

# 简单文本编辑器

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## 一、问题描述

设计一个文本编辑器，允许将文件读到内存中，也就是存储在一个缓冲区中。这个缓冲区将作为一个类的内嵌对象实现，缓冲区中的每行文本是一个字符串，将每行存储在一个双向链表的节点中，设计在缓冲区中的行上的种种操作和在单个行中字符上执行的字符串操作的编辑命令。

## 二、基本要求

(1)文本编辑器至少包含如下命令列表，这些命令可用大写或小写字母输入。

- √ R: 读取文本文件到缓冲区中，缓冲区中以前的任何内容将丢失，当前行是文件的第一行。
- √ W: 将缓冲区的内容写入文本文件，当前行或缓冲区均不改变。
- √ I: 插入单个新行，用户必须在恰当的提示符的响应中输入新行并提供其行号。
- √ D: 删除当前行并移到下一行。
- √ F: 可以从第1行开始或从当前行开始，查找包含有用户请求的目标串的第一行。
- √ C: 将用户请求的字符串修改成用户请求的替换文本，可选择是仅在当前行中有效还是对全文有效。
- √ Q: 退出编辑器，立即结束。
- √ H: 显示解释所有命令的帮助消息，程序也接受“?”作为H的替代者。
- √ N: 当前行移到下一行，也就是在缓冲区中进一行。
- √ P: 当前行移到上一行，也就是在缓冲区中退一行。
- √ B: 当前行移到开始处，也就是移到缓冲区的第一行。
- √ E: 当前行移到结束处，也就是移到缓冲区的最后一行。
- √ G: 当前行移到缓冲区中用户指定的行号。
- √ V: 查看缓冲区的全部内容，打印到终端上。

### 三、工具及准备工作

硬件：联想 ThinkBook 16+

软件：VS 2022

### 四、分析与实现

文本编辑器允许将文件读到内存中,即存储在一个缓冲区中。文本的每行文本是一个字符串,每行存储在一个双向链表的节点中。

定义一个 SimpleTextEditor 类,继承自 DbLkList 并使用 CharString\* 进行实例化。

相关接口如下:

```
class SimpleTextEditor : public DbLkList<CharString*>
{
public:
    SimpleTextEditor(char fName[]); //构造函数
    ~SimpleTextEditor(); //析构函数
    void Run(); //运行文本编辑器
private:
    //函数操作
    void Clear(); //重载Clear函数
    bool NextLine(); //下一行
    bool PrevLine(); //上一行
    void ShowCurRow(); //显示当前行
    bool GotoLine(); //转到指定行
    bool GotoFirstLine(); //转到第一行
    bool GotoLastLine(); //转到最后一行
    bool GotoLineAux(int nLineNum); //转到指定行辅助函数
    bool InsertLine(); //插入行
    bool DeleteLine(); //删除当前行
    bool ReadFile(); //读文件
    bool WriteFile(bool OutPutFlag = 1); //写文件
    bool FindString(); //查找字符串
    bool FindStringAux(const CharString& strFind, int &nLineNum,
int &nIndex); //查找字符串辅助函数
    bool ChangeLine(); //替换当前行或所有行的指定文本串
    bool ReplaceLineAux(const CharString& strReplace, int
&nLineNum, int &nIndex); //替换字符串辅助函数
    void ViewFile(); //查看文件
```

