
项目说明文档

数据结构课程设计

——考试报名系统

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1 分析

1.1 项目简介

考试报名工作给各高校报名工作带来了新的挑战，给教务管理部门增加了很大的工作量。本项目是对考试报名管理的简单模拟，用控制台选项的选择方式完成下列功能：输入考生信息；输出考生信息；查询考生信息；添加考生信息；修改考生信息；删除考生信息。

2 设计

2.1 数据结构设计

如上所述，该系统要求大量的增加、删除、修改操作，而链表进行增加、删除等操作十分简便，因此考虑使用链表数据结构。

2.2 类结构设计

链表包括两个抽象数据类型（ADT）——链表结点类（`ListNode`）与链表类（`List`），本系统采用 `class` 描述链表结点类（`ListNode`）与链表类（`List`）。该链表封装成了一个头文件，所以在这里增加两个类，`student` 类表示一个学生，`EMIS` 类表示考试报名系统。

2.3 成员与操作设计

链表结点类（`ListNode`）

```
template<class T> class List;

template<class T>
class ListNode
{
public:
    friend List<T>;
    ListNode() : _pre(nullptr), _next(nullptr) {}
    ListNode(const T& item) : _data(item), _pre(nullptr), _next(nullptr) {}
    ~ListNode() { _pre = nullptr, _next = nullptr; } //析构函数
    ListNode<T>* next()const { return this->_next; } //返回后置指针
    ListNode<T>* pre()const { return this->_pre; } //返回前置指针
    T data()const { return this->_data; } //返回数据
    void setData(T d) { _data = d; } //设置数据
private:
    T _data; //存数据
    ListNode* _next; //后置指针
    ListNode* _pre; //前置指针
};
```

链表类 (List)

```

template<class T>
class List
{
public:
    List() :_len(0), _head(new ListNode<T>()) {
        _head->_next = _head;
        _head->_pre = _head;
    }
    ~List() {
        this->clear();
        delete _head;
    }
public:
    ListNode<T>* find(const T& item)const;
    void clear();//清除
    void push(const T& item);//后插
    void push(const T&& item);
    bool insertBefore(const T& item, ListNode<T>* itor);//在 itor 前插入
    bool insertAfter(const T& item, ListNode<T>* itor);//在 itor 后插入
    bool insert(const T& item, int ind);//在 ind 位置插入
    bool erase(ListNode<T>* itor);//删除
    ListNode<T>* begin()const { return this->_head->_next; }
    ListNode<T>* end()const { return this->_head; }
    bool change(const T& newitem, ListNode<T>* itor);//修改
    int size()const { return this->_len; }
    bool empty()const { return !(this->_len); }
    void print()const;
private:
    int _len;//length
    ListNode<T>* _head;//the pointer to the first node
};

```

Student 类

```
class EMIS;

class student{
public:
    student() = default;
    friend class EMIS;
    friend std::istream& operator>>(std::istream& is, student& student);
    friend std::ostream& operator<<(std::ostream& os, const student& student);
    const int number()const { return _number; }
    const std::string name()const { return _name; }
    const std::string sex()const { return _sex; }
    const int age()const { return _age; }
    const std::string type()const { return _type; }
    void set(int number, std::string name, std::string sex, int age, std::string type) {
        _number = number; _name = name; _sex = sex; _age = age; _type = type;
    }
private:
    int _number;//学号
    std::string _name;//姓名
    std::string _sex;//性别
    int _age;//年龄
    std::string _type;//报名类型
};
```

EMIS 类

```
class EMIS{
public:
    EMIS() = default;
    void push(const student& stu) { _list.push(stu); }
    bool seek();//3查找
    bool del();//2删除
    bool insert();//1插入
    void statistics() const;//5统计
    bool revise();//4修改
    const List<student>& getList() const { return this->_list; }
    void print()const;//输出
private:
    List<student> _list;
};
```

