COMP108
Data Structures and Algorithms

Data structures - Linked Lists (Part II Insertion)

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Reminder: Online Class Test on Thu 02 Mar

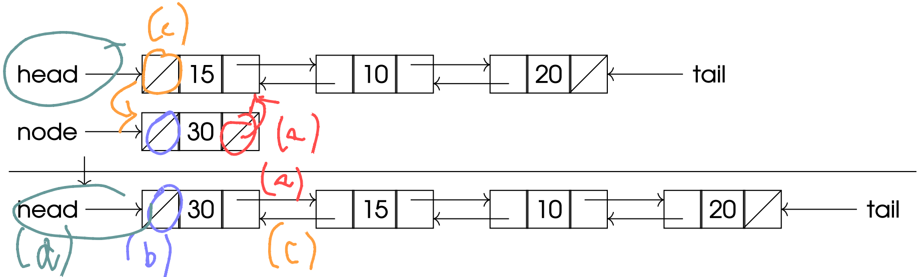
2022-23

revision lecture this Thu

Linked lists - Algorithm - Insertion of a node to the front of the list

Need: a) next of 30 $\Longrightarrow$ 15; b) prev of 30 $\Longrightarrow$ NIL; c) prev of 15 $\Longrightarrow$ 30; d) head $\Longrightarrow$ 30

List-Insert-Head(L, node)



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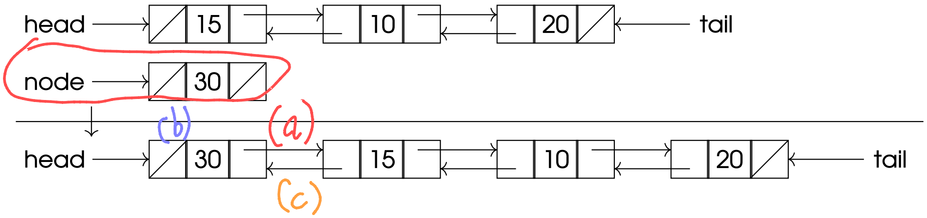

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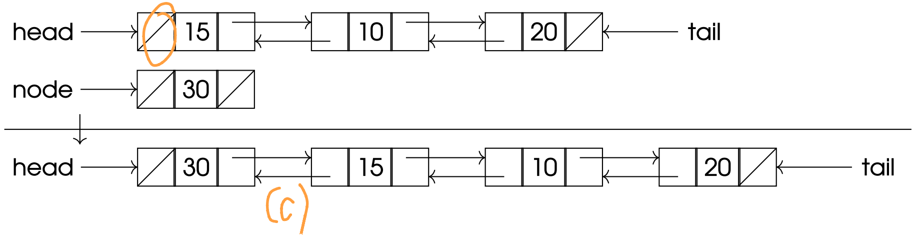

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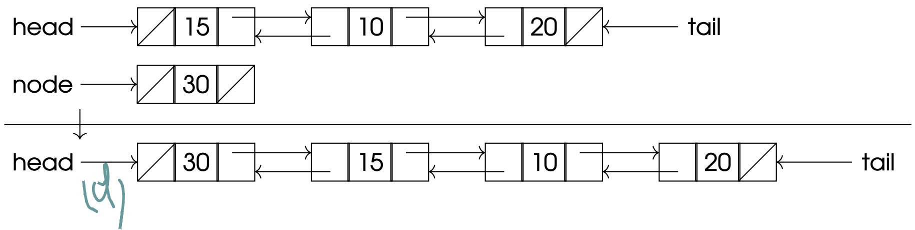

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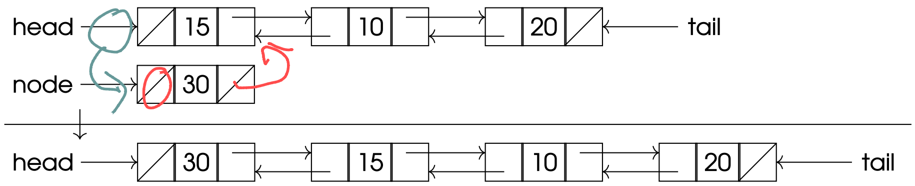
Q. What happen if moving head ← node to line #3 before the if-statement?



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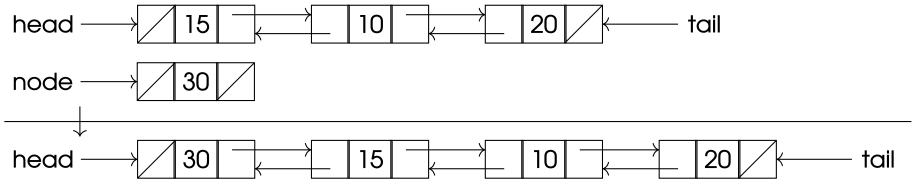
Q. What happen if moving head ← node to line #3 before the if-statement?

