Swap two Nodes of LL

Problem Level: Medium

Problem Description:

Given a singly linked list of integers along with two integers, 'i,' and 'j.' Swap the nodes that are present at the 'i-th' and 'j-th' positions.

Sample Input 1:

```
1 (number of test cases)
3 4 5 2 6 1 9 -1
3 4
```

Sample Output 1:

```
3 4 5 6 2 1 9
```

Approach to be followed:

We need to maintain 4 variables in this problem. What we can do is maintain the p1, c1 , p2 and c2 node variables that would store the address of the two nodes to be swapped and their previous nodes. Let's assume that i is smaller than j or assign the smaller value to i and greater one to j.

The basic idea behind swapping the nodes will be:

S. No.	Step	Operation
1.	Take the jth node to ith position.	p1.next = c2
2.	Take the ith node to jth position.	p2.next = c1
3.	Create a temporary node variable to store the node next to c2.	temp=c2.next
4.	Update the next of c2.	c2.next = c1.next
5.	Update the next of c1.	c1.next=temp

Some cases that we need to take care of:

(We are taking i as the smaller number and j as the bigger one, and that all the 4 variables p1,c1, p2 and c2 can be traversed by the learner)

1. **i==0**
   In this case, there wouldn't be any p1 variable, and we need to update the head as well.
   Operations to be performed in this case:
   - p2.next=c1
   - temp=c1.next
   - c1.next=c2.next
   - c2.next=temp
   - head=c2

2. **i==0 and j==1**
   For this case, we have to update the next carefully. Also, head would be updated:
   - head=c2
   - temp=c2.next
   - c2.next=c1
   - c1.next=temp

3. **j-i =1**
   This means both the nodes are alternate, which means p2 and c1 will be the same node. Carefully update the next variables.
   - p1.next=c2
   - temp=c2.next
   - c2.next=c1
   - c1.next=temp

4. **All other conditions**
   Swap the nodes like we discussed earlier:
   - p1.next=c2
   - p2.next=c1
   - temp=c2.next
   - c2.next=c1.next
   - c1.next=temp

Pseudocode:

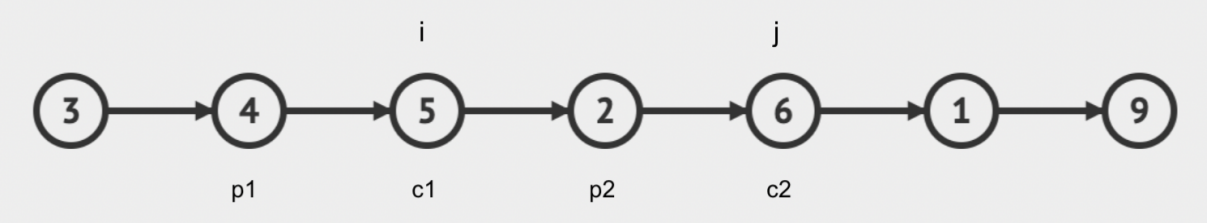
```
function swapNodes( head, i, j){
    // Initialize x and y as the minimum and maximum value of i and j.
     Initializa x=minimum of (i,j)
     Initialize y=maximum of (i,j)
    Initialize p1=head
    Initialize p2=head
    Initialize c1=head
     Initialize  c2=head
  //  If x is 0
    if(x==0):
```

```
    c1=head
  // If y is 1, that is x is 0 and y-x is 1.
    if(y==1):
       c2=head<-next
       head=c2
       Initialize temp=c2<-next
       c2<-next=c1
       c1<-next=temp

   // Only x is 0.
    else:

       while(y!=1):
          p2=p2<-next
          y--


       c2=p2<-next
       p2<-next=c1
       Initialize temp=c1.next
       c1<-next=c2<-next
       c2<-next=temp
       head=c2


   // If y-x is 1. That is both the nodes are alternate.
   else if(y-x==1):
     // Traverse to the xth node of the Linked list
      while(x!=1):
         p1=p1.next
         x--

      c1=p1<-next
      c2=c1<-next
      p1<-next=c2
      Initialize temp=c2<-next
      c2<-next=c1
      c1<-next=temp

  // All other cases.
   else:

      while(x!=1):
         p1=p1<-next
         x--

      c1=p1<-next
      while(y!=1):
         p2=p2<-next
         y--

// This traversing step can be done more optimally by using a single loop for p1 and p2
```

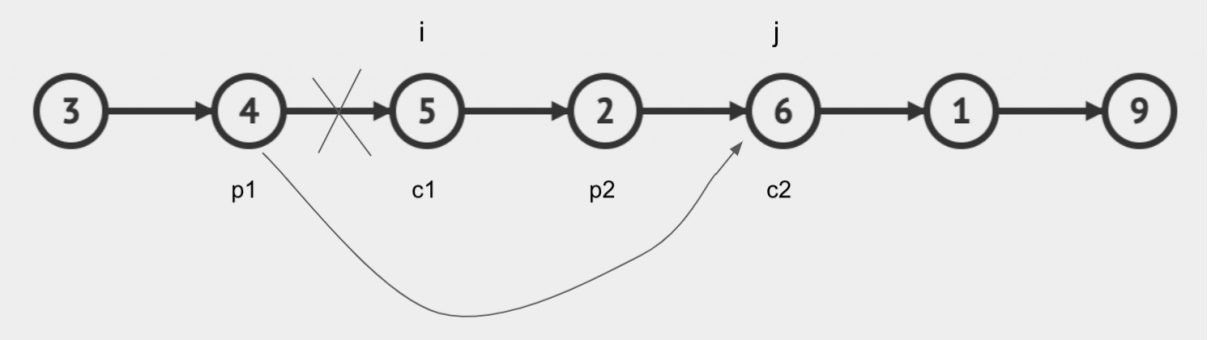
```
        c2=p2<-next
        p1<-next=c2
        p2<-next=c1
        Initialize temp=c2<-next
        c2<-next=c1.next
        c1<-next=temp

    return head
}
```