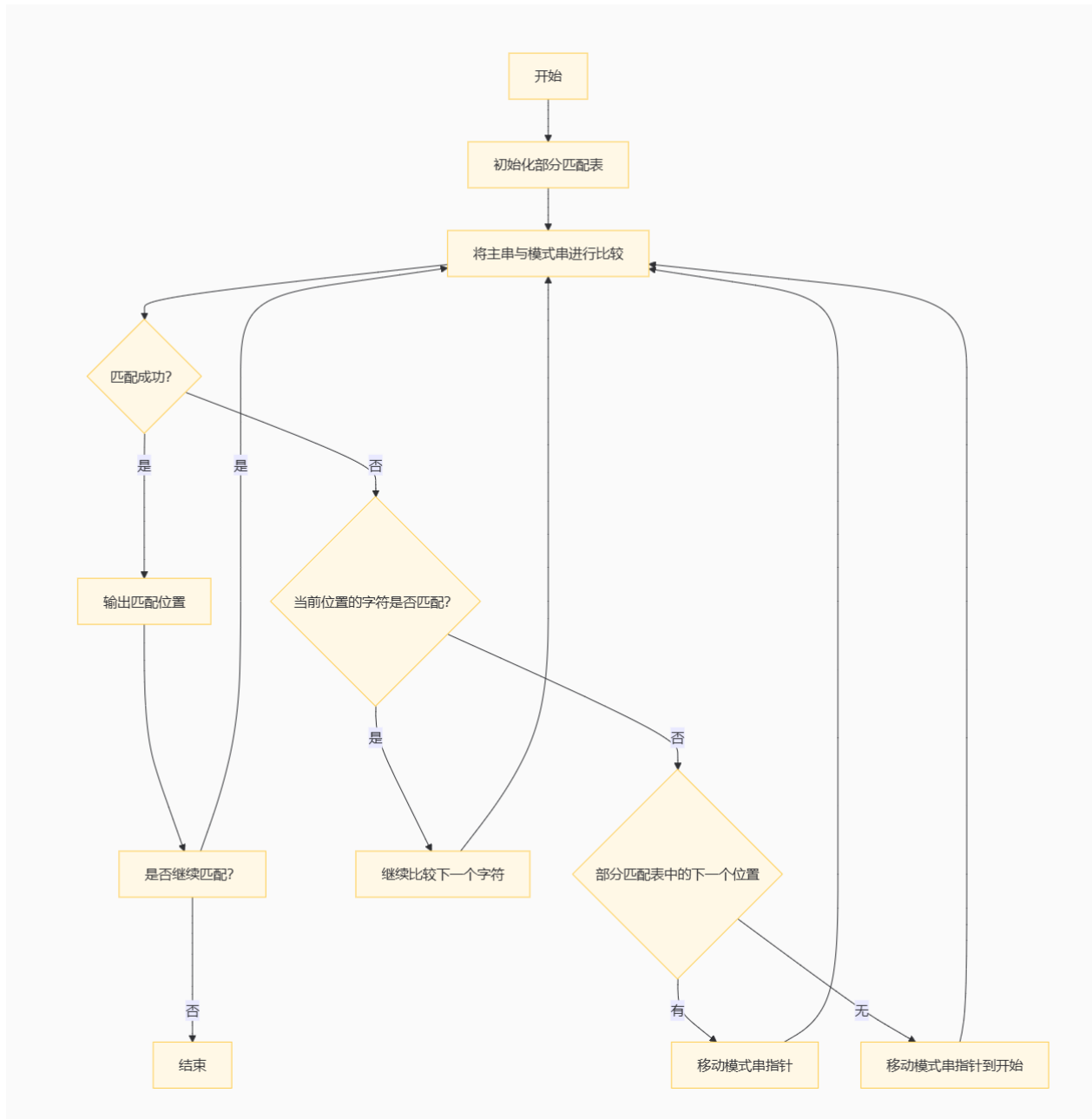
```

void Help();//帮助

//数据成员
int m_nCurRow;//当前行
CharString m_strFileName;//编辑文件名
};

```

本程序实现中，最关键的步骤为KMP算法用于查找字符串，提供的查找，替换功能都基于此，因此着重阐述KMP算法的基本流程如下：



## 五、测试与结论

测试文本：

### 文本 1

The Adventure of the Dancing Men

by Sir Arthur Conan Doyle

I have had so much to do lately that I exist in a sort of haze, which not even the excitement of a possible nor'-wester this afternoon has done anything to shake off.

It is not my nature, however, to lose heart, and I am gradually emerging from the shadows.

My dear Watson, I owe my very real recovery to you.

Not only did you take away the immediate causes of my languor and depression by your astute diagnosis, but you did not cease to encourage me with your unwavering faith in the future.

Your pages have given me sunshine when all was cloud.

It is a joy to me to see you, to know that you are here.

That is not for my sake, Watson, but for yours.

It is hard upon you to come to me with your troubles, but you can be sure that if I have health and strength left I shall be only too glad to share them with you.

