

2025

COMPUTER SCIENCE — HONOURS

Paper : DSCC-3

(Data Structure)

Full Marks : 75

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

1. Answer **any five** questions : 2×5
- (a) Why is stack used in recursion?
 - (b) Compare singly linked lists and doubly linked lists on the basis of traversal and memory usage.
 - (c) State the conditions that lead to stack overflow and stack underflow.
 - (d) List any two advantages of linked lists over arrays.
 - (e) State two reasons for using data structures in computer programs.
 - (f) Define the tree data structure and explain the significance of root and leaf nodes.
 - (g) Differentiate between a Linear queue and a Circular queue.
 - (h) “Binary Search is not always efficient as compared to Linear Search.”— Justify or contradict the statement.

Section - A

Answer **any three** of the following questions.

2. Elements are removed from a Queue and inserted into a Stack. What will be the effect on the order of elements and why? If the elements are sent back to the Queue again by removing them from Stack, will the elements get their same position in Queue as before? Explain. 3+2
3. Will a deleted node from the Binary Search Tree regain its original position after immediately reinsertion? Explain with suitable example. 5
4. Construct a Max Heap using the following data and show each insertion steps : 5
20, 12, 30, 25, 40, 10, 15, 28.
5. Write an algorithm to delete a node from a doubly linked list, where a node contains one data and two addresses (previous and next) portion. 5
6. How can the polynomial $4x^3 - 10x^2 + 3$ be represented using a linked list? Write the advantage of circular queue over linear queue. 2+3

Please Turn Over

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Section - B

Answer *any five* of the following questions.

7. (a) Insert the following keys step by step in the given order into an empty Binary Search Tree.
47, 23, 59, 18, 41, 52, 64, 35, 46, 39
- (b) Convert $A + (B * C - (D / E)^F) * G * H$ into postfix form using stack. Show the steps. 4+6
8. (a) A hash table of size 11 uses double hashing for collision resolution. The hash functions are :
- $$h_1(k) = k \text{ mod } 11$$
- $$h_2(k) = 7 - (k \text{ mod } 7)$$
- The following keys = {22, 41, 53, 46, 30, 13, 67} needed to insert in the Hash Table. Calculate the index for each key. Resolve collisions using double hashing and draw Hash Table.
- (b) Suppose you are asked to search a particular data from a set of 8-data using Binary Search. What will be the maximum number of comparisons for searching the data? 8+2
9. (a) Two stacks STK1 and STK2 are initially empty. Each stack supports its own PUSH and POP operations. Perform the following operations in the given order :
- PUSH (STK1, 10); PUSH (STK1, 25); PUSH (STK2, 5);
 PUSH (STK2, POP(STK1)); PUSH (STK1, POP(STK1) + POP(STK2));
 PUSH (STK1, POP(STK2)); PUSH (STK2, 30); POP (STK1)
- What will be the final status of both stacks?
- (b) Derive the running time complexity of Quick Sort for Best and Worst Case. 6+(2+2)
10. (a) Apply Insertion Sort Algorithm to sort the following data in decreasing order. Show the steps clearly.
42, 18, 35, 9, 27, 14, 50, 6, 31, 22, 45, 11, 5, 41.
- (b) Is Binary Search and Binary Search Tree same in concept? Justify your answer. 8+2
11. (a) Write the function in C to find the predecessor of a node in linked list.
- (b) Construct the following queue of characters where queue is a circular array which is allocated six memory cells.
 FRONT = 2, REAR = 4 and QUEUE :, A, C, D,,
- Describe the queue as the following operations take place :
- F is added to the queue.
 - Two characters are deleted from the queue.
 - K, L, M are added into the queue.
 - R is added to the queue.
 - One character is deleted from the queue.
- 5+5

(3)

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12. (a) Write down the function to insert an element into a sorted array of descending order.
(b) The post-order and in-order traversal sequences nodes in a binary tree are given below :
Post-order : DGEBHIFCA
In-order : DBGEACHFI
Construct the binary tree. 5+5
13. (a) Compare Linear search and Binary search with respect to :
(i) Data Structure
(ii) Time Complexity
(iii) Practical applicability.
(b) Discuss how a poor hash function affects hasing performance. 7+3
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