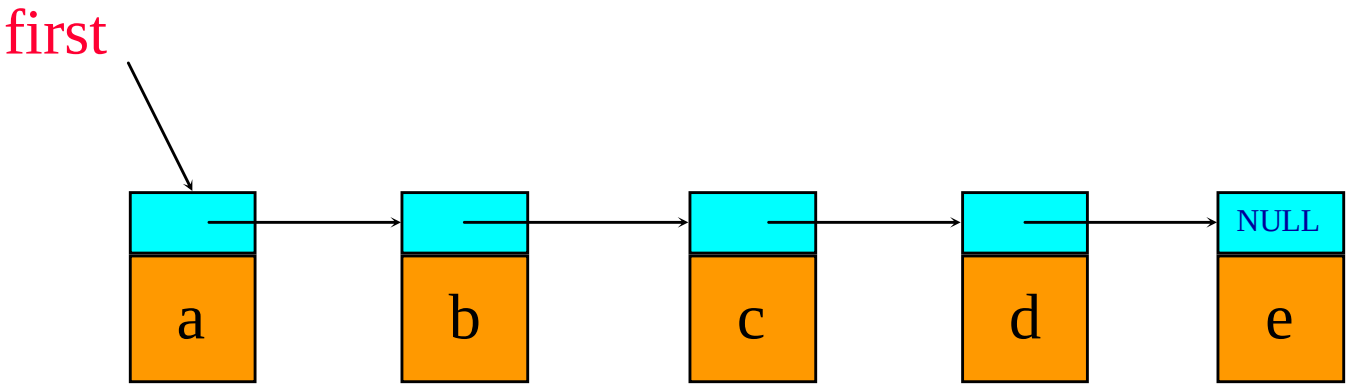
# The Template Class Chain

# Chain

- Linear list.
- Each element is stored in a node.
- Nodes are linked together using pointers.

# The Class Chain




Use ChainNode

link (datatype ChainNode<T>*)

data (datatype T)

# The Template Class Chain

```
template<class T>
class Chain
{
   public:
      Chain() {first = 0;}
         // constructor, empty chain
      ~Chain(); // destructor
      bool IsEmpty() const {return first == 0;}
      // other methods defined here
   private:
      ChainNode<T>* first;
};
```

# The Destructor

```
template<class T>
chain<T>::~chain()
{// Chain destructor. Delete all nodes
 // in chain.
   while (first != NULL)
   {// delete first
      ChainNode<T>* next = first->link;
      delete first;
      first = next;
   }
}
```

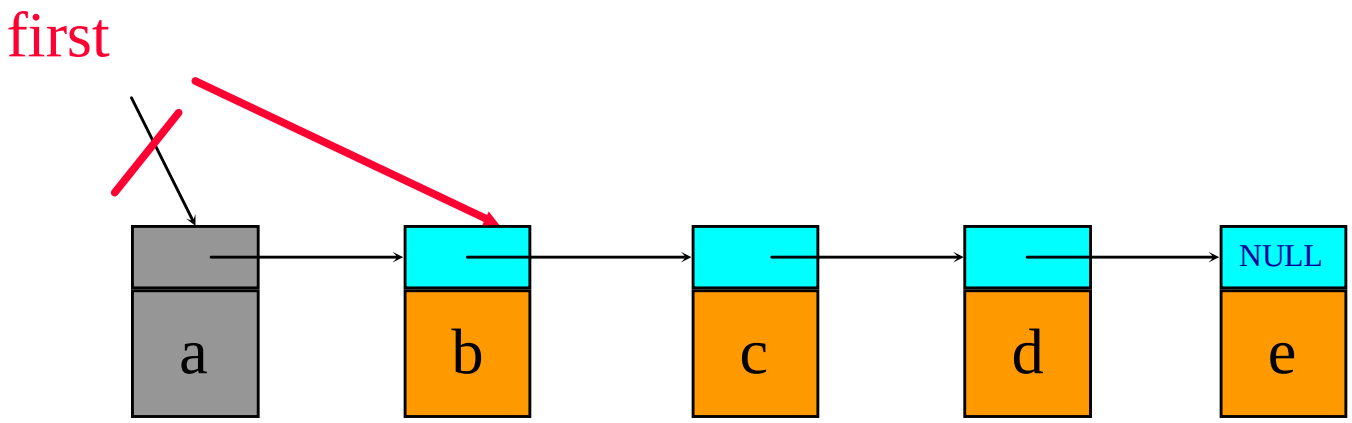
# The Method IndexOf

```
template<class T>
int Chain<T>::IndexOf(const T& theElement) const
{
   // search the chain for theElement
   ChainNode<T>* currentNode = first;
   int index = 0;  // index of currentNode
   while (currentNode != NULL &&
          currentNode->data != theElement)
   {
      // move to next node
      currentNode = currentNode->next;
      index++;
   }
```

# The Method IndexOf

```
    // make sure we found matching element
    if (currentNode == NULL)
        return -1;
    else
        return index;
}
```