A. We will lose pointer to the original list $\Longrightarrow$ broken list



Linked lists - Algorithm - Insertion of a node to the tail of the list

Need: a) next of 30 $\Longrightarrow$ NIL; b) prev of 30 $\Longrightarrow$ 20; c) next of 20 $\Longrightarrow$ 30; d) tail $\Longrightarrow$ 30

List-Insert-Tail(L, node)

Comparing with List-Insert-Head(L, node)

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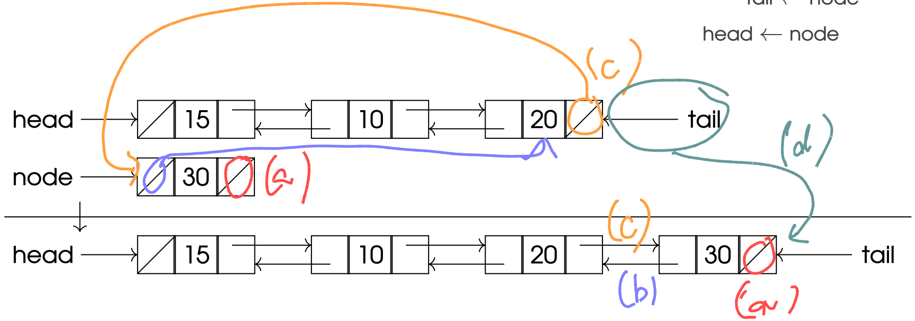

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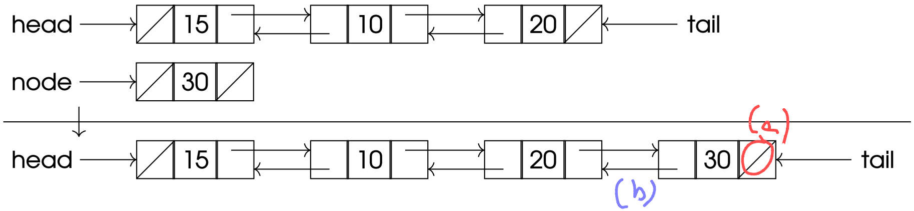

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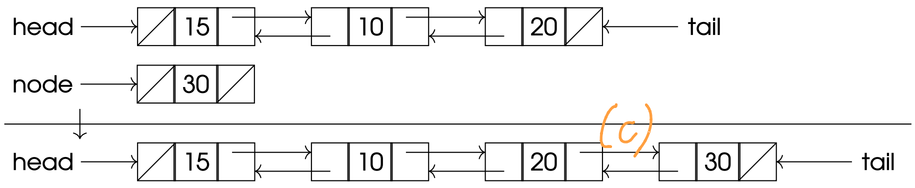

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        head ← node
(d) tail ← node
```

Comparing with List-Insert-Head(L, node)

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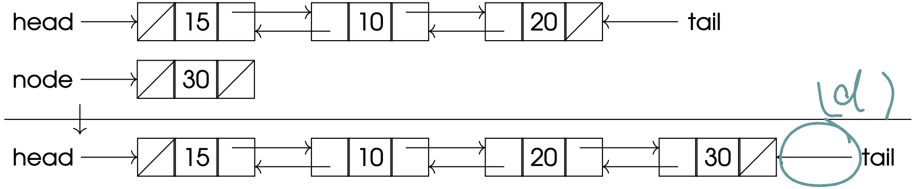
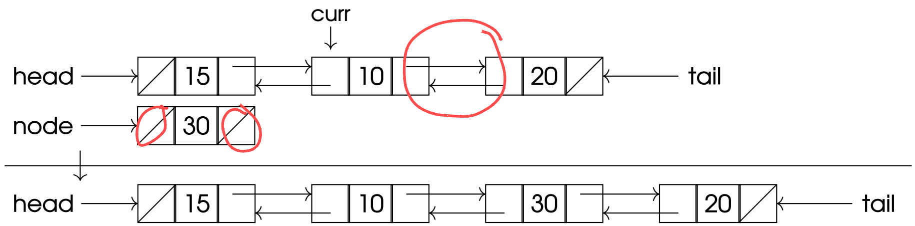


Linked list - Algorithm - Insertion in the middle

Suppose we want to insert a node somewhere in the list, say after a node pointed to by **curr**



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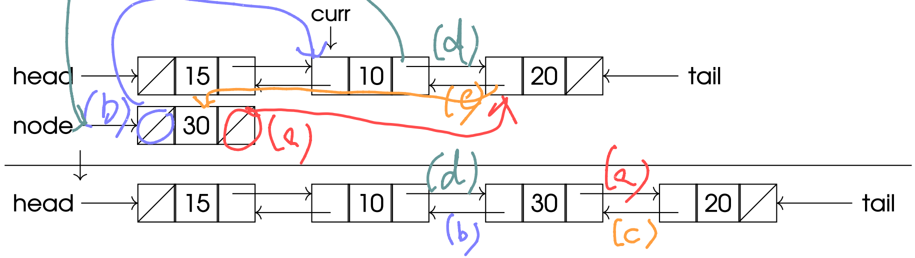
Need: a) next of 30 $\Longrightarrow$ 20; b) prev of 30 $\Longrightarrow$ 10; c) prev of 20 $\Longrightarrow$ 30; d) next of 10 $\Longrightarrow$ 30



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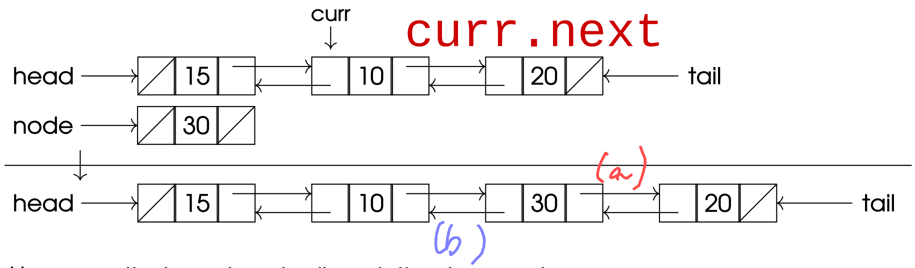

