National University of Computer and Emerging Sciences

Lab Manual 03
Data Structures

Course Instructor	Miss. Arooj Khalil
Lab Instructor	Miss. Saira Arshad Miss Seemab Ayub
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Department of Computer Science
FAST-NU, Lahore, Pakistan

Task1

Implement a Struct 'Node' that contains two data members: A template variable 'data', Node pointer 'next. Now implement a single linked list class having two private data members Node pointer 'tail' and 'head' .Implement the following functions:

a. Insert at start void insertAtStart(T const element);
b. Insert at end void insertAtEnd(T const element);
c. Print void print() const;
d. Search an element bool search(T const& element) const;
e. Check whether the list is empty bool isEmpty() const;
f. Insert value v1 before value v2 bool insertBefore(T const v1, T const v2) const;
g. Delete all occurrences of a given value void deleteAll(T const value)
h. Destructor
i. Delete from Start void DeleteAtStart();

1. ReverseLinkList

Given the head of a single link list you are required to reverse that link list and then return the reversed link list. You are not allowed to create another link list or simple exchange the data between nodes
 Example:
Input: 1, 2, 3, 4, 5
Output: 5, 4, 3, 2, 1
2. IsPalindrome
Given the head of a single link list you are required to check if it a palindrome or not assuming that the link list is even.
Example 1:
Input: 3, 5,5, 3
Output: Palindrome
Example 2:
Input: 1,2, 3, 1
Output: Not a Palindrome
3. ReorderLinkList
Given the head of a single link list of the order L0 → L1 → ... → Ln - 1 → Ln. Reorder the link list in the format L0 → Ln→ L1 → Ln - 1 → L2 → Ln - 2 → ...
The nodes are required to be reordered not the node data.

Example 1:
Input: 1, 2, 3, 4, 5
Output: 1, 5, 2, 4, 3
Example 2:
Input: 6, 7, 8, 9
Output: 6, 9, 7, 8

4. SwapNodes
Given the head of a single link list and an integer 'n'. Swap the node at nth position from the start of the link list with the nth node from the end of the link list. Do not swap the data of the nodes. Do not use tail.
Example 1:
Input: 1, 2, 3, 4, 5, 6, 7, 8, 9 and n=3
Output: 1, 2, 7, 4, 5, 6, 3, 8, 9
Explanation:
the 3rd element from the start is 3 and the 3rd element from the end is 7 so 3 is swapped with 7.
Example 2:
Input: 2, 4, 8, 3 and n=1
Output: 3, 4, 8, 2
Explanation: the 1st element from the start is 2 and the 1st element from the end is 3 so 2 is swapped with 3. 5. Insert a node at head and tail in O(1) time
6. Create a suitable main to test the above functions.