# Delete An Element




delete(0)

deleteNode = first;

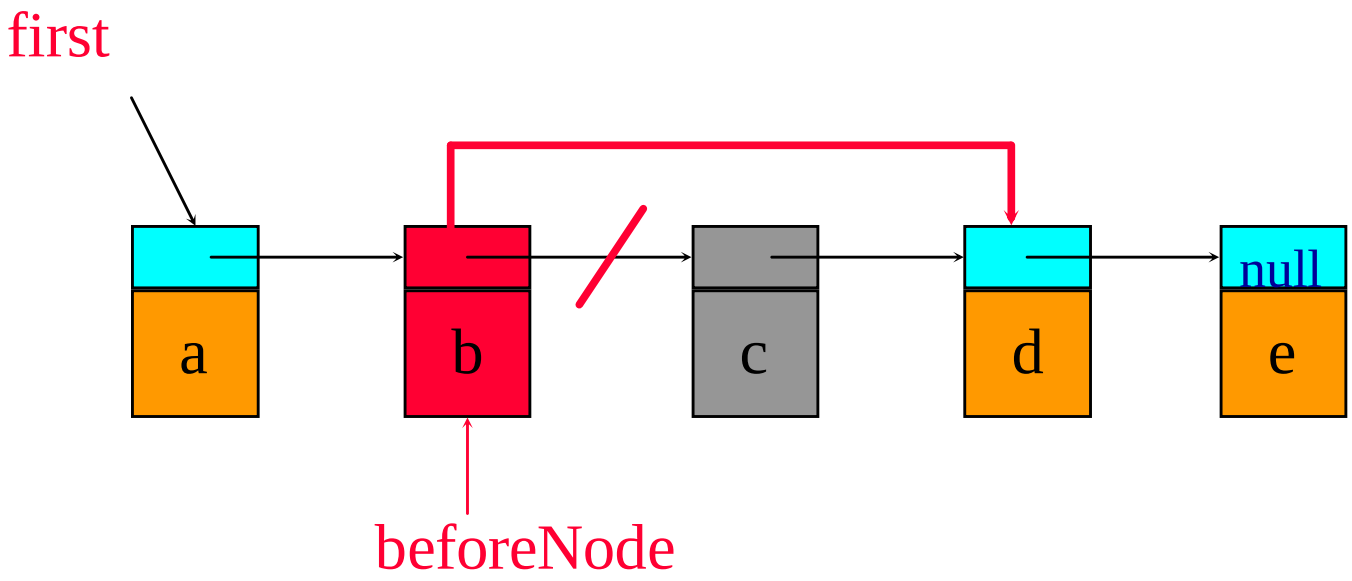
first = first−•link;

delete deleteNode;

# Delete An Element

```
template<class T>
void Chain<T>::Delete(int theIndex)
{
   if (first == 0)
   throw "Cannot delete from empty chain";
   ChainNode<T>* deleteNode;
   if (theIndex == 0)
   {// remove first node from chain
      deleteNode = first;
      first = first->link;
   }
```

