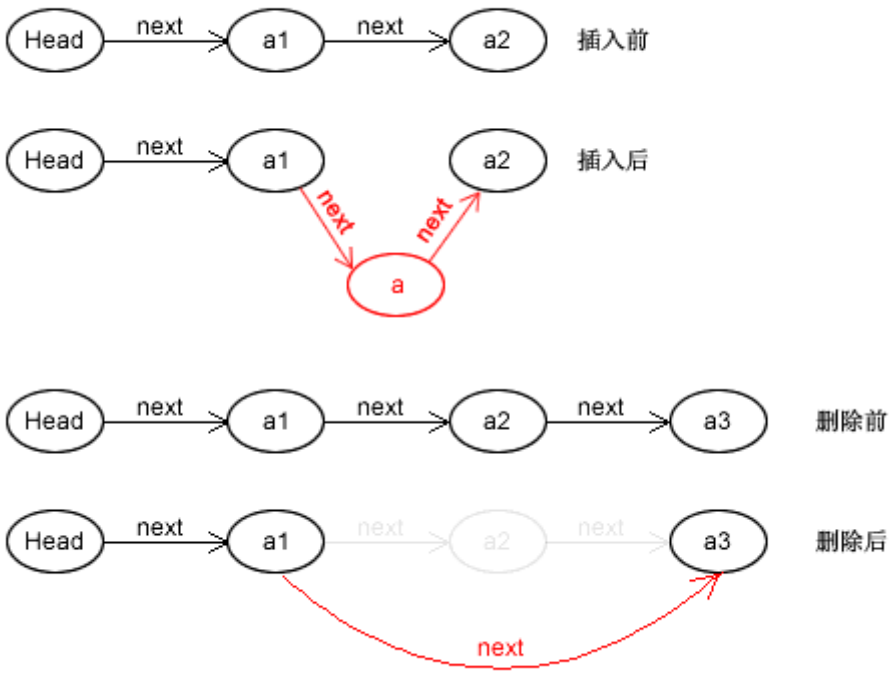
https://www.cnblogs.com/yjmyzz/archive/2010/10/17/1853562.html

下面是单链表插入和删除的算法图解：



可以看到：链表在元素插入/删除时，无需对后面的元素进行移动，只需要修改自身以及相邻节点的next指向即可，所以插入/删除元素的开销要比顺序表小得多。但是也应该注意到，其它操作比如：查找元素，反转倒置链表等，有可能需要遍历整个链表中的所有元素。

下面是泛型版本的Node.cs

```
namespace 线性表
{
    public class Node<T>
    {
        private T data;
        private Node<T> next;

        public Node(T val, Node<T> p)
        {
            data = val;
            next = p;
```

```
        }

        public Node(Node<T> p)
        {
            next = p;
        }

        public Node(T val)
        {
            data = val;
            next = null;
        }


        public Node()
        {
            data = default(T);
            next = null;
        }

        public T Data
        {
            get { return data; }
            set { data = value; }
        }

        public Node<T> Next
        {
            get { return next; }
            set { next = value; }
        }
    }
}
```

