Arrays, Strings & Linked Lists Lecture 7

Tuesday, 30 July 2024 6:05 AM

obj 1 → obj 2 → obj 3 → ···

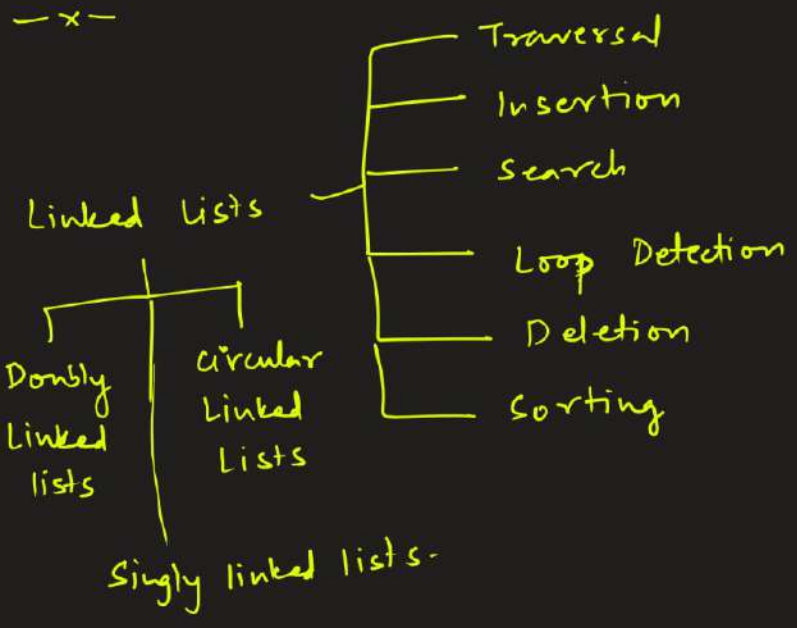
```
struct Node
    int data;
    Node* next;
```

```
Node * head;
head → data = x;
head → next = t;
```

(*head).data

```
Class Node:
    def __init__ (self, data):
        self.data = data
        self.next = None
```

```
new_node = Node(x)
new_node.next = head;
head = new_node
```

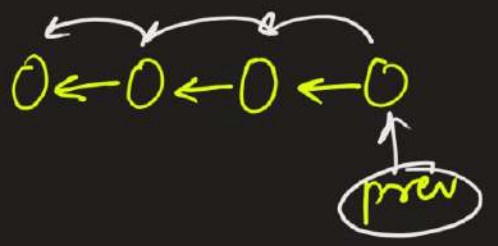


https://www.geeksforgeeks.org/problems/print-linked-list-elements/1

```python
class Solution:
    # Function to display the elements of a linked list
    def display(self, head):
        #code here
        t = head
        while t:
            print(t.data, end=' ')
            t = t.next
        print('')
```

```cpp
class Solution {
  public:
    // Function to display the elements of a linked list
    void display(Node *head) {
        // your code goes here
        Node* t = head;
        while(t) {
            cout << t->data << " ";
            t = t->next;
        }
        cout << endl;
    }
};
```

https://leetcode.com/problems/reverse-linked-list



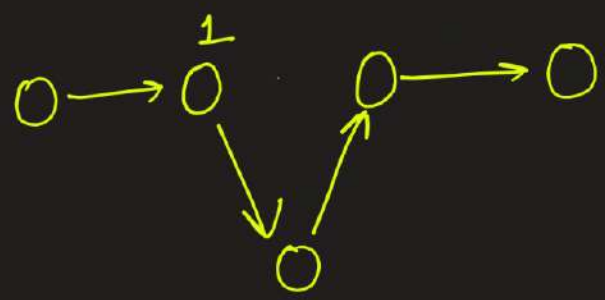
T = O(n)

S = O(1)

```
next = curr->next;
curr->next = prev;
prev = curr;
curr = next;
```