### 文本 2

line1

line2

line3

基本功能测试：

1. 行转换，内容显示等进行测试

V/v 指令：

```
command:v
The Adventure of the Dancing Men

by Sir Arthur Conan Doyle

I have had so much to do lately that I exist in a sort of haze, which not even the excitement of a possible nor'-wester this afternoon has done anything to shake off.
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That is not for my sake, Watson, but for yours.
It is hard upon you to come to me with your troubles, but you can be sure that if I have health and strength left I shall be only too glad to share them with you.
1: The Adventure of the Dancing Men
```

H/h/? 指令:

```
command:?
命令列表:
H/h: 显示全部帮助信息
V/v: 查看文件内容
S/s: 保存文件
Q/q: 退出编辑器
N/n: 下一行
P/p: 上一行
G/g: 转到指定行
B/b: 转到第一行
E/e: 转到最后一行
I/i: 插入行
D/d: 删除行
F/f: 查找字符串
C/c: 替换字符串
1: The Adventure of the Dancing Men
```

行切换指令:

```
command:n
2:
command:n
3: by Sir Arthur Conan Doyle
command:n
4:
command:n
5: I have had so much to do lately that I exist in a sort of haze, which not even the excitement of a possible nor'-wester this afternoon has done anything to shake off.
command:n
6: It is not my nature, however, to lose heart, and I am gradually emerging from the shadows.
command:p
5: I have had so much to do lately that I exist in a sort of haze, which not even the excitement of a possible nor'-wester this afternoon has done anything to shake off.
command:p
4:
command:G
请输入行号: 10
10: It is a joy to me to see you, to know that you are here.
command:B
1: The Adventure of the Dancing Men
command:e
12: It is hard upon you to come to me with your troubles, but you can be sure that if I have health and strength left I shall be only too glad to share them with you.
```

2. 添加删除文本功能测试

```
1: The Adventure of the Dancing Men
command:i
请输入要插入的行号 (默认当前行) :
请输入要插入的内容: Insert Test
插入成功
1: Insert Test
command:v
Insert Test
The Adventure of the Dancing Men

by Sir Arthur Conan Doyle

I have had so much to do lately that I exist in a sort of haze, which not even the excitement of a possible nor'-wester this afternoon has done anything to shake off.
It is not my nature, however, to lose heart, and I am gradually emerging from the shadows.
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It is a joy to me to see you, to know that you are here.
That is not for my sake, Watson, but for yours.
It is hard upon you to come to me with your troubles, but you can be sure that if I have health and strength left I shall be only too glad to share them with you.
1: Insert Test
command:D
删除成功
1: The Adventure of the Dancing Men
command:v
The Adventure of the Dancing Men

by Sir Arthur Conan Doyle

I have had so much to do lately that I exist in a sort of haze, which not even the excitement of a possible nor'-wester this afternoon has done anything to shake off.
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It is a joy to me to see you, to know that you are here.
That is not for my sake, Watson, but for yours.
It is hard upon you to come to me with your troubles, but you can be sure that if I have health and strength left I shall be only too glad to share them with you.
1: The Adventure of the Dancing Men
```

3. 查找功能测试

```

command:v
The Adventure of the Dancing Men
by Sir Arthur Conan Doyle

I have had so much to do lately that I exist in a sort of haze, which not even the excitement of a possible nor'-wester this afternoon has done anything to shake off.
It is not my nature, however, to lose heart, and I am gradually emerging from the shadows.
My dear Watson, I owe my very real recovery to you.
Not only did you take away the immediate causes of my languor and depression by your astute diagnosis, but you did not cease to encourage me with your unwavering faith in the future.
Your pages have given me sunshine when all was cloud.
It is a joy to me to see you, to know that you are here.
That is not for my sake, Watson, but for yours.
It is hard upon you to come to me with your troubles, but you can be sure that if I have health and strength left I shall be only too glad to share them with you.
1: The Adventure of the Dancing Men
command:f
是否从当前行开始查找 (否则从头开始)? (y/n):y
请输入要查找的字符串: away
8: Not only did you take away the immediate causes of my languor and depression by your astute diagnosis, but you did not cease to encourage me with your unwavering faith in the future.
在第8行第23列找到字符串
command:f
是否从当前行开始查找 (否则从头开始)? (y/n):n
请输入要查找的字符串: be sure
12: It is hard upon you to come to me with your troubles, but you can be sure that if I have health and strength left I shall be only too glad to share them with you.
在第12行第67列找到字符串