# Delete(2)



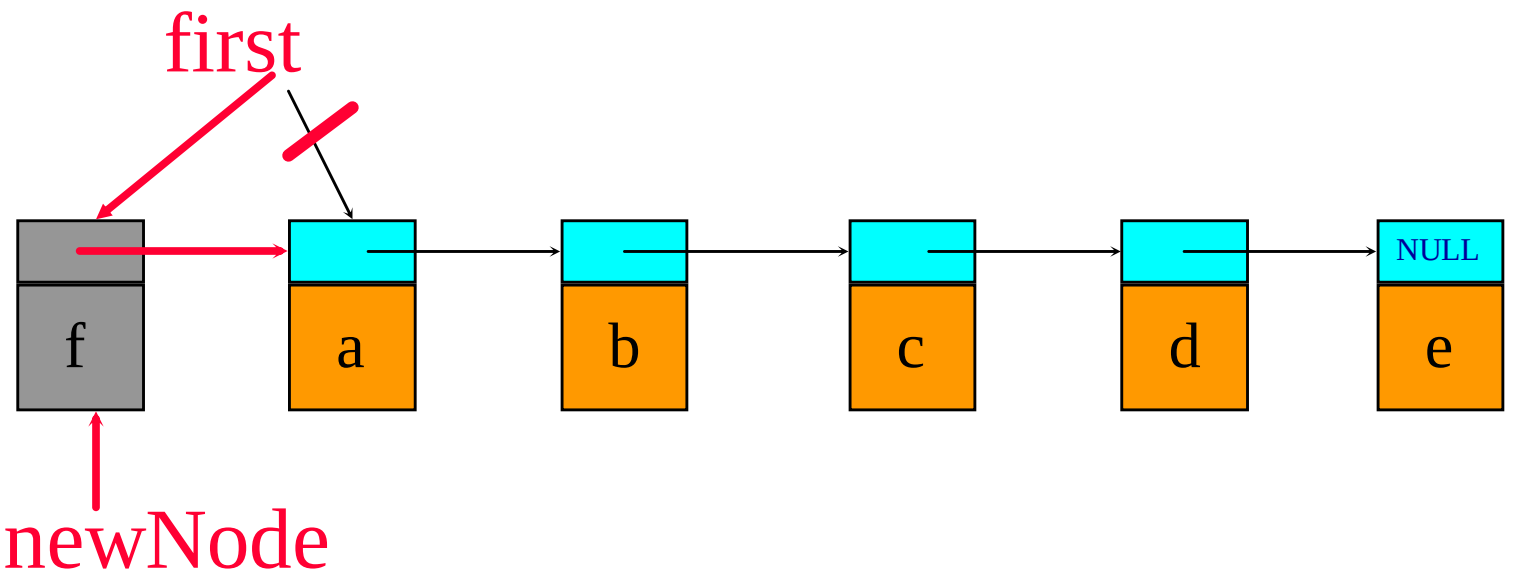

Find & change pointer in beforeNode

```
beforeNode->link = beforeNode->link->link;
delete deleteNode;
```

# Delete An Element

```
else
{  // use p to get to beforeNode
   ChainNode<T>* p = first;
   for (int i = 0; i < theIndex - 1; i++)
   {if (p == 0)
      throw "Delete element does not exist";
    p = p->next;}
   deleteNode = p->link;
   p->link = p->link->link;
 }
 delete deleteNode;
}
```

# One-Step Insert(0,'f')



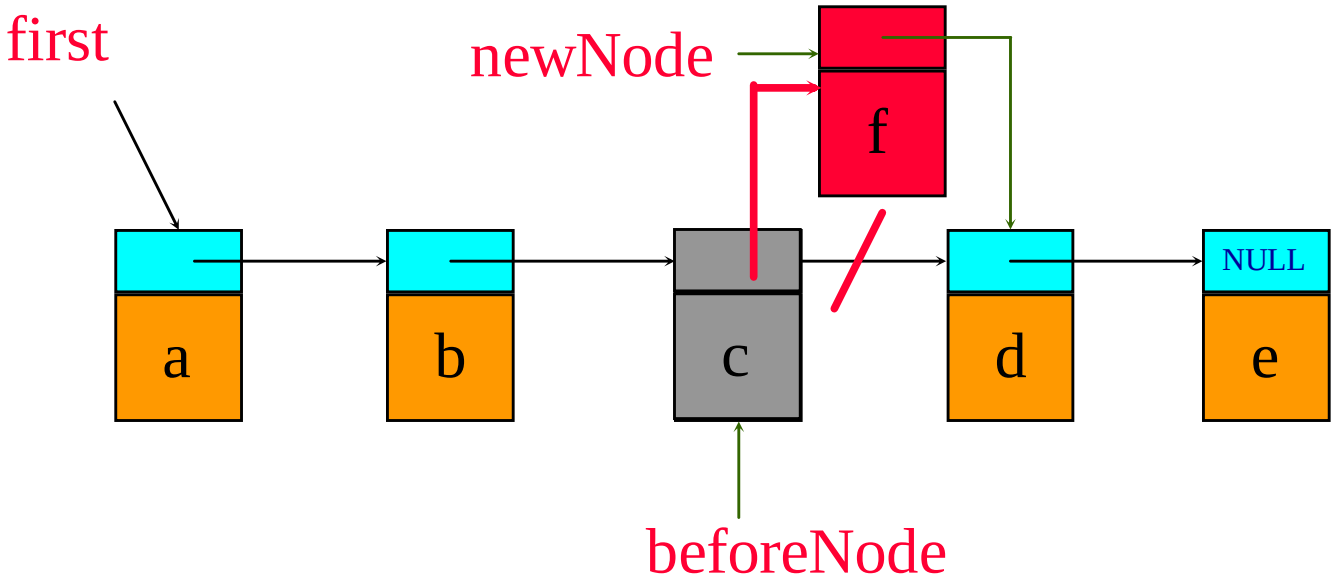

first = new ChainNode<char>('f', first);

# Insert An Element

```
template<class T>
void Chain<T>::Insert(int theIndex,
                      const T& theElement)
{
   if (theIndex < 0)
       throw "Bad insert index";

   if (theIndex == 0)
      // insert at front
      first = new chainNode<T>
              (theElement, first);
```

# Two-Step Insert(3,'f')




beforeNode = first−•link−•link;

beforeNode−•link = new ChainNode<char>

('f', beforeNode−•link);

# Inserting An Element

```
    else
    {   // find predecessor of new element
        ChainNode<T>* p = first;
        for (int i = 0; i < theIndex - 1; i++)
        {if (p == 0)
         throw "Bad insert index";
         p = p->next;}
        // insert after p
        p->link = new ChainNode<T>
                        (theElement, p->link);
    }
}
```