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Linked List

Methodology and Program

By Abhishek Navlakhi

Semester 3: Data Structures

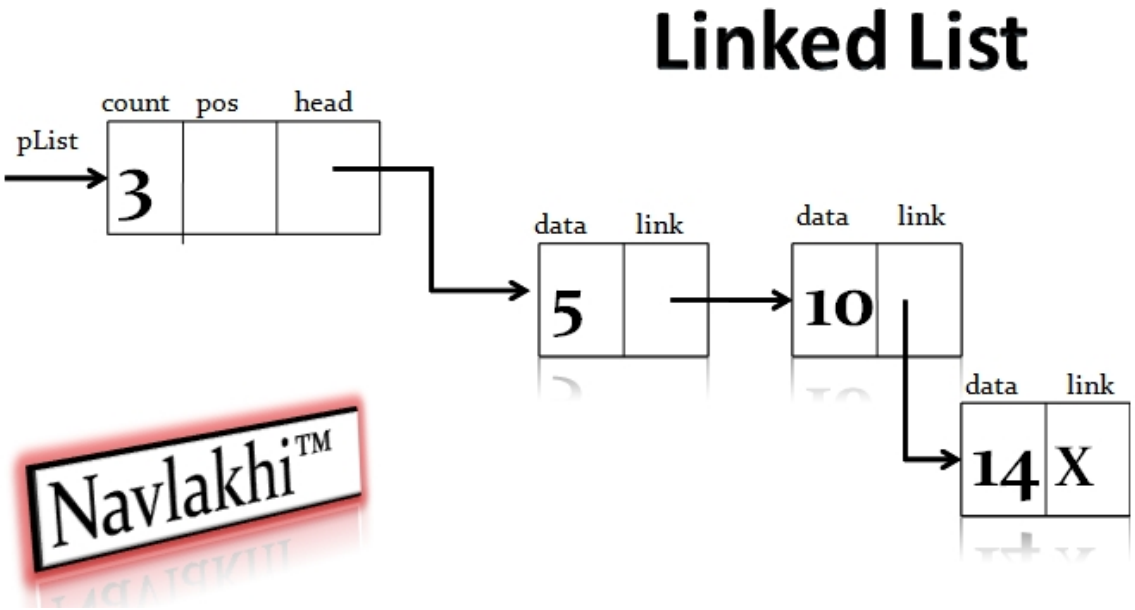
Linked list is a connected list of items. This form of structure is useful over the array type data structure when an unpredictable and large volume of data is expected. The major objective for storage of data is to make retrieval faster. Hence there has to be some logical way of adding data items in the list. Here we will be using the ascending order as the storage order for the data item, hence we can stop as soon as we get an item greater or equal to the target item specified.

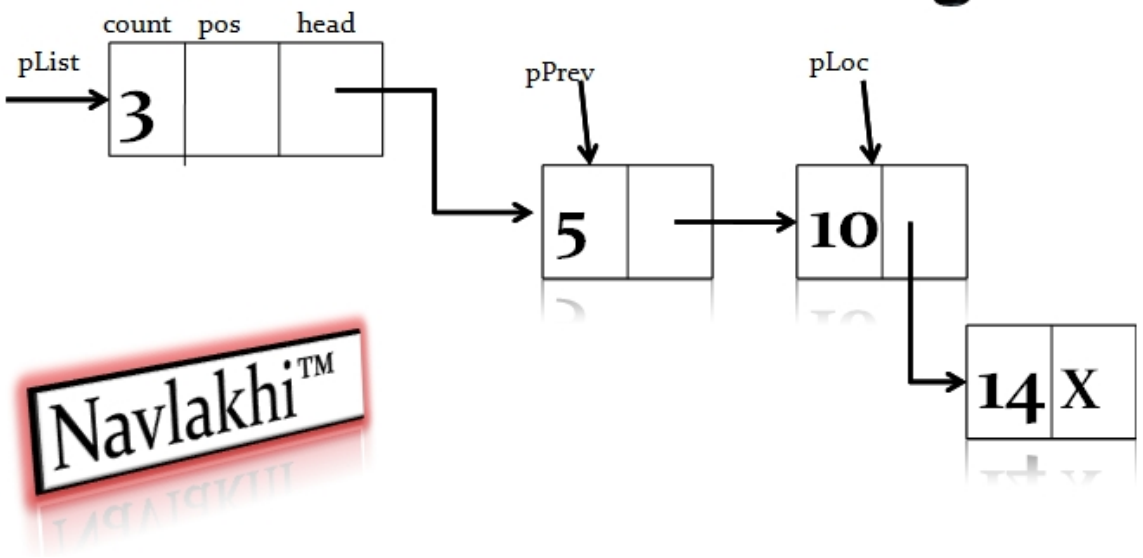
Lets lay down a few programming basics

ADDITION OF DATA

Case 1: pPrev!=NULL

Assuming we are adding 7, and the searchNode function will first locate where to insert the new data item. 'pPrev' will point (refer) to the location just smaller than the data to be inserted (7 in this case) & 'pLoc' will point to the next item.




