Data Structures and Algorithms
ISI-Delhi
Instructor: Krishnendu Mukhopadhyaya

Problems Session 2

Introduction to Data Structures

Problem 1

Given a singly linked list, the task is to find the middle node of the linked list.

- If the number of nodes is **odd**, return the middle node.
- If the number of nodes is **even**, there are two middle nodes, so return the **second middle node**.

Problem 2

Show how to implement a queue using two stacks. Analyze the running time of the queue operations.

Problem 3

For the set {1, 4, 5, 10, 16, 17, 21} of keys, draw binary search trees of heights 2, 3, 4, 5, and 6.

Problem 4

Give a nonrecursive algorithm that performs an inorder tree walk using stacks.

Problem 5

For each of the four types of lists in the following table, what is the asymptotic worst-case running time for each dynamic-set operation listed?

Operation	Unsorted singly linked	Sorted singly linked	Unsorted doubly linked	Sorted doubly linked
SEARCH(L, k)				
INSERT(L, x)				
DELETE(L, x)				
SUCCESSOR(L, x)				
PREDECESSOR(L, x)				
MINIMUM(L)				
MAXIMUM(L)				

Supplementary Excercise

1. Argue that since sorting n elements takes $\Omega(n \lg n)$ time in the worst case in the comparison model, any comparison-based algorithm for constructing a binary search tree from an arbitrary list of n elements takes $\Omega(n \lg n)$ time in the worst case.