Dry Run:

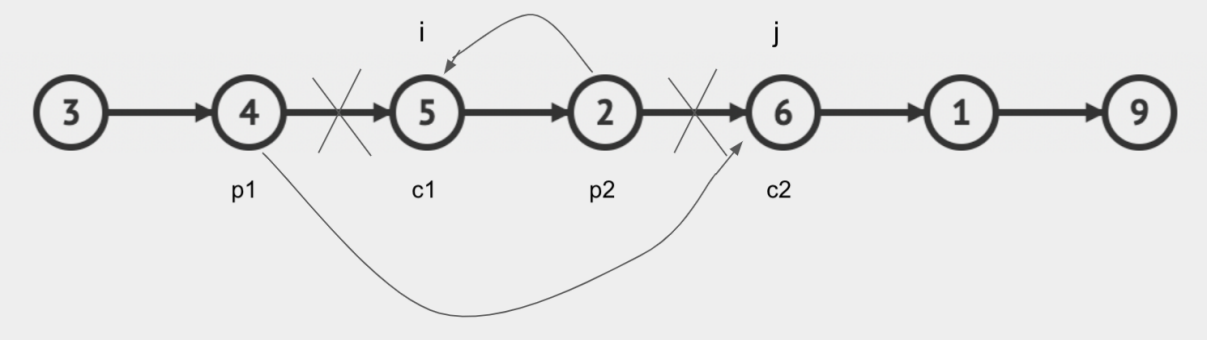
Input:
3 4 5 2 6 1 9 -1
2 4



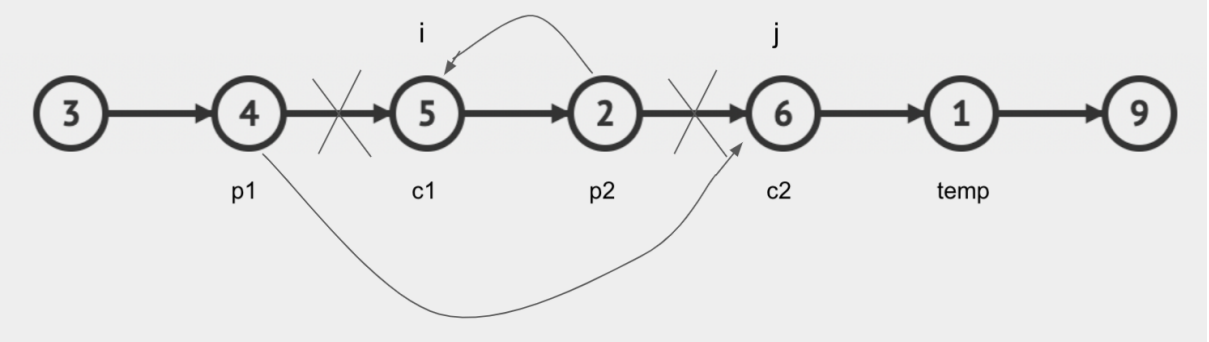
1. Step 1: p1.next= c2



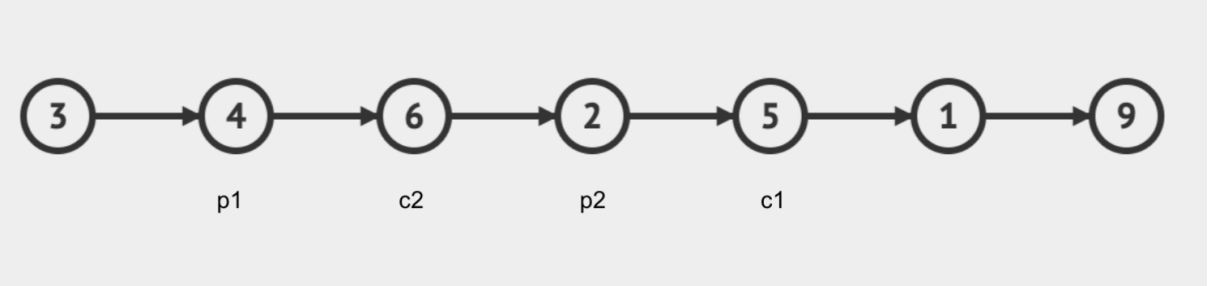
2. Step 2: p2.next = c1



3. Step 3: temp =c2.next



4. Step 4: c2.next=c1.next
5. Step 5: c1.next = temp



Time Complexity: O(N), where **N** denotes the number of nodes in the Linked List.