Linked List – Adding 7
count
pos
head
pList
3
pPrev
pLoc
5
10
14
X
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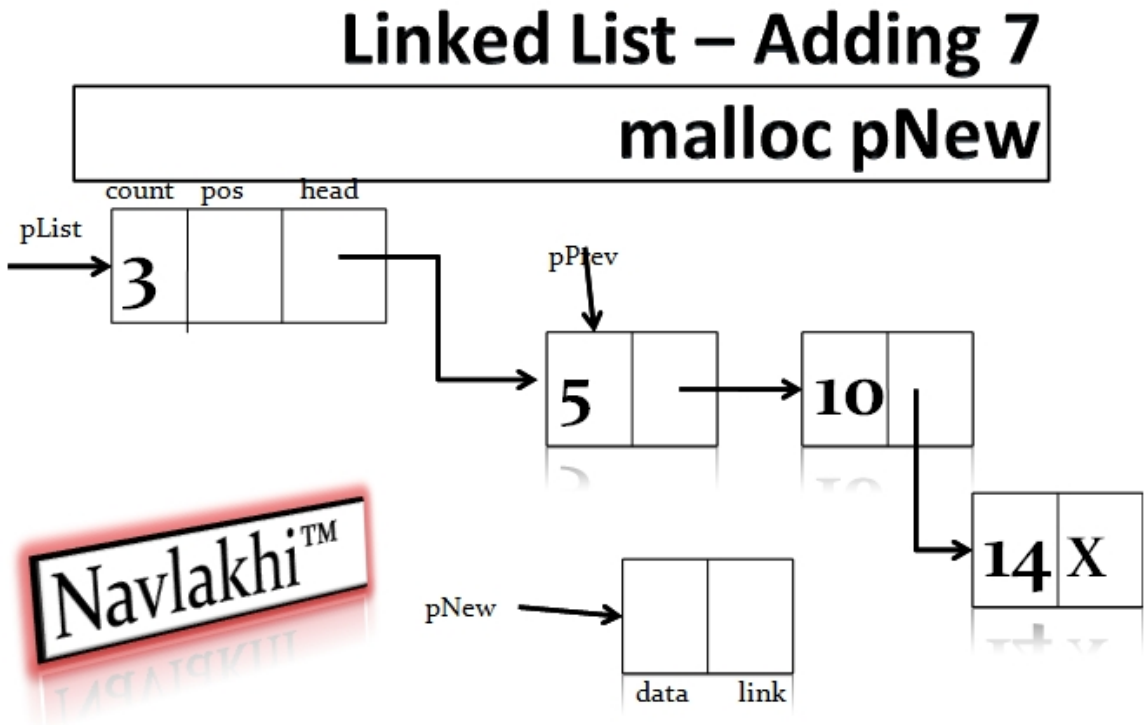
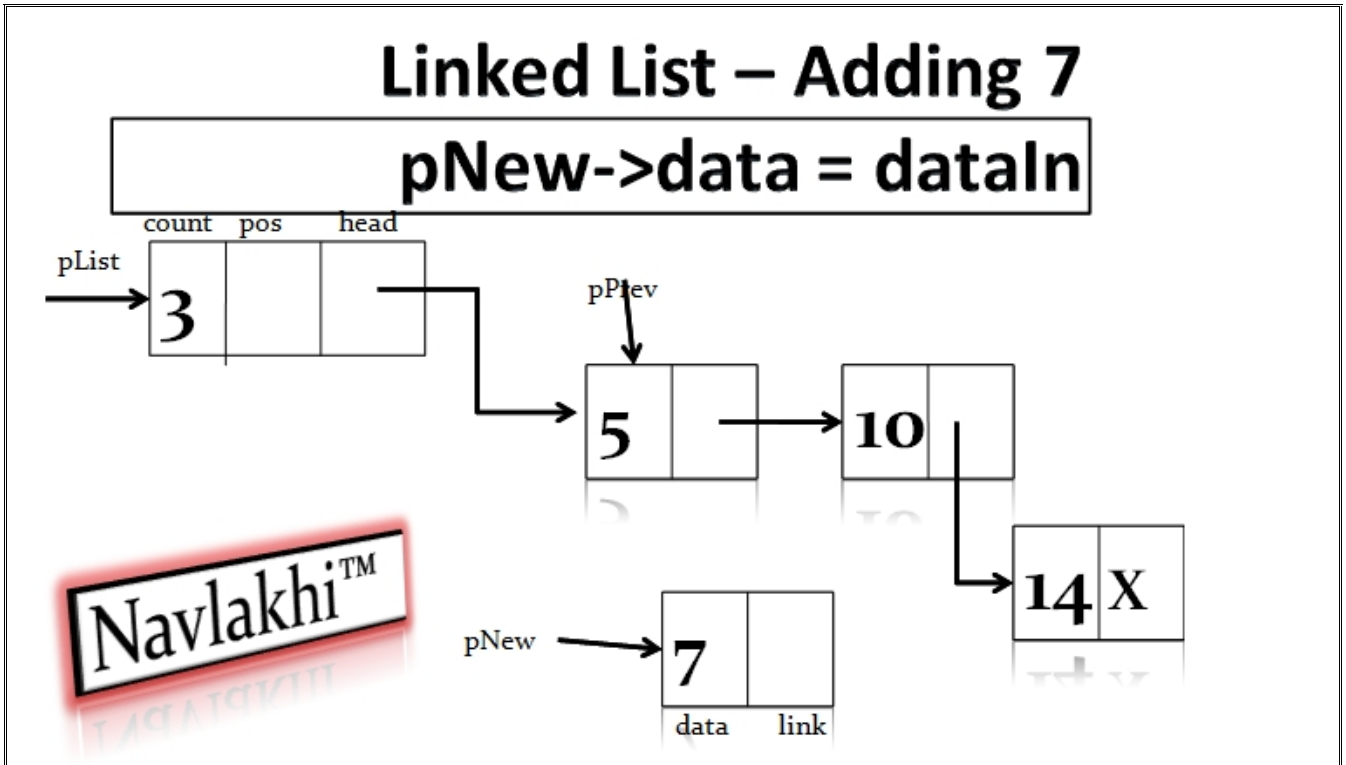
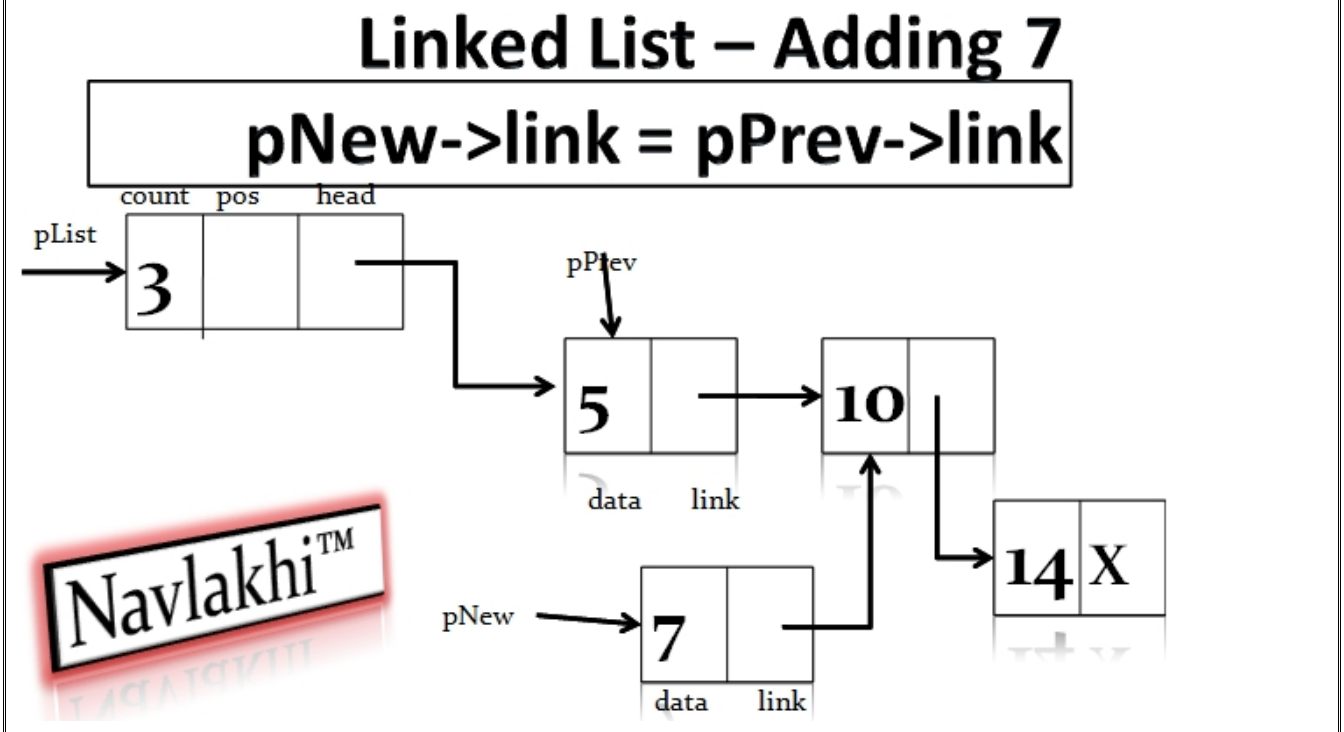
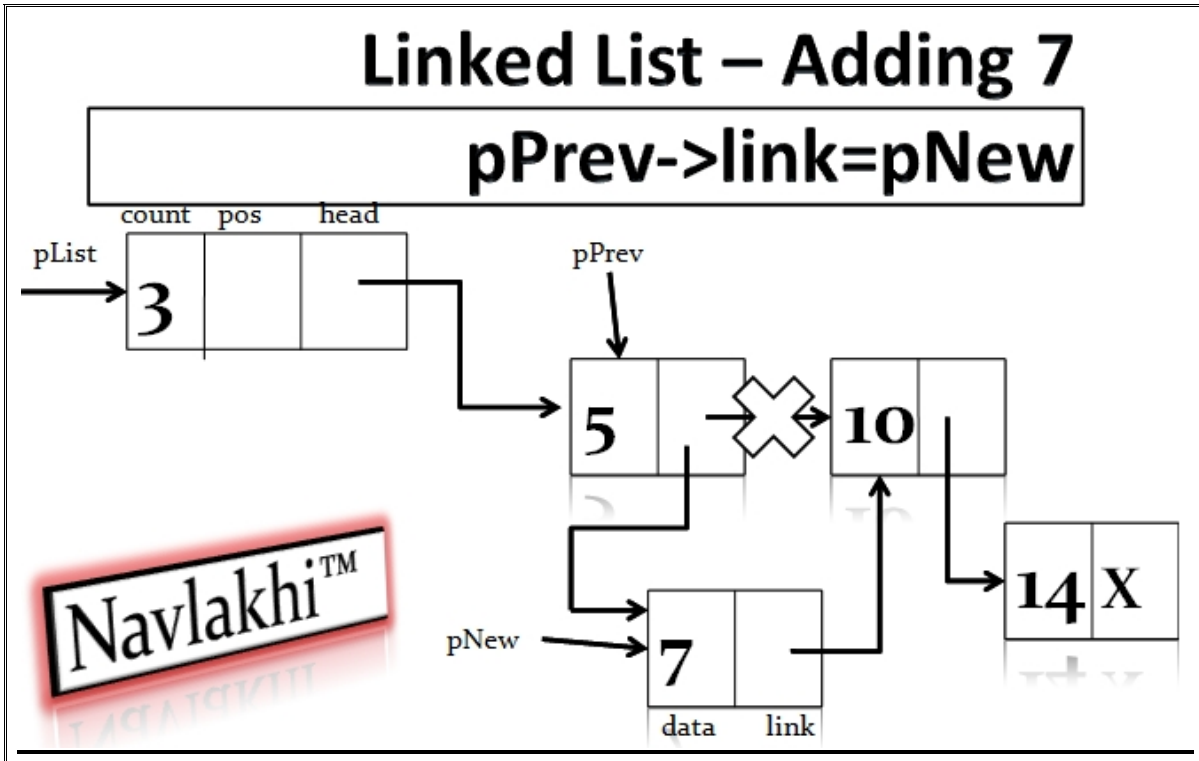