```
// assume that curr is actually pointing to a node
List-Insert(L, curr, node)
(a) node.next ← curr.next
(b) node.prev ← curr
```

Linked list - Algorithm - Insertion in the middle

Suppose we want to insert a node somewhere in the list, say after a node pointed to by **curr**

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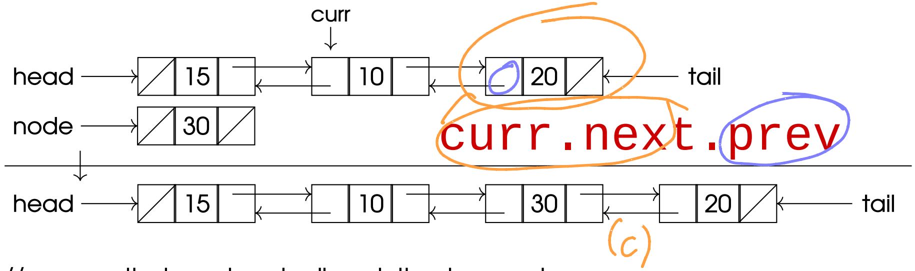

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(c)     curr.next.prev ← node
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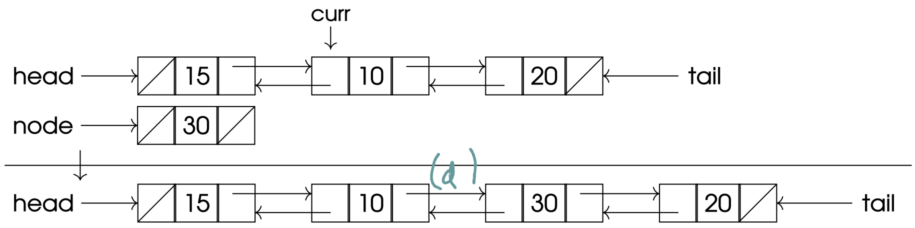

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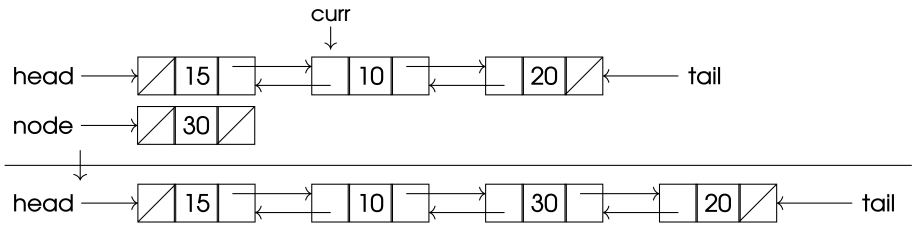

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    curr.next.prev ← node
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```

What happen if `curr` is not in the middle?

Time complexity

Are the following statements correct about a linked list with *n* elements?

The time complexity of inserting an element to the head of a doubly linked list is $O(1)$. ✓

The time complexity of inserting an element to the tail of a doubly linked list is $O(1)$. ✓

The time complexity of inserting an element to the head of a singly linked list is $O(1)$. ✓

The time complexity of inserting an element to the tail of a singly linked list is $O(1)$. ✗

The time complexity of inserting an element to a sorted doubly linked list to maintain the order is $O(1)$.

```
finding position: O(n)
insert into that postion: O(1)
```

Summary: Linked lists - Insertion

Next: Linked lists - Deletion

For note taking