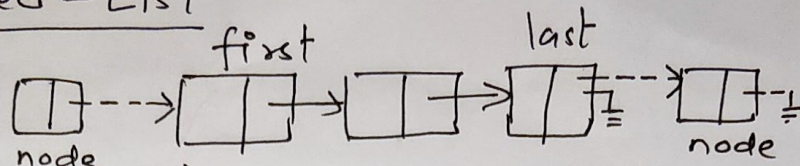


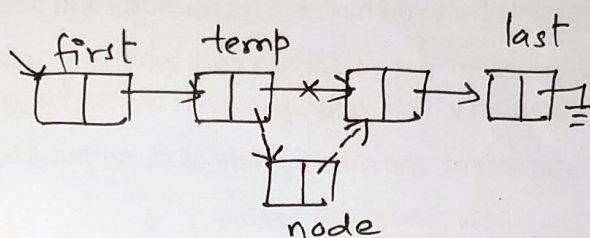
# Singly Linked - List



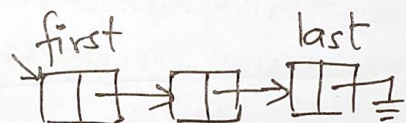
(1)  $\text{addFirst}(\text{node}) \rightarrow O(1)$   
 $\text{node.next} = \text{first}$   
 $\text{first} = \text{node}$   
 $\text{Size}++$

(2)  $\text{addLast}(\text{node}) \rightarrow O(1)$   
 $\text{last.next} = \text{node}$   
 $\text{node.next} = \text{null}$   
 $\text{last} = \text{node}$   
 $\text{Size}++$

(3)  $\text{insertSP}(\text{node}) \rightarrow O(n)$   
 $\text{Node temp} = \text{first}$   
 for  $i = 1$  to  $\text{position} - 1$ , do  
 $\text{temp} = \text{temp.next}$   
 $\text{node.next} = \text{temp.next}$   
 $\text{temp.next} = \text{node}$   
 $\text{Size}++$

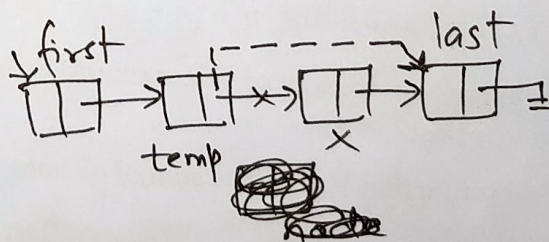


(4)  $\text{deleteFirst}() \rightarrow O(1)$   
 $\text{first} = \text{first.next}$   
 $\text{Size}--$



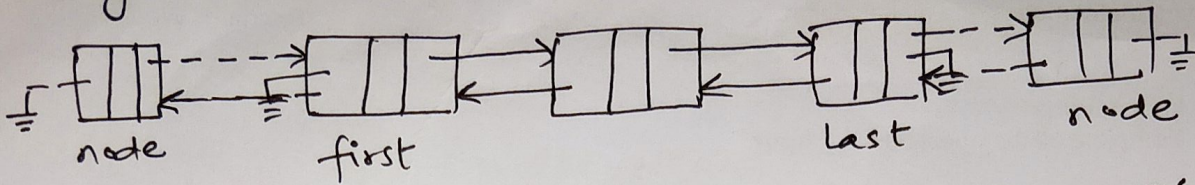
(5)  $\text{deleteLast}() \rightarrow O(n)$   
 $\text{Node temp} = \text{first}$   
 while  $(\text{temp.next} \neq \text{last})$   
 $\text{temp} = \text{temp.next}$   
 $\text{temp.next} = \text{null}$   
 $\text{last} = \text{temp}$   
 $\text{Size}--$

(6)  $\text{deleteSP}() \rightarrow O(n)$   
 $\text{Node temp} = \text{first}$   
 for  $i = 1$  to  $\text{position} - 1$  do  
 $\text{temp} = \text{temp.next}$   
 $\text{temp.next} = \text{temp.next.next}$   
 $\text{Size}--$





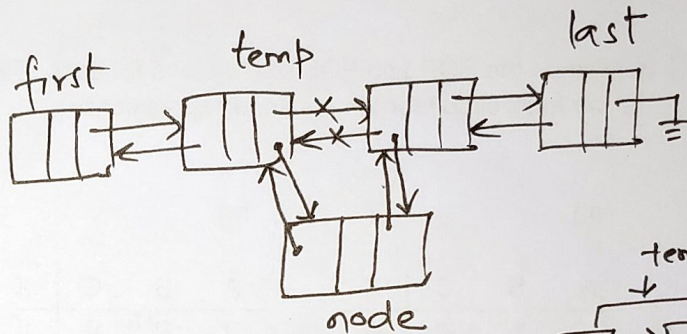
## Doubly Linked-List



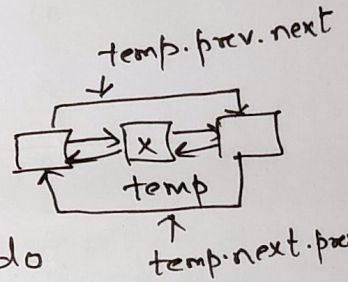
1)  $\text{addFirst}(\text{node}) \rightarrow O(1)$   
 $\text{node.next} = \text{first}$   
 $\text{first.prev} = \text{node}$   
 $\text{node.prev} = \text{null}$   
 $\text{first} = \text{node}$   
 $\text{Size}++$

2)  $\text{addLast}(\text{node}) \rightarrow O(1)$   
 $\text{last.next} = \text{node}$   
 $\text{node.next} = \text{null}$   
 $\text{node.prev} = \text{last}$   
 $\text{last} = \text{node}$   
 $\text{Size}++$

3)  $\text{InsertSP}(\text{node}) \rightarrow O(n)$   
 $\text{Node temp} = \text{first}$   
 for  $i = 1$  to  $\text{position} - 1$ , do  
 $\text{temp} = \text{temp.next}$   
 $\text{node.next} = \text{temp.next}$   
 $\text{node.prev} = \text{temp}$   
 $(\text{temp.next}).\text{prev} = \text{node}$   
 $\text{temp.next} = \text{node}$   
 $\text{Size}++$



(6)  $\text{deleteSP}() \rightarrow O(n)$   
 $\text{Node temp} = \text{first}$   
 for  $i = 1$  to  $\text{position}$  do  
 $\text{temp} = \text{temp.next}$   
 $\text{temp.prev.next} = \text{temp.next}$   
 $\text{temp.next.prev} = \text{temp.prev}$   
 $\text{Size}--$



4)  $\text{deleteFirst}() \rightarrow O(1)$   
 $\text{first} = \text{first.next}$   
 $\text{first.prev} = \text{null}$   
 $\text{Size}--$

(5)  $\text{deleteLast}() \rightarrow O(1)$   
 $\text{last.prev.next} = \text{null}$   
 $\text{last} = \text{last.prev.prev.next}$   
 $\text{Size}--$

Another technique  $\text{deleteLast}() \rightarrow O(n)$   
 $\text{Node temp} = \text{first}$   
 while  $(\text{temp.next} \neq \text{last})$   
 $\text{temp} = \text{temp.next}$   
 $\text{temp.next} = \text{null}$   
 $\text{last} = \text{temp}$   
 $\text{Size}--$