Linked List – Adding 7
malloc pNew
count
pos
head
pList
3
pPrev
5
10
14
X
Navlakhi™
pNew
data
link


Linked List – Adding 7
pNew->data = dataIn
count
pos
head
pList
3
pPrev
5
10
14
X
Navlakhi™
pNew
7
data
link


Linked List – Adding 7
pNew->link = pPrev->link
count
pos
head
pList
3
pPrev
5
10
data
link
14
X
Navlakhi™
pNew
7
data
link


Linked List – Adding 7
pPrev->link=pNew
count
pos
head
pList
3
pPrev
5
10
14
X
pNew
7
data
link
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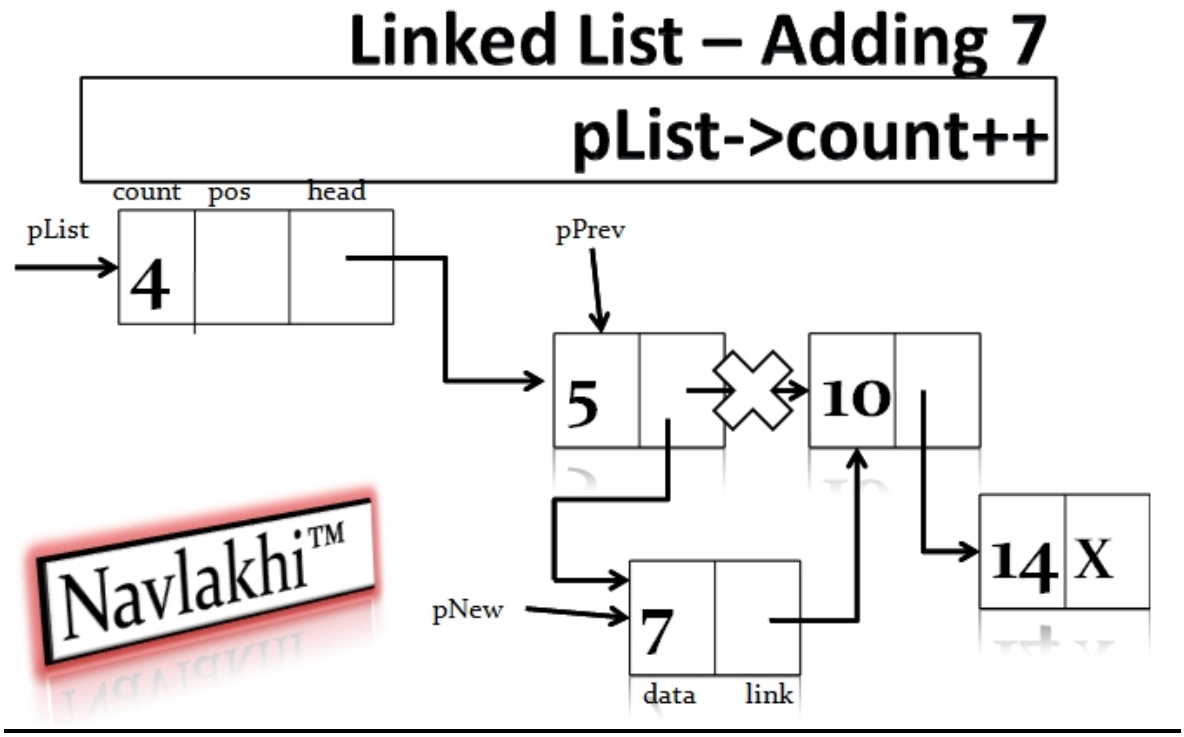
Linked List – Adding 7
pList->count++
count
pos
head
pList
4
pPrev
5
10
14
X
pNew
7
data
link
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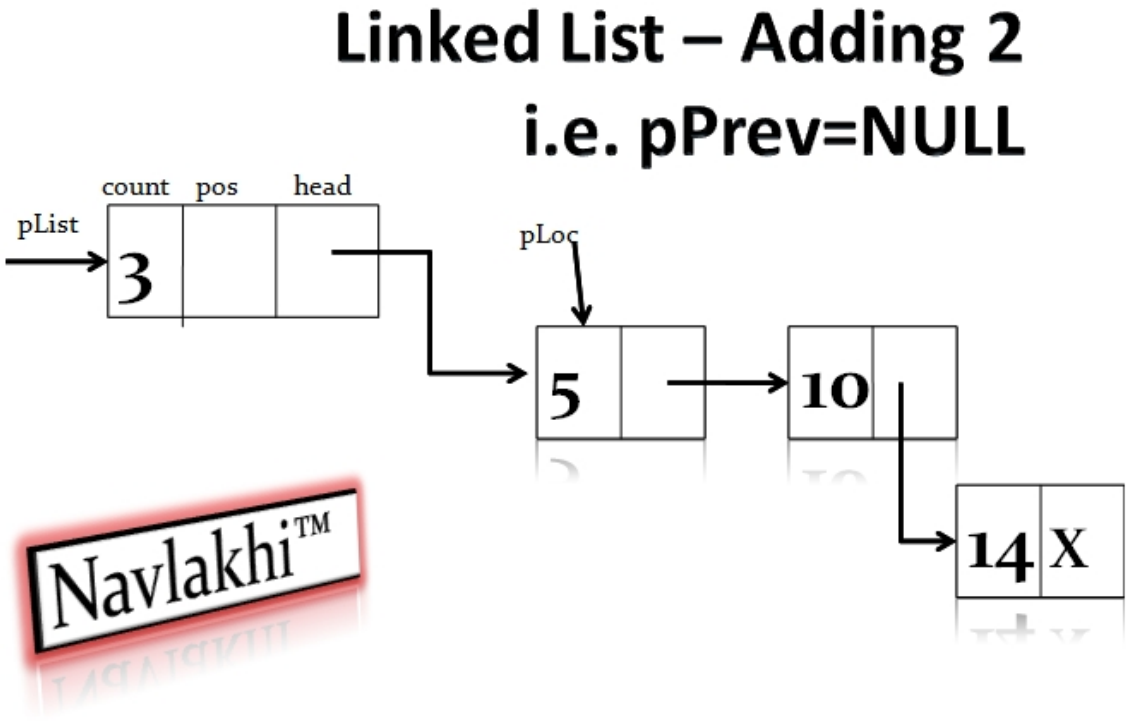
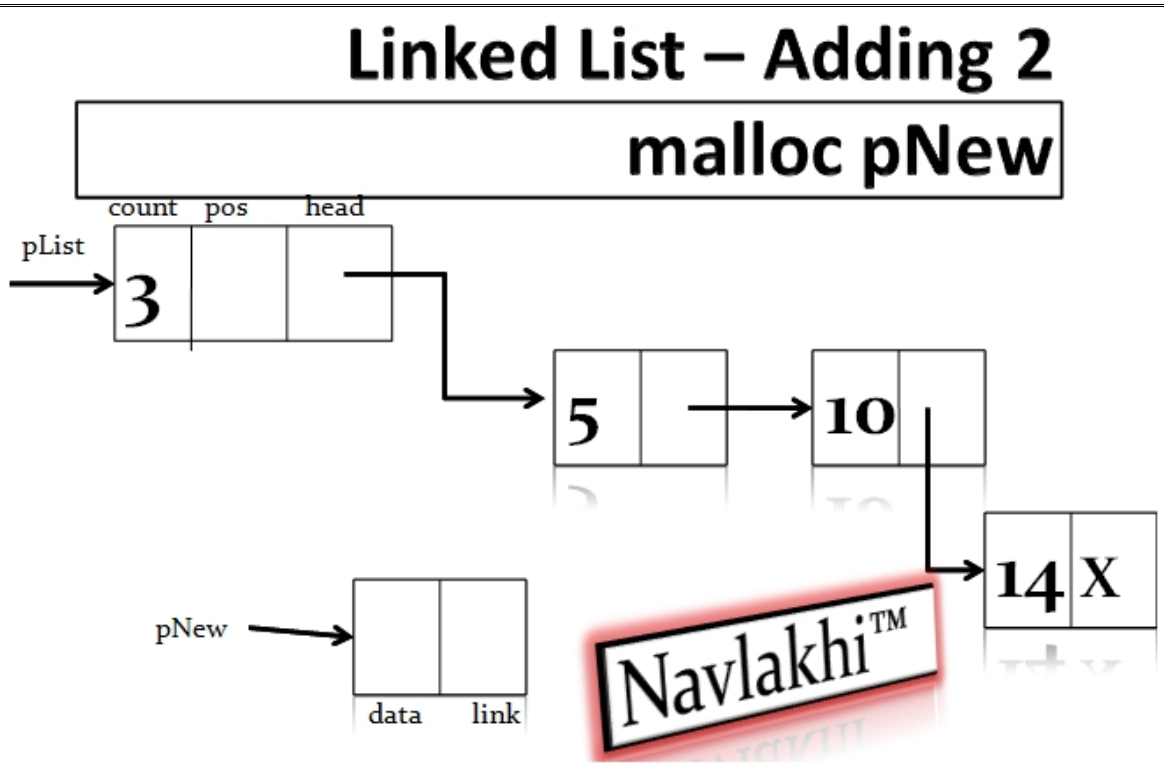
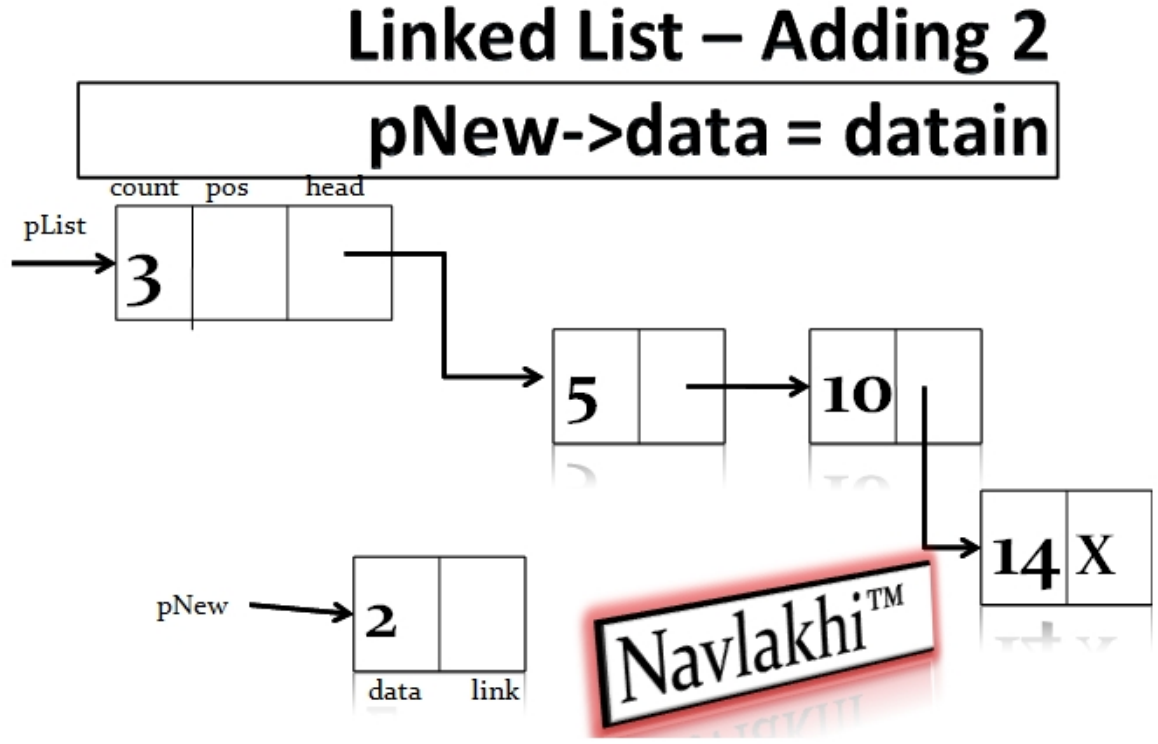
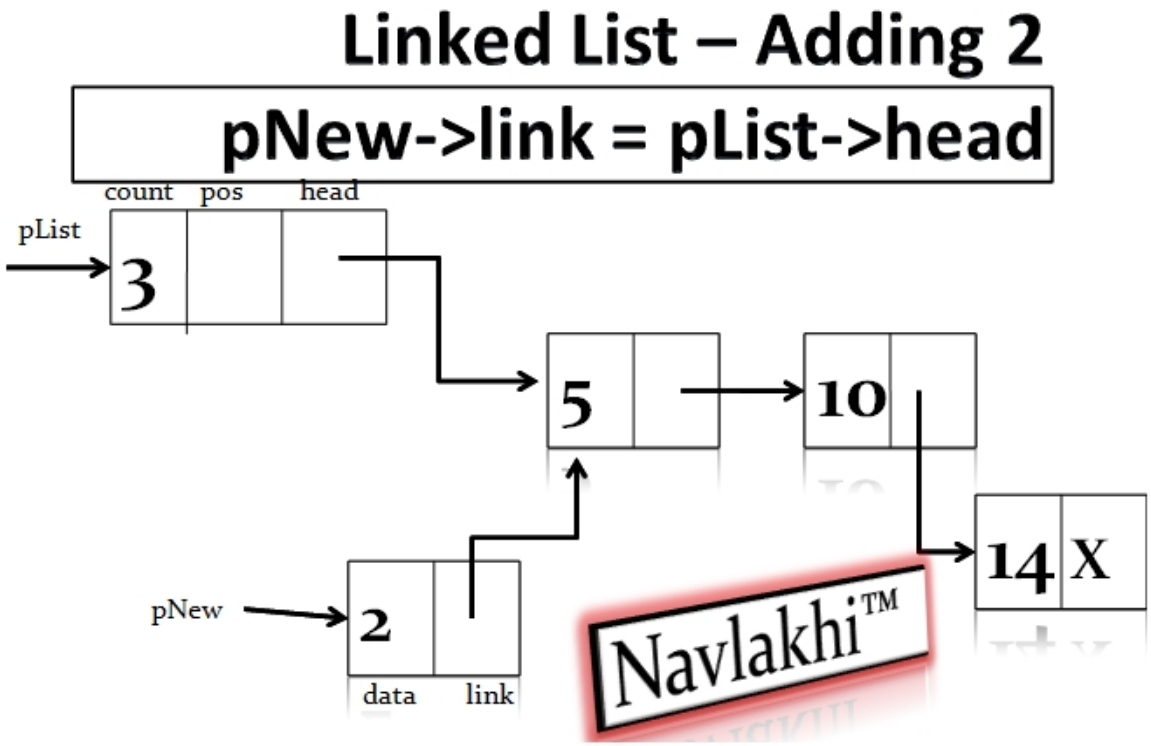
Case 2: pPrev==NULL

