

[Total No. of Questions - 9] [Total No. of Printed Pages - 4]

Dec-24-0098 (CBCS/NEP)
CSPC-311 (Data Structures and Algorithms)
[CS, CSE, AILM, CS AIDS]
B.Tech. 3rd

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

SECTION - A
(Attempt one question)

1. (a) Explain the different types of data structures and their applications in programming. Discuss the characteristics of algorithms and how they relate to data structures. (6)
- (b) Describe the concept of time complexity and space complexity with examples. (6)

OR

2. (a) Describe the various operations that can be performed on arrays and their significance. (6)
- (b) Consider a sparse matrix with dimensions 5×5 and the following non-zero elements:

(1, 2) = 5
(2, 3) = 10
(3, 1) = 15

Perform the following operations on the sparse matrix:

- (a) Insert the element 20 at position (4, 4).
(b) Update the element at position (2, 3) to 25.
(c) Delete the element at position (1, 2).

Provide the step-by-step process for each operation. (6)

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SECTION - B
(Attempt one question)

3. (a) Explain how to traverse a linked list and the importance of traversal. (6)
- (i) What are the postfix and prefix forms of the expression?
 $A + B * (C - D) / (P - R)$
- (ii) Explain the usage of stack in recursive algorithm implementation. (6)

OR

4. (a) Describe the memory allocation process for linked lists and its significance. (6)
- (b) A circular queue has a size of 5 and has 3 elements 10, 20 and 40 where $F=2$ and $R=4$. After inserting 50 and 60, what is the value of F and R . Trying to insert 30 at this stage what happens? Delete 2 elements from the queue and insert 70, 80 & 90. Show the sequence of steps with necessary diagrams with the value of F & R . (6)

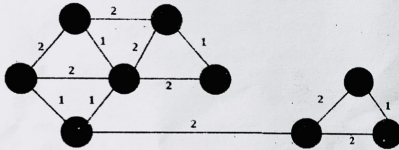
SECTION - C
(Attempt one question)

5. (a) Explain the difference between depth-first search (DFS) and breadth-first search (BFS) in tree traversal. (6)
- (b) Insert the following sequence of elements to create a balanced binary search tree:
9, 27, 50, 15, 2, 21, 36 (6)

OR

[P.T.O.]

6. (a) Discuss the concept of AVL trees and their balancing mechanism. (6)
- (b) Construct the minimum spanning tree (MST) for the given graph using Kruskal's Algorithm. (Assume nodes name accordingly). (6)



SECTION - D

(Attempt one question)

7. (a) Design an algorithm/pseudocode for selection sort. Illustrate the working of selection sort on the following array with 7 elements: 30, 45, 25, 32, 55, 60, 49. (6)
- (b) Compare Linear search and binary search, highlighting their advantages and disadvantages. (6)

OR

8. (a) Describe the process of implementing hash tables and their significance in data retrieval. (6)
- (b) Write an algorithm/pseudocode to sort elements using Heap sort technique. Illustrate the working of Heap sort algorithm on the following input: 35, 15, 0, 1, 60. (6)

SECTION - E

(All questions are compulsory.
Each question carries 2 marks)

9. i. Define space complexity.
- ii. What is the main advantage of using linked lists over arrays?
- iii. What is a doubly linked list?
- iv. Compare linear and non-linear data structures with examples.
- What is the purpose of pointers in tree representation?
- What is index searching? (6×2=12)