DAY 12 :

Task 2:

Q) Linked List Middle Element Search

You are given a singly linked list. Write a function to find the middle element without using any extra space and only one traversal through the linked list.

EXPLANATION:

Class Overview

The Linkedlist class represents a singly linked list, which is a collection of nodes where each node contains data and a reference to the next node. The class includes methods to add nodes, print the list, and find the middle element of the list.

Components

1. Node Class

The Node class is an inner static class that represents an element of the linked list. Each node has two attributes:

- data: Stores the value of the node.

- next: A reference to the next node in the linked list.

The Node class has a constructor to initialize these attributes.

2. Linkedlist Class

The Linkedlist class manages the linked list and includes the following key methods:

Head : A reference to the first node in the linked list.

Methods

1. printMiddle()

Purpose : This method prints the middle element of the linked list.

Logic : It uses two pointers, slow and fast. Both pointers start at the head of the list. The fast pointer moves two steps at a time while the slow pointer moves one step at a time. When the fast pointer reaches the end of the list, the slow pointer will be at the middle element.

Condition: It only proceeds if the list is not empty.

2. addToTheLast(Node node)

Purpose: This method adds a new node to the end of the linked list.

Logic: If the list is empty (i.e., head is null), the new node becomes the head. If the list is not empty, it traverses to the end of the list and sets the next reference of the last node to the new node.

3. printList()

Purpose: This method prints all the elements of the linked list.

Logic: It starts from the head and traverses the list, printing each node's data until it reaches the end of the list.

Main Method

-Initialization: An instance of the Linkedlist class is created.

Adding Nodes: Several nodes are added to the list using the addToTheLast() method.

Printing the List: The printList() method is called to print all the elements of the list.

Finding the Middle Element: The printMiddle() method is called to print the middle element of the list.

Summary

The Linkedlist class provides a simple implementation of a singly linked list with the ability to add nodes, print the list, and find the middle element. The printMiddle() method efficiently finds the

middle by using two pointers, ensuring a time complexity of O(n). The addToTheLast() method ensures nodes can be added efficiently, and printList() provides a way to traverse and display the list elements.