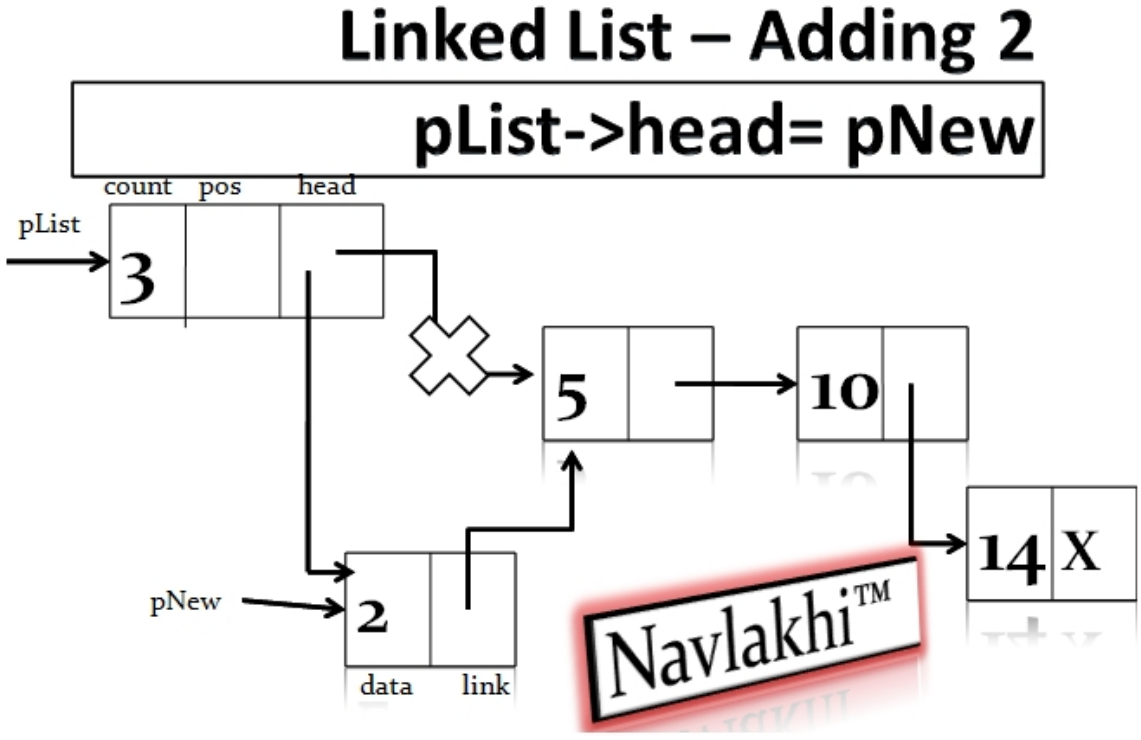
Assuming we are adding smaller than the smallest, i.e. before the old first, then pPrev will be NULL

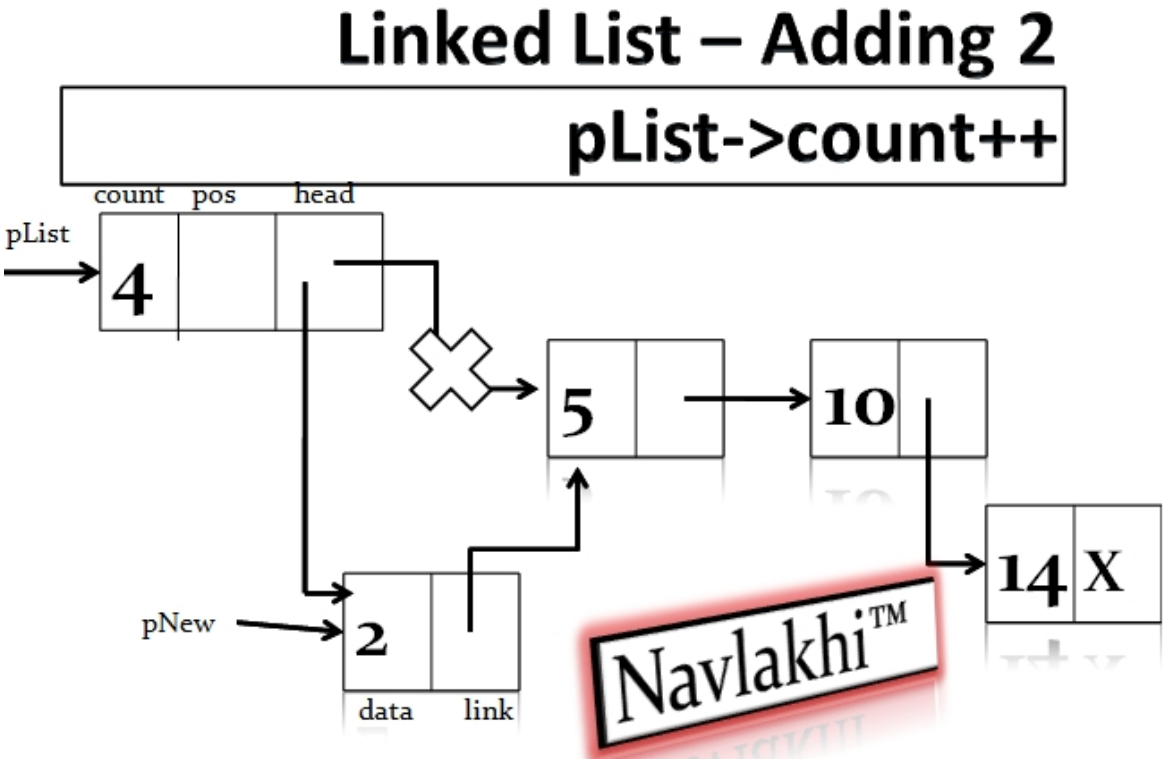



Linked List – Adding 2
malloc pNew
count
pos
head
pList
3
5
10
14
X
pNew
data
link
Navlakhi™


Linked List – Adding 2
pNew->data = datain
count
pos
head
pList
3
5
10
14
X
pNew
2
data
link
Navlakhi™


Linked List – Adding 2
pNew->link = pList->head
count
pos
head
pList
3
5
10
14
X
pNew
2
data
link
Navlakhi™

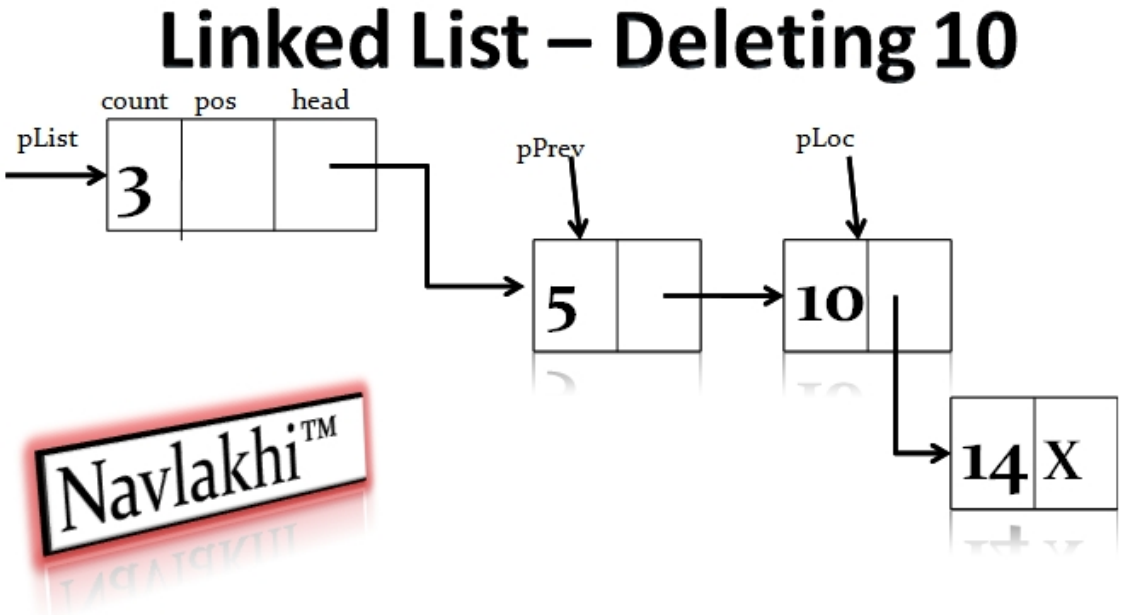

Linked List – Adding 2
pList->head= pNew
count
pos
head
pList
3
5
10
14
X
pNew
2
data
link
Navlakhi™

