

EST2003: Data Structure and Programming Methodology

Lab 6: Linked List Practice

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Problem 1: Remove Nodes with Target Sum

Background

In this lab, we practice manipulating singly linked lists by removing nodes that match a certain summation condition.

You are given a singly linked list. Your task is to remove nodes such that the **sum of two nodes is equal to a given number n** , and return the modified list.

Task

- Traverse the list and identify any pair of nodes (**at most two elements**) that sum up to **n** .
- Remove such nodes from the list.
- Return the updated list or the original list if no matching pair exists.

Notes

- No duplicate values exist in the original list.
- The summation must include at most two elements. For example, $n = 8$, $1 + 2 + 5 = 8$ does not meet the conditions.
- If no such nodes exist, return the list unchanged.

Example

- **Input:** head = [1, 2, 3, 4, 5], $n = 2$
Output: [1, 3, 4, 5]
- **Input:** head = [1, 2, 4, 5, 7], $n = 8$
Output: [2, 4, 5]
- **Input:** head = [1, 2], $n = 3$
Output: []
- **Input:** head = [1, 3, 4, 5, 7, 10], $n = 9$
Output: [1, 3, 7, 10]
- **Input:** head = [1, 3, 4, 5, 7, 10], $n = 2$
Output: [1, 3, 4, 5, 7, 10]

Problem 2: Split Linked List into k Parts

Background

You are given a singly linked list and an integer k . The goal is to partition the list into k consecutive parts such that:

- Each part has length as equal as possible (the difference in length is no more than 1).
- Earlier parts are longer than the later ones if needed.
- Some parts may be `null` if $k > \text{list length}$.
- Return the **middle part** (for even k , return the left middle part).

Tasks

- Determine the total length of the list.
- Divide the list into k parts as evenly as possible.
- Return the middle part of these partitions.

Example

- **Input:** head = [1, 2, 3], $k = 5$
k-parts: [[1], [2], [3], [], []]
Output: [3]
- **Input:** head = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10], $k = 3$
k-parts: [[1, 2, 3, 4], [5, 6, 7], [8, 9, 10]]
Output: [5, 6, 7]
- **Input:** head = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10], $k = 4$
k-parts: [[1, 2, 3], [4, 5, 6], [7, 8], [9, 10]]
Output: [4, 5, 6]