```

#### 4. 替换功能测试

```

E:\New Project(C++)\数据结构 × + ∨
Please input the file name(default: test.txt):
命令列表:
H/h: 显示全部帮助信息
V/v: 查看文件内容
S/s: 保存文件
Q/q: 退出编辑器
N/n: 下一行
P/p: 上一行
G/g: 转到指定行
B/b: 转到第一行
E/e: 转到最后一行
I/i: 插入行
D/d: 删除行
F/f: 查找字符串
C/c: 替换字符串
1: line1
command:v
line1
line2
line3
1: line1
command:c
是否只替换当前行 (否则替换所有行)? (y/n):y
请输入要查找的字符串: in
请输入要替换的字符串: as
替换成功
1: lasel
command:n
2: line2
command:c
是否只替换当前行 (否则替换所有行)? (y/n):y
请输入要查找的字符串: li
请输入要替换的字符串: be
替换成功
2: bene2
command:v
lase1
bene2
line3
2: bene2
command:c
是否只替换当前行 (否则替换所有行)? (y/n):n
请输入要查找的字符串: e
请输入要替换的字符串: x
替换成功
2: bxn2
command:v
lasx1
bxnx2
linx3
2: bxn2

```

#### 5. 读写指令测试

```
Microsoft Visual Studio 调试 × + ∨

Please input the file name(default: test.txt):
命令列表:
H/h: 显示全部帮助信息
V/v: 查看文件内容
S/s: 保存文件
Q/q: 退出编辑器
N/n: 下一行
P/p: 上一行
G/g: 转到指定行
B/b: 转到第一行
E/e: 转到最后一行
I/i: 插入行
D/d: 删除行
F/f: 查找字符串
C/c: 替换字符串
1: The Adventure of the Dancing Men
command:i
请输入要插入的行号 (默认当前行):
请输入要插入的内容: Hello! This is my simple text editor.
插入成功
1: Hello! This is my simple text editor.
command:q
是否选择保存? (y/n) :y
Successful Exit with file saved automaticly!
```

```
Please input the file name(default: test.txt):
命令列表:
H/h: 显示全部帮助信息
V/v: 查看文件内容
S/s: 保存文件
Q/q: 退出编辑器
N/n: 下一行
P/p: 上一行
G/g: 转到指定行
B/b: 转到第一行
E/e: 转到最后一行
I/i: 插入行
D/d: 删除行
F/f: 查找字符串
C/c: 替换字符串
1: Hello! This is my simple text editor.
command:v
Hello! This is my simple text editor.
The Adventure of the Dancing Men
by Sir Arthur Conan Doyle

I have had so much to do lately that I exist in a sort of haze, which not even the excitement of a possible nor'-wester this afternoon has done anything to shake off.
It is not my nature, however, to lose heart, and I am gradually emerging from the shadows.
My dear Watson, I owe my very real recovery to you.
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Your pages have given me sunshine when all was cloud.
It is a joy to me to see you, to know that you are here.
That is not for my sake, Watson, but for yours.
It is hard upon you to come to me with your troubles, but you can be sure that if I have health and strength left I shall be only too glad to share them with you.
1: Hello! This is my simple text editor.
```

## 异常输入测试:

### 1. 指令输入错误

```
command:Z
invalid command!(use 'h/H' to get help)
command:o
invalid command!(use 'h/H' to get help)
command:!
invalid command!(use 'h/H' to get help)
command:
command:
```

### 2. 输入文本不存在

Please input the file name(default: test.txt): error.txt  
文件 "error.txt" 未找到

### 3. 切换行时行号超出范围

```
command:g
请输入行号: 100
行号超出范围
command:g
请输入行号: 0
行号超出范围
command:B
1: Hello! This is my simple text editor.
command:p
已经到达文件开头
command:e
13: It is hard upon you to come to me with your troubles, but you can be sure that if I have health and strength left I
shall be only too glad to share them with you.
command:n
已经到达文件末尾
```