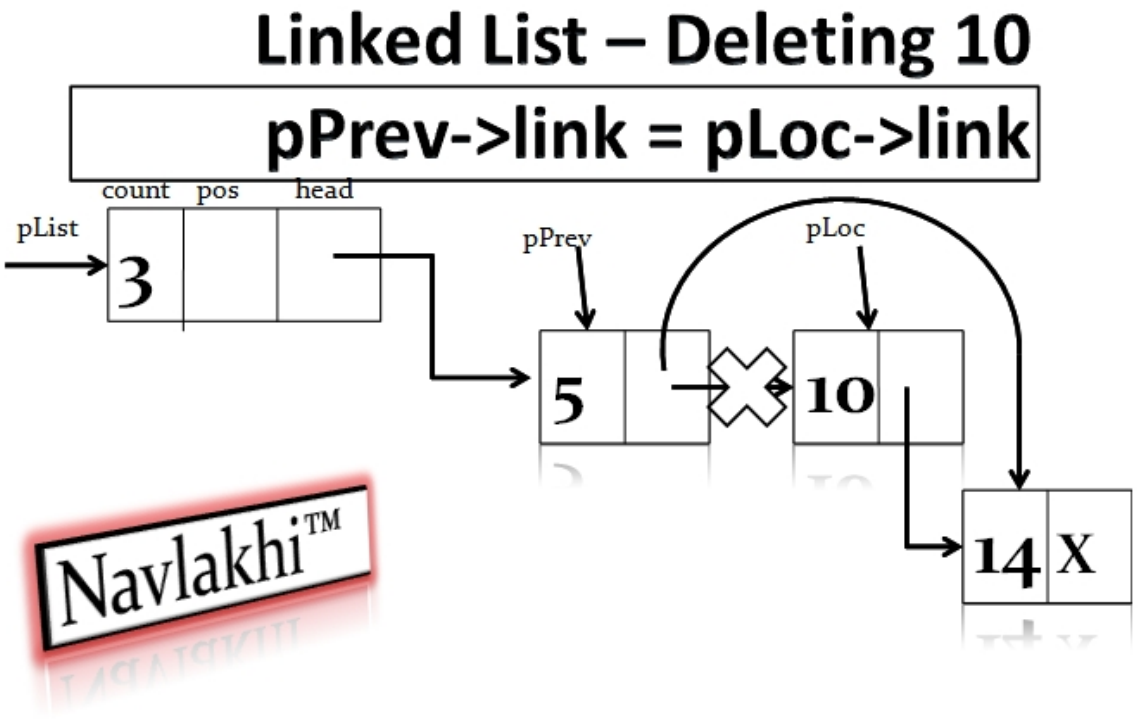


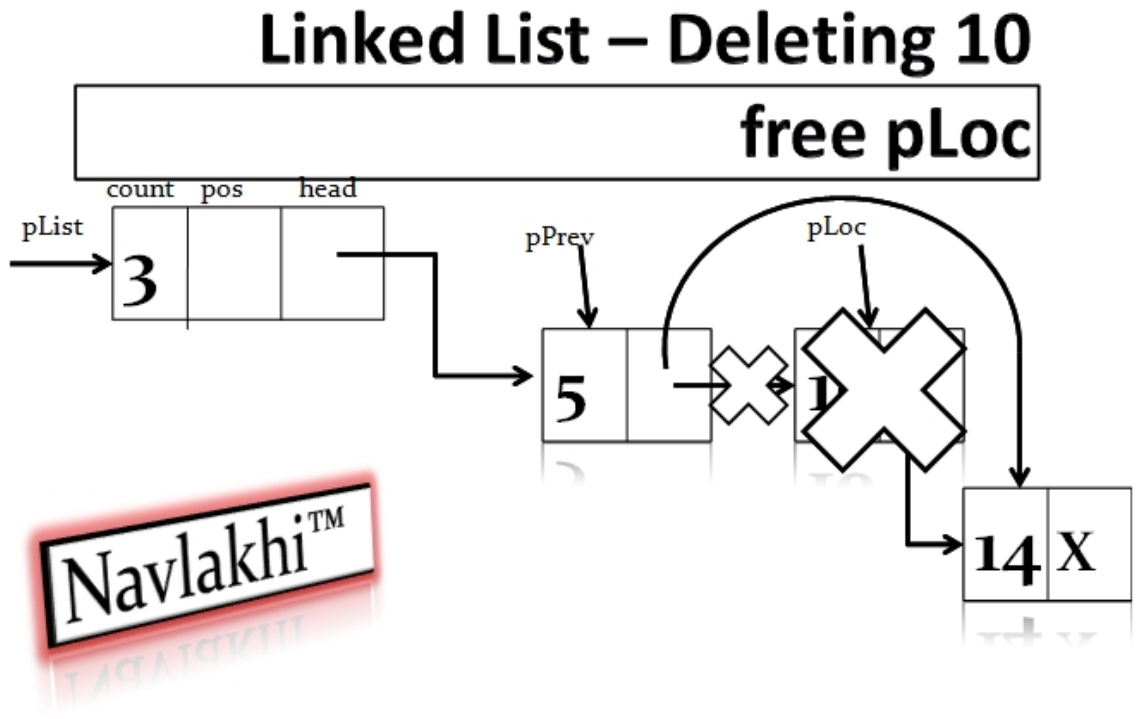
DELETING A NODE

Case 1: pPrev!=NULL (Not deleting the 1st Node)

The same searchNode function will set pPrev and pLoc as shown below.




Linked List – Deleting 10
pPrev->link = pLoc->link
count
pos
head
pList
3
pPrev
pLoc
5
10
14
X
Navlakhi™


