAR, APR, JUN, JUL, AUG, SEP, OCT, NOV, DEC (3)

OR

Explain the time complexity of common operations (insertion, deletion, and search) in an AVL tree, and how does it compare to a regular binary search tree (BST)? (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Construct Postfix expression of ((A+B)-C*(D/E))+F using stack ? (5)

8. Describe the Big-O notation. Calculate the time complexity of the following function: f(n)=2n^3+3n+5. (5)
9. Evaluate why Quick Sort performs better on average than other sorting algorithms. (5)
10. Explain the algorithm for BFS using an example. (5)
11. Analyze how separate chaining and open addressing handle collision resolution in hashing under high-load conditions. (5)
12. Develop the pseudo-code for deletion of an element form the Linked List at any position (5)

OR

Develop an Algorithm for the insertion of an element inside the Circular Queue. (5)

****