> 链表中需要有一个Head节点做为开始，这跟顺序表有所不同，下面是单链表的实现：

```
using System;
using System.Text;

namespace 线性表
{
    public class LinkList<T> : IListDS<T>
    {
        private Node<T> head;

        public Node<T> Head
        {
            get { return head; }
            set { head = value; }
        }

        public LinkList()
        {
            head = null;
        }

        /// <summary>
        /// 类索引器
        /// </summary>
        /// <param name="index"></param>
        /// <returns></returns>
        public T this[int index]
        {
            get
            {
                return this.GetItemAt(index);
            }
        }
```

```
        /// <summary>
        /// 返回单链表的长度
        /// </summary>
        /// <returns></returns>
        public int Count()
        {
            Node<T> p = head;
            int len = 0;
            while (p != null)
            {
                len++;
                p = p.Next;
            }
            return len;
        }

        /// <summary>
        /// 清空
        /// </summary>
        public void Clear()
        {
            head = null;
        }

        /// <summary>
        /// 是否为空
        /// </summary>
        /// <returns></returns>
        public bool IsEmpty()
        {
            return head == null;
        }

        /// <summary>
        /// 在最后附加元素
        /// </summary>
        /// <param name="item"></param>
        public void Append(T item)
        {
            Node<T> d = new Node<T>(item);
```

```
            Node<T> n = new Node<T>();

            if (head == null)
            {
                head = d;
                return;
            }

            n = head;
            while (n.Next != null)
            {
                n = n.Next;
            }
            n.Next = d;
        }

        //前插
        public void InsertBefore(T item, int i)
        {
            if (IsEmpty() || i < 0)
            {
                Console.WriteLine("List is empty or Position is error!");
                return;
            }

            //在最开头插入
            if (i == 0)
            {
                Node<T> q = new Node<T>(item);
                q.Next = Head;//把"头"改成第二个元素
                head = q;//把自己设置为"头"
                return;
            }

            Node<T> n = head;
            Node<T> d = new Node<T>();
            int j = 0;

            //找到位置i的前一个元素d
            while (n.Next != null && j < i)
            {
```

```
                d = n;
                n = n.Next;
                j++;
            }

            if (n.Next == null) //说明是在最后节点插入(即追加)
            {
                Node<T> q = new Node<T>(item);
                n.Next = q;
                q.Next = null;
            }
            else
            {
                if (j == i)
                {
                    Node<T> q = new Node<T>(item);
                    d.Next = q;
                    q.Next = n;
                }
            }
        }

        /// <summary>
        /// 在位置i后插入元素item
        /// </summary>
        /// <param name="item"></param>
        /// <param name="i"></param>
        public void InsertAfter(T item, int i)
        {
            if (IsEmpty() || i < 0)
            {
                Console.WriteLine("List is empty or Position is error!");
                return;
            }

            if (i == 0)
            {
                Node<T> q = new Node<T>(item);
                q.Next = head.Next;
                head.Next = q;
                return;
```

```
            }

            Node<T> p = head;
            int j = 0;

            while (p != null && j < i)
            {
                p = p.Next;
                j++;
            }
            if (j == i)
            {
                Node<T> q = new Node<T>(item);
                q.Next = p.Next;
                p.Next = q;
            }
            else
            {
                Console.WriteLine("Position is error!");
            }
        }

        /// <summary>
        /// 删除位置i的元素
        /// </summary>
        /// <param name="i"></param>
        /// <returns></returns>
        public T RemoveAt(int i)
        {
            if (IsEmpty() || i < 0)
            {
                Console.WriteLine("Link is empty or Position is error!");
                return default(T);
            }

            Node<T> q = new Node<T>();
            if (i == 0)
            {
                q = head;
                head = head.Next;
                return q.Data;
```

```
            }

            Node<T> p = head;
            int j = 0;

            while (p.Next != null && j < i)
            {
                j++;
                q = p;
                p = p.Next;
            }

            if (j == i)
            {
                q.Next = p.Next;
                return p.Data;
            }
            else
            {
                Console.WriteLine("The node is not exist!");
                return default(T);
            }
        }

        /// <summary>
        /// 获取指定位置的元素
        /// </summary>
        /// <param name="i"></param>
        /// <returns></returns>
        public T GetItemAt(int i)
        {
            if (IsEmpty())
            {
                Console.WriteLine("List is empty!");
                return default(T);
            }

            Node<T> p = new Node<T>();
            p = head;

            if (i == 0)
```

```
            {
                return p.Data;
            }

            int j = 0;

            while (p.Next != null && j < i)
            {
                j++;
                p = p.Next;
            }

            if (j == i)
            {
                return p.Data;
            }
            else
            {
                Console.WriteLine("The node is not exist!");
                return default(T);
            }
        }

        //按元素值查找索引
        public int IndexOf(T value)
        {
            if (IsEmpty())
            {
                Console.WriteLine("List is Empty!");
                return -1;
            }
            Node<T> p = new Node<T>();
            p = head;
            int i = 0;
            while (!p.Data.Equals(value) && p.Next != null)
            {
                p = p.Next;
                i++;
            }
            return i;
        }
```

```
        /// <summary>
        /// 元素反转
        /// </summary>
        public void Reverse()
        {
            LinkList<T> result = new LinkList<T>();
            Node<T> t = this.head;
            result.Head = new Node<T>(t.Data);
            t = t.Next;

            //(把当前链接的元素从head开始遍历，逐个插入到另一个空链表中，这样得到的新链表正好元素顺序跟原链表是相反的)
            while (t!=null)
            {
                result.InsertBefore(t.Data, 0);
                t = t.Next;
            }
            this.head = result.head;//将原链表直接挂到"反转后的链表"上
            result = null;//显式清空原链表的引用，以便让GC能直接回收
        }


        public override string ToString()
        {
            StringBuilder sb = new StringBuilder();
            Node<T> n = this.head;
            sb.Append(n.Data.ToString() + ",");
            while (n.Next != null)
            {
                sb.Append(n.Next.Data.ToString() + ",");
                n = n.Next;
            }
            return sb.ToString().TrimEnd(',');

        }
    }
}
```

测试代码片断：

```
Console.WriteLine("-------------------------------------");
Console.WriteLine("单链表测试开始...");
LinkList<string> link = new LinkList<string>();
link.Head = new Node<string>("x");
link.InsertBefore("w", 0);
link.InsertBefore("v", 0);
link.Append("y");
link.InsertBefore("z", link.Count());
Console.WriteLine(link.Count());//5
Console.WriteLine(link.ToString());//v,w,x,y,z
Console.WriteLine(link[1]);//w
Console.WriteLine(link[0]);//v
Console.WriteLine(link[4]);//z
Console.WriteLine(link.IndexOf("z"));//4
Console.WriteLine(link.RemoveAt(2));//x
Console.WriteLine(link.ToString());//v,w,y,z
link.InsertBefore("x", 2);
Console.WriteLine(link.ToString());//v,w,x,y,z
Console.WriteLine(link.GetItemAt(2));//x
link.Reverse();
Console.WriteLine(link.ToString());//z,y,x,w,v
link.InsertAfter("1", 0);
link.InsertAfter("2", 1);
link.InsertAfter("6", 5);
link.InsertAfter("8", 7);
link.InsertAfter("A", 10);//Position is error!

Console.WriteLine(link.ToString()); //z,1,2,y,x,w,6,v,8
```