Duration: 2 hours   **Max Marks: 60**

Instructions: *1) Figures to the right indicate Full Marks.*
                2) All Questions are compulsory, however there are internal choice

Q1. Answer any 5 of the following.   **5 x 2 = 10**

a) What do we mean by time-complexity of an algorithm?
b) What is a cyclic graph? Explain with an example.
c) Why do we use the malloc () function in C and what is the syntax?
d) List any 2 applications of Linked List in the real world.
e) What are the strlwr () and strcat () string functions used for in C?
f) List out any 2 differences between the Stacks and Queues Data structures.
g) How do we declare and define a node of a Linked List in C?

Q2. Answer any 5 of the following.   **5 x 2=10**

a) What do we mean by height and depth of a node with respect to Tree data structure?
b) What is an Adjacency Matrix? Explain with an example
c) What is an Array?
d) Why is Merge Sort better than Bubble Sort? Give any 2 points.
e) What are Derived Data Types? Give one example.
f) What is the procedure for In-Order tree traversal? (2)
g) What is the use of the TOS (top of stack) pointer in Stacks?

Q3. Answer the following.

A. Why is the Binary Search operation called as Divide and Conquer Algorithm? Explain the search process with an example   **(5)**
B. Explain the working of Selection sort with the following example: 36,9,2,78   **(5)**

<div align="center">OR</div>

C. Write the algorithm to add an element at the beginning of a Single Dimensional Array.   **(5)**

Q4. Answer the following.

A. Convert the following infix expression to postfix using stack in a step-by-step manner showing the output and stack data structure at each step.   **(5)**

    P- (Q+ R).

B. Explain the concept of a Queue Data Structure and a circular queue.   **(5)**
<div align="center">OR</div>

C. How is a queue represented using Linked List? Explain the enqueue () and the dequeue () operations.   **(5)**

Q5. Answer the following.

A. What is an expression tree? Construct an expression tree for the following expression:
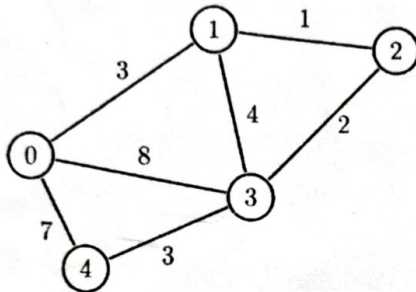$(3 - 4) + (8 / 2)$. **(5)**

B. Construct a Binary Search tree with the following values: 29,45,39,72,8,9. Explain the process of deleting the root node from the above tree. **(5)**

OR

C. Write a short note on AVL trees. **(5)**

Q6. Answer the following.

A. Calculate the shortest path step-by-step for the following graph using the DIJKSTRA algorithm. **(5)**

B. What is the difference between linear and non-linear data structure? Explain any one non-linear data structure with an example. **(5)**

OR

C. What is a doubly Linked List? Explain the process of deleting the second node from a doubly linked list having 4 nodes diagrammatically. **(5)**

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