Linked List – Deleting 10
free pLoc
count
pos
head
pList
3
pPrev
pLoc
5
14
X
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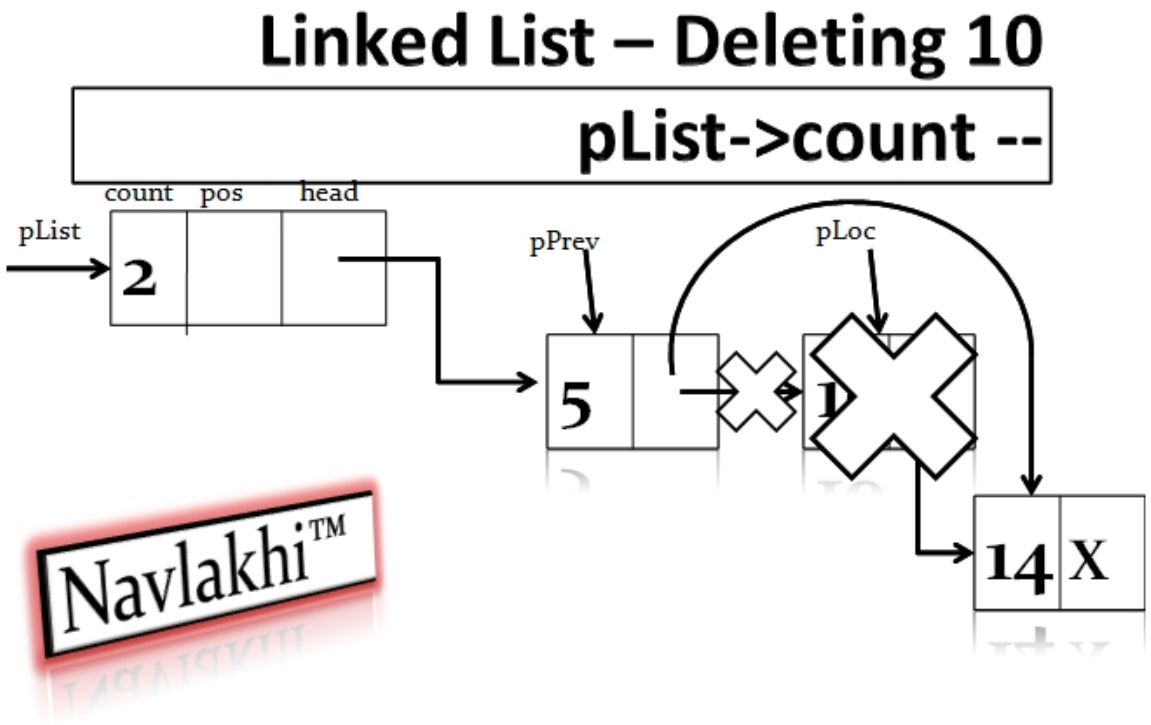
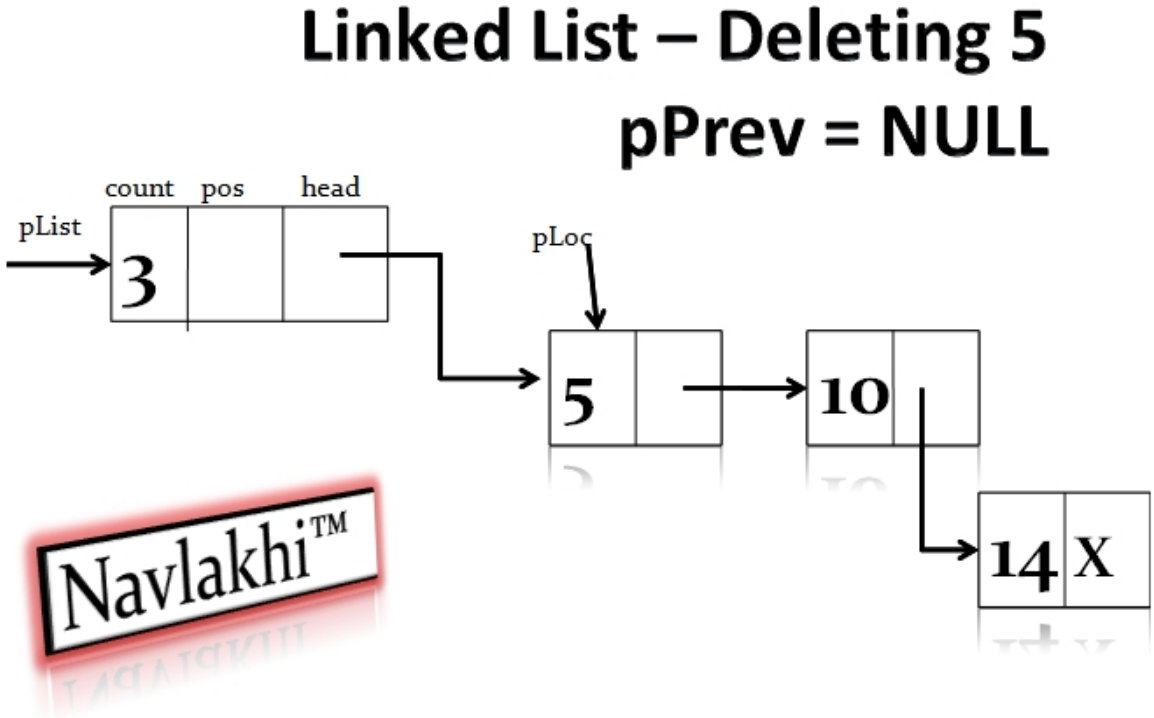
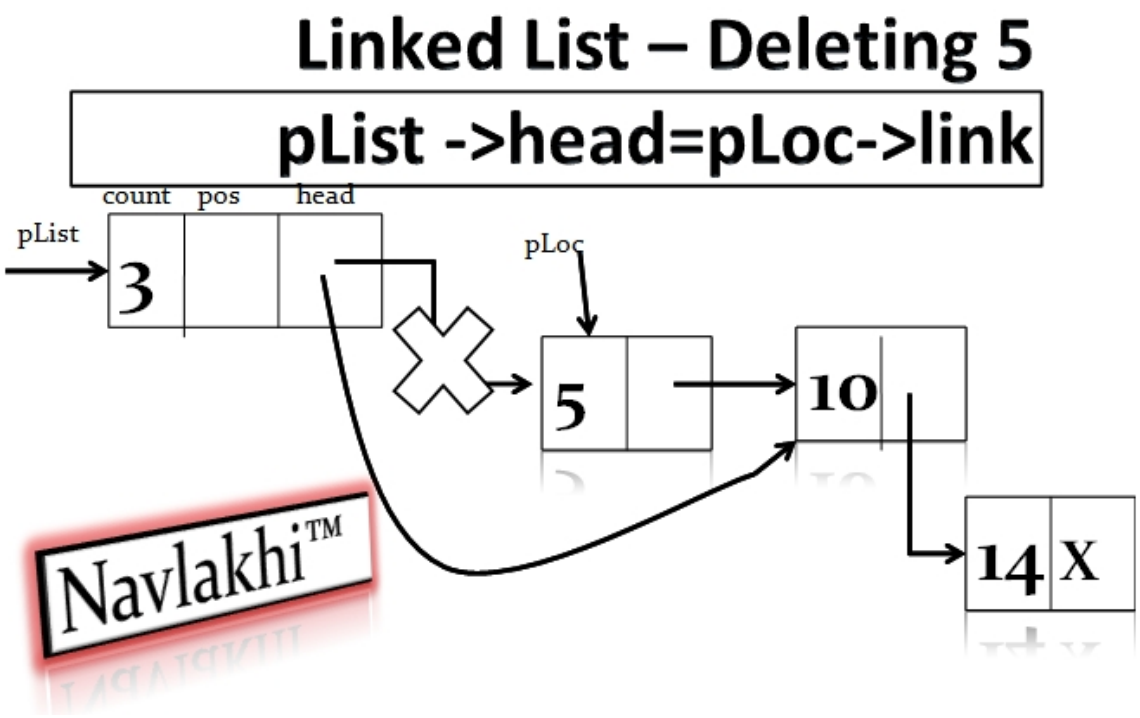


