

**DATA STRUCTURES**  
**ASSIGNMENT - III**  
**(FOR THE FOURTH AND THE FIFTH LAB SESSIONS)**

**Assignments to be completed during lab sessions**

1. Write functions to perform the following operations on a doubly linked list.
  - (a) Write a function to add an element at the beginning of the list.
  - (b) Write a function to print the elements in the list both with forward and backward traversals.
  - (c) Write a function to count the number of elements in the list.
  - (d) Write a function to remove the first element of the list.
  - (e) Write a function to add an element at the end of the list.
  - (f) Write a function to remove the last element of the list.
  - (g) Write a function to add an element at a given position of the list.
  - (h) Write a function to remove the element at a given position of the list.
  - (i) Write a function to add data after the first occurrence of a given key value in the linked list.
  - (j) Write a function to remove the first occurrence of a given data of the list.
  - (k) Write a function to reverse the elements in the list.
  - (l) Write a function to reverse the elements in the list without creating a new list.
  - (m) Write a function to insert an element in a sorted list such that the final list is also sorted.
  - (n) Write a function to sort the elements in a list.

**Additional assignments**

1. Write functions to perform the following operations on one/two doubly linked list(s).
  - (a) Write a function to merge two lists.
  - (b) Write a function to get/access the data at the  $i$ th node of the list.
  - (c) Write a function to merge two sorted linked lists such that after merging the resultant list is also sorted.

- (d) Use recursion to print the list.
  - (e) Use recursion to print the list in the reverse order.
  - (f) Use recursion to reverse the list.
  - (g) It may happen that in a (faulty) doubly linked list having some of the nodes pointing to some random node with their previous pointers. Write a function to rectify the list, if it is faulty.
  - (h) Given a doubly-linked list and a positive integer  $n$ , write a function to rotate the linked list clockwise by  $n$  modulo  $l$  nodes, where  $l$  is the length of the list.
2. Write functions to perform the following operations on a circular singly linked list.
- (a) Write a function to add an element at the beginning of the list.
  - (b) Write a function to print the elements in the list.
  - (c) Write a function to count the number of elements in the list.
  - (d) Write a function to remove the first element of the list.
  - (e) Write a function to add an element at the end of the list.
  - (f) Write a function to remove the last element of the list.
3. Write functions to perform the following operations on a circular doubly linked list.
- (a) Write a function to add an element at the beginning of the list.
  - (b) Write a function to print the elements in the list both with forward and backward traversals.
  - (c) Write a function to count the number of elements in the list.
  - (d) Write a function to remove the first element of the list.
  - (e) Write a function to add an element at the end of the list.
  - (f) Write a function to remove the last element of the list.