C-DAC Mumbai

Date 01/10/2024

Subject: Algorithm and Data Structure
Assignment 3

Solve the assignment with following thing to be added in each question.

-Program
-Flow chart
-Explanation
-Output
-Time and Space complexity

Submission Date: 3/10/2024

1. Implement a singly linked list with basic operations: insert, delete, search.

- **Test Case 1**:
  Input: Insert 3 → Insert 7 → Insert 5 → Delete 7 → Search 5
  Output: List = [3, 5], Found = True
- **Test Case 2**:
  Input: Insert 9 → Insert 4 → Delete 4 → Search 10
  Output: List = [9], Found = False

2. Reverse a singly linked list.

- **Test Case 1**:
  Input: List = [1, 2, 3, 4, 5]
  Output: List = [5, 4, 3, 2, 1]
- **Test Case 2**:
  Input: List = [10, 20, 30]
  Output: List = [30, 20, 10]

3. Detect a cycle in a linked list.

- **Test Case 1**:
  Input: List = [1 → 2 → 3 → 4 → 5 → 3 (cycle)]
  Output: Cycle Detected
- **Test Case 2**:
  Input: List = [6 → 7 → 8 → 9]
  Output: No Cycle

4. Merge two sorted linked lists.

- **Test Case 1**:
  Input: List1 = [1, 3, 5], List2 = [2, 4, 6]
  Output: Merged List = [1, 2, 3, 4, 5, 6]
- **Test Case 2**:
  Input: List1 = [10, 15, 20], List2 = [12, 18, 25]
  Output: Merged List = [10, 12, 15, 18, 20, 25]

5. Find the nth node from the end of a linked list.

- **Test Case 1**:
  Input: List = [10, 20, 30, 40, 50], n = 2
  Output: 40
- **Test Case 2**:
  Input: List = [5, 15, 25, 35], n = 4
  Output: 5

6. Remove duplicates from a sorted linked list.

- **Test Case 1**:
  Input: List = [1, 1, 2, 3, 3, 4]
  Output: List = [1, 2, 3, 4]
- **Test Case 2**:
  Input: List = [7, 7, 8, 9, 9, 10]
  Output: List = [7, 8, 9, 10]

7. Implement a doubly linked list with insert, delete, and traverse operations.

- **Test Case 1**:
  Input: Insert 10 → Insert 20 → Insert 30 → Delete 20
  Output: List = [10, 30]
- **Test Case 2**:
  Input: Insert 1 → Insert 2 → Insert 3 → Delete 1
  Output: List = [2, 3]

8. Reverse a doubly linked list.

- **Test Case 1**:
  Input: List = [5, 10, 15, 20]
  Output: List = [20, 15, 10, 5]
- **Test Case 2**:
  Input: List = [4, 8, 12]
  Output: List = [12, 8, 4]

9. Add two numbers represented by linked lists.

- **Test Case 1**:
  Input: List1 = [2 → 4 → 3], List2 = [5 → 6 → 4] (243 + 465)
  Output: Sum List = [7 → 0 → 8]
- **Test Case 2**:
  Input: List1 = [9 → 9 → 9], List2 = [1] (999 + 1)
  Output: Sum List = [0 → 0 → 0 → 1]

10. Rotate a linked list by k places.

- **Test Case 1**:
  Input: List = [10, 20, 30, 40, 50], k = 2
  Output: List = [30, 40, 50, 10, 20]
- **Test Case 2**:
  Input: List = [5, 10, 15, 20], k = 3
  Output: List = [20, 5, 10, 15]

11. Flatten a multilevel doubly linked list.

- **Test Case 1**:
  Input: List = [1 → 2 → 3, 3 → 7 → 8, 8 → 10 → 12]
  Output: Flattened List = [1 → 2 → 3 → 7 → 8 → 10 → 12]
- **Test Case 2**:
  Input: List = [1 → 2 → 3, 2 → 5 → 6, 6 → 7 → 9]
  Output: Flattened List = [1 → 2 → 5 → 6 → 7 → 9 → 3]

12. Split a circular linked list into two halves.

- **Test Case 1**:
  Input: Circular List = [1 → 2 → 3 → 4 → 5 → 6 → (back to 1)]
  Output: List1 = [1 → 2 → 3], List2 = [4 → 5 → 6]
- **Test Case 2**:
  Input: Circular List = [10 → 20 → 30 → 40 → (back to 10)]
  Output: List1 = [10 → 20], List2 = [30 → 40]

13. Insert a node in a sorted circular linked list.

- **Test Case 1**:
  Input: Circular List = [10 → 20 → 30 → 40 → (back to 10)], Insert 25
  Output: Circular List = [10 → 20 → 25 → 30 → 40 → (back to 10)]
- **Test Case 2**:
  Input: Circular List = [5 → 15 → 25 → (back to 5)], Insert 10
  Output: Circular List = [5 → 10 → 15 → 25 → (back to 5)]

14. Check if two linked lists intersect, and find the intersection point if they do.

- **Test Case 1**:
  Input: List1 = [1 → 2 → 3 → 4 → 5], List2 = [6 → 7 → 4 → 5]
  Output: Intersection Point = 4
- **Test Case 2**:
  Input: List1 = [10 → 20 → 30 → 40], List2 = [15 → 25 → 35]
  Output: No Intersection

15. Find the middle element of a linked list in one pass.

- **Test Case 1**:
  Input: List = [1, 2, 3, 4, 5]
  Output: Middle = 3
- **Test Case 2**:
  Input: List = [11, 22, 33, 44, 55, 66]
  Output: Middle = 44