Case 2: **Deleting the first Node (pPrev==NULL)**




Linked List – Deleting 5
pList ->head=pLoc->link
count
pos
head
pList
3
pLoc
5
10
14
X
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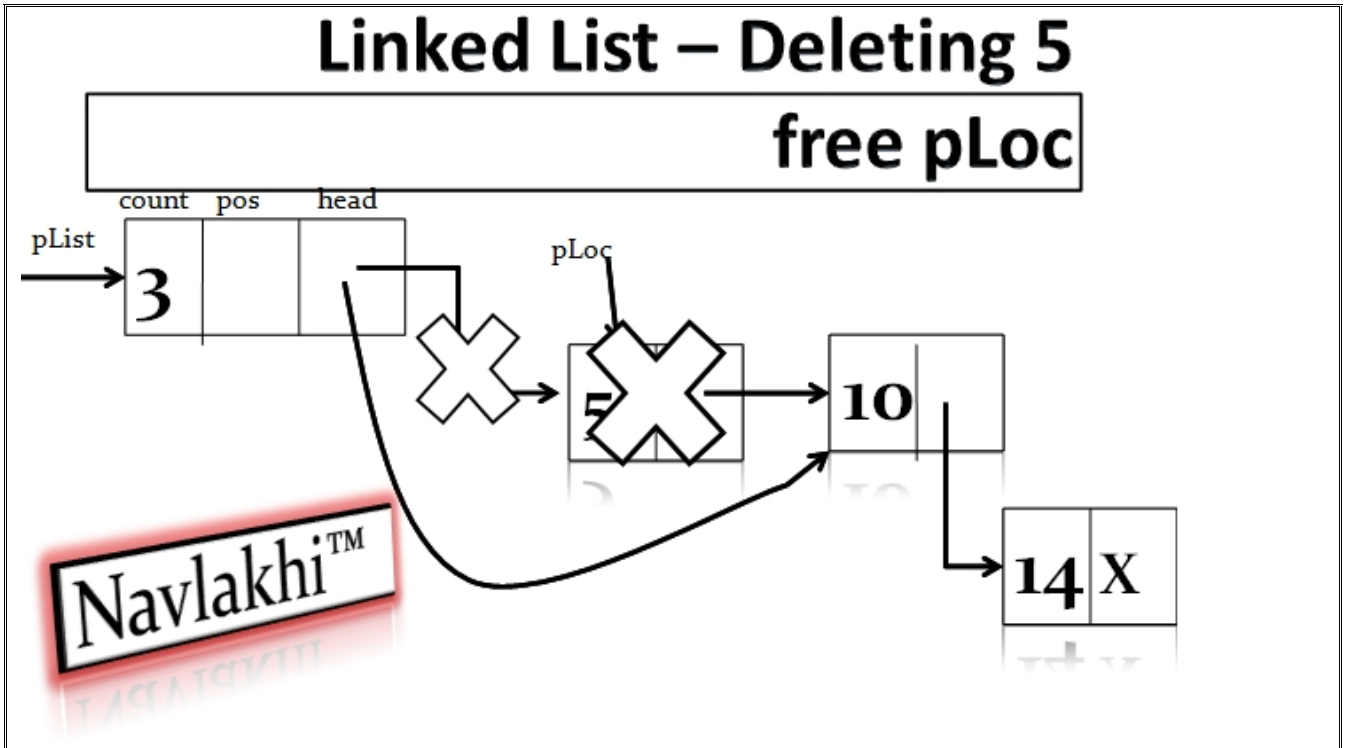
Linked List – Deleting 5
free pLoc
count
pos
head
pList
3
pLoc
5
10
14
X
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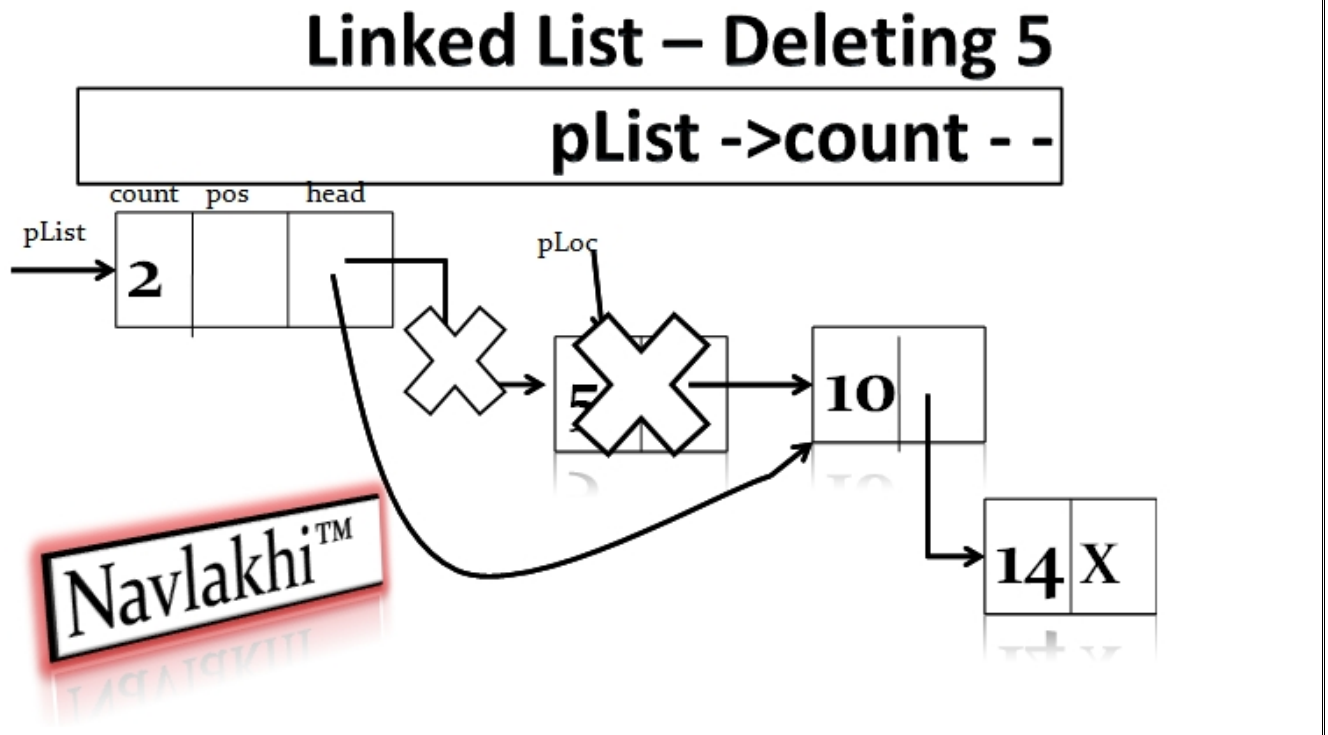
Linked List – Deleting 5
pList ->count - -
count
pos
head
pList
2
pLoc
5
10
14
X
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Program

```
/* Singly Linked List */
#include <stdio.h>
#include <alloc.h>
#include <stdlib.h>

struct  node
{
int data;
struct node *link;
};

struct  list
{
int count;
struct node *pos;
struct node *head;
}*pList;

struct node *pPrev,*pLoc;
```

```
int searchNode(int target)
{

pPrev=NULL;

pLoc=pList->head;

while(pLoc!=NULL && target > pLoc->data)
{
     pPrev=pLoc;
     pLoc=pLoc->link;
}

if (pLoc==NULL)
       return 0; /*Not found*/
else
       if (target == pLoc->data) return 1; /*FOUND*/
else
       return 0;
}
```

```
void printList( )
{
int i;
if (pList->count==0) printf("The List is Empty \n");
else
{
        pList->pos=pList->head;
        printf("..... The List data is as follows .....\n");
        for(i=0;i< pList->count;i++)
        {
                printf("%d\t",pList->pos->data);
                pList->pos=pList->pos->link;
        }
        printf("\n******** END OF LIST ***********\n");
}
}
```

```
void deleteNode( )
{
if (pPrev==NULL)
                        pList->head=pLoc->link;

else                    pPrev->link=pLoc->link;

pList->count =pList->count - 1;
free(pLoc);
}
```

```
void removeNode(int key)
{
int found;

found=searchNode(key);

if (found==1)
        deleteNode();
else
        printf("Error: No matching data found\n");
}
```

```
int insertNode( int dataIn)
{
struct node *pNew;
pNew = (struct node *) malloc(sizeof(struct node));
if (pNew != NULL)
{
        pNew->data=dataIn;

        if (pPrev!=NULL)
        {
                pNew->link=pPrev->link;
                pPrev->link=pNew;
        }
        else
        {
                pNew->link=pList->head;
                pList->head=pNew;
        }
        pList->count+=1;
        return 1;
}
else
        return 0;
}
```

```
void addNode( int dataIn)
{
int found,success;

found = searchNode(dataIn);
if (found==1)  printf("Data already inserted\n");
else
{       success=insertNode(dataIn);
        if (success==1)       printf("Data Inserted Successfully\n");
        else    printf("Out of Memory... \n");
}
}
```

```
int menu()
{
int choice;
printf("\n\n********************\n\n");
printf(" ....   M E N U ...\n");
printf("1: Add new data\n");
printf("2: Delete data\n");
printf("3: Print List\n");
printf("4: Quit\n\n");
printf("********************\n\n");

printf("feed in your choice: ");
scanf("%d",&choice);

return choice;
}
```

```
void createList()
{
pList = (struct list *)malloc(sizeof(struct list));
if (pList != NULL)
{
        pList -> head=NULL;
        pList -> count=0;
}
else
{
        printf("Insufficient Memory to create Head Node...Exiting..\n");
        exit(1);
}
}
```

```
void main( )
{
int choice;
int dataIn,deleteKey;

createList( );

do
{
        choice = menu();

        if (choice==1)
    {
                printf("Feed in the data: ");
                scanf("%d",&dataIn);
                addNode(dataIn);
    }
        else
        if (choice==2)
        {
                  printf("Enter key to be deleted: ");
                  scanf("%d",&deleteKey);
                   removeNode(deleteKey);
        }
        else
        if (choice==3)
        {
            printList( );
        }

} while(choice!=4);

}
```

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