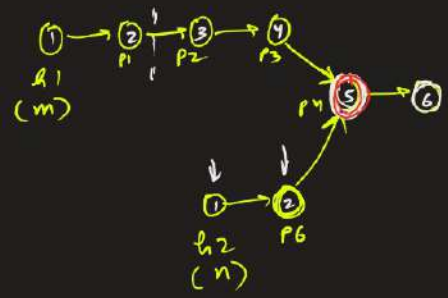
```
class Solution {
public:
    ListNode* reverseList(ListNode* head) {
        ListNode* prev = NULL, *curr = head, *next = NULL;
        while(curr) {
            next = curr->next;
            curr->next = prev;
            prev = curr;
            curr = next;
        }
        return prev;
    }
};
```

https://www.hackerrank.com/challenges/insert-a-node-at-a-specific-position-in-a-linked-list/problem




```
SinglyLinkedListNode* insertNodeAtPosition(SinglyLinkedListNode* llist, int data, int position) {
    SinglyLinkedListNode *newNode = new SinglyLinkedListNode(data);
    if(position == 0){
        newNode->next = llist;
        return newNode;
    }
    SinglyLinkedListNode* t = llist;
    for(int i=0; i<position-1; i++)
        t = t->next;
    newNode->next = t->next;
    t->next = newNode;
    return llist;
}
```

https://www.hackerrank.com/challenges/find-the-merge-point-of-two-joined-linked-lists/problem



Brute :- $O(mn)$

Hashing: $T = O(m+n)$, $S = O(m)$

Count :- $T = O(m+n)$, $S = O(1)$ ← 2 counts

2-pointers :- $T = O(m+n)$, $S = O(1)$

Detect loop :- $T = O(m+n)$, $S = O(1)$

Count $(h_1) \rightarrow O(m) \rightarrow m = 6$

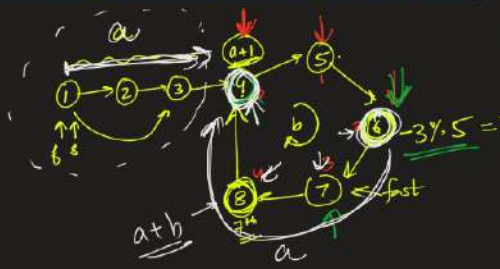
Count $(h_2) \rightarrow O(n) \rightarrow n = 4$

$|m-n| = 2$

bigger list at this element

```
int findMergeNode(SinglyLinkedListNode* head1, SinglyLinkedListNode* head2) {
    SinglyLinkedListNode *p1 = head1, *p2 = head2;
    while(p1 != p2) {
        p1 = p1->next;
        p2 = p2->next;
        if(p1 == NULL)
            p1 = head2;
        if(p2 == NULL)
            p2 = head1;
    }
    return p1->data;
}
```

https://leetcode.com/problems/linked-list-cycle-ii/description/



Total # ele = a

-3%5 = 2%5

	pos	steps
s →	a+1	a
f →	a%b+a+1	a
	(2k+1-a-1)%b+ a+1	

From the int point if you move 'a' steps you land at cycle starting point

$(2a+1-a-1)\%b + a+1$

$a\%b + a+1$

Floyd's cycle Detection algorithm

$(2k+1-(a+1))\%b + a+1$

K hops → fast ptr?

0 hops → 1.

1 hop → 3.

2 hops → 5. (1)(1)

3 hops → 7 (3)(3)

4 hops → (4) ← 9 (5)(0)

5 hops (6) ← 11 (7)(2)

6 hops (8) ← 13 (9)(4)

7 hops (5) ← 15 (11)(1)

K hops → 2k+1

$k = b-a$

$a+1+(b-a)$

$= b+1$

$a+b+1$

after k steps

$a+1+k = a+1+(2k+a)\%b$

s → a+1

f → a+1 + a%b

$k = (2k+a)\%b$

$(k+a)\%b = 0$

$k = -a\%b$ ✓

$k = b-a$

$(p+2k-a-1)\%b + a+1$

$(2k+a\%b)\%b + a+1$

$a+1+(2k+a)\%b$