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/**
 * Definition for singly-linked list.
 * public class ListNode {
 *     int val;
 *     ListNode next;
 *     ListNode(int x) { val = x; }
 * }
 */
class Solution {
    public void reorderList(ListNode head) {
        if (head == null || head.next == null)
            return;
        ListNode mid = getMid(head);
        ListNode h2 = mid.next;
        mid.next = null;
        ListNode newHead = reverse(h2);
        interleave(head, newHead);
    }

    private ListNode getMid(ListNode head) {
        ListNode fast = head;
        ListNode slow = head;
        while (fast.next != null && fast.next.next != null) {
            fast = fast.next.next;
            slow = slow.next;
        }
        return slow;
    }

    private ListNode reverse(ListNode head) {
        ListNode pre = null;
        while (head != null) {
            ListNode tmp = head.next;
            head.next = pre;
            pre = head;
            head = tmp;
        }
        return pre;
    }

    private ListNode interleave(ListNode h1, ListNode h2) {
        ListNode dh = new ListNode(0);
        ListNode itr = dh;
        while (h1 != null && h2 != null) {
            itr.next = h1;
            h1 = h1.next;
            itr = itr.next;
            itr.next = h2;
            h2 = h2.next;
            itr = itr.next;
        }
        itr.next = h1;
        return dh.next;
    }
}

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}