### 4. 其他意外输入

```
command:g
请输入行号: asdg
行号错误!
```

```
command:i
请输入要插入的行号 (默认当前行): 123
行号错误!
1: Hello! This is my simple text editor.
command:i
请输入要插入的行号 (默认当前行): -1
行号错误!
1: Hello! This is my simple text editor.
command:i
请输入要插入的行号 (默认当前行): !
行号错误!
1: Hello! This is my simple text editor.
```

```
command:f
是否从当前行开始查找 (否则从头开始)? (y/n) :k
是否从当前行开始查找 (否则从头开始)? (y/n) :y
请输入要查找的字符串:
查找字符串为空
```

```
command:c
是否只替换当前行 (否则替换所有行)? (y/n) :j
是否只替换当前行 (否则替换所有行)? (y/n) :$
是否只替换当前行 (否则替换所有行)? (y/n) :n
请输入要查找的字符串: %%
请输入要替换的字符串:
替换字符串为空
1: Hello! This is my simple text editor.
command:c
是否只替换当前行 (否则替换所有行)? (y/n) :
y
是否只替换当前行 (否则替换所有行)? (y/n) :y
请输入要查找的字符串: %%
请输入要替换的字符串: !
未找到字符串
1: Hello! This is my simple text editor.
```



结论:

- 文本编辑器功能测试完善且正常
- 鲁棒性良好，意外输入考虑周全
- 用户界面友好，提示充足

## 六、思考与感悟

### 1. 程序效率问题:

- 使用 `CharString*`（即指针）来实例化 `dbl_link_list` 可以提高效率，避免无谓的大量文本拷贝操作，在每次 `GetElem()` 时，取得指针就可以直接进行修改操作，但是如果使用 `CharString` 实例化，就需要通过 `GetElem()` 和 `SetElem()` 来回两次对文本进行拷贝。

### 2. 内存安全问题

- 抛开效率，直接使用 `CharString` 对象（而非指针）通常更安全，因为对象的生命周期由编译器自动管理。当对象超出其作用域时，编译器会自动调用其析构函数来释放资源，从而减少了内存泄漏的风险。
- 在现代C++编程中，可以考虑使用智能指针（如 `std::unique_ptr` 和 `std::shared_ptr`）来管理动态分配的内存。这些智能指针在超出作用域时会自动释放所指向的内存，从而进一步提高了内存的安全性。

### 3. 继承、多态与模板的便利性:

- 继承允许我们创建一个新的类（派生类），该类从另一个类（基类）继承属性和方法。这使得代码更加模块化和可重用。
- 多态允许我们使用基类指针或引用来调用派生类中的方法。这增加了代码的灵活性和可扩展性，使我们能够更容易地处理不同类型的对象。
- 模板允许我们编写与数据类型无关的代码。通过使用模板，我们可以创建可重用的函数和类，这些函数和类可以处理多种数据类型，而无需为每种类型编写专门的代码。

### 4. 版本管理与Git:

- 使用Git进行版本管理可以追踪代码的变更历史，使我们能够轻松地回滚到之前的版本或比较不同版本之间的差异。
- Git还提供了分支和合并功能，使得多人协作开发变得更加容易。每个人可以在自己的分支上独立工作，然后将更改合并到主分支中。

- 通过使用Git，我们可以更好地管理项目，提高开发效率，并减少因版本冲突或丢失而导致的风险。

## 5. 加深对数据结构的理解：

- 链表和串是计算机科学中基本且重要的数据结构。通过实现和使用这些数据结构，可以更深入地理解它们的内部原理、性能特点和适用场景。
- 对于链表，了解其插入、删除和搜索操作的时间复杂度以及如何在不同情况下优化这些操作是非常有价值的。
- 对于串，了解其存储方式（如定长串和变长串）、串操作（如连接、比较和子串查找）以及串的应用（如文本处理和模式匹配）也是非常重要的。

## 6. 功能的升级：

- 之后可考虑增加撤回等操作
- 可以进一步将界面升级为类似vim的实时操作界面