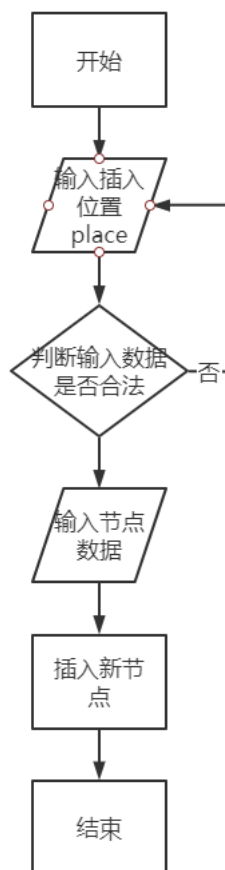
2.4 系统设计

系统调用 solve()函数实现初始化，并完成对链表的创建和输入数据工作，然后根据用户所输入的操作码（order）执行对应的操作。

3 实现

3.1 插入功能的实现

3.1.1 插入功能流程图



3.1.2 插入功能核心代码

```
bool EMIS::insert() {
    int place = -1;
    std::cout << "Please enter the position of the candidate you want to insert: ";
    std::cin >> place;
    while (place <= 0 || place > this->_list.size() + 1) {
        std::cout << "Insertion failed, please re-enter: ";
        std::cin >> place;
    }
    std::cout << "Please input the candidate number, name, gender, age and application type of the candidate to be inserted in sequence!" << '\n';
    student stu;
    std::cin >> stu;
    this->_list.insert(stu, place);
    return true;
}

template<typename T>
bool List<T>::insert(const T& item, int ind) {
    if (ind <= 0 || ind > this->_len + 1)
        return false;
    ListNode<T>* pmove = this->_head;
    for (int i = 1; i < ind; i++) {
        pmove = pmove->next();
    }
    this->insertAfter(item, pmove);
    return true;
}

bool List<T>::insertAfter(const T& item, ListNode<T>* itor) {
    if (!itor)
        return false;
    ListNode<T>* newnode = new ListNode<T>(item);
    newnode->_pre = itor;
    newnode->_next = itor->_next;
    itor->_next->_pre = newnode;
    itor->_next = newnode;
    this->_len++;
    return true;
}
```

3.1.3 插入功能截屏示例

```
root@iZbp180dvecytxjnhuzrznZ:~/css_design/subject# ./p1.out
First, please establish a candidate information system!
Please enter the number of candidates:2
Please enter the candidate's exam number, name, gender, age and application type in turn
!
1 stu1 女 20 软件设计师
2 stu2 男 21 软件开发师

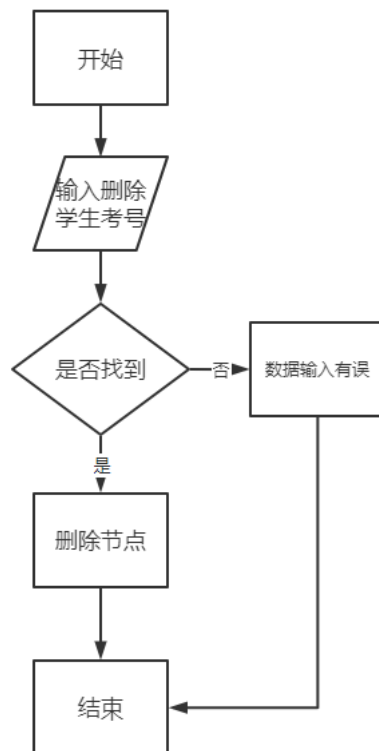
test numbername      sex      age      application type
1      stu1      女      20      软件设计师
2      stu2      男      21      软件开发师
Please select the operation you want to perform (1 means insert, 2 means delete, 3 means
search, 4 means modify, 5 means statistics, 0 means cancel operation)

Please choose what you want to do:1
Please enter the position of the candidate you want to insert:3
Please input the candidate number, name, gender, age and application type of the candidat
e to be inserted in sequence!
3 stu3 男 20 软件设计师

test numbername      sex      age      application type
1      stu1      女      20      软件设计师
2      stu2      男      21      软件开发师
3      stu3      男      20      软件设计师
Please choose what you want to do:1
Please enter the position of the candidate you want to insert:5
Insertion failed, please re-enter: 
```

3.2 删除功能的实现

3.2.1 删除功能流程图



3.2.2 删除功能核心代码

```
bool EMIS::del() {
    std::cout << "Please enter the candidate number of the candidate to be deleted: ";
    int number = -1;
    std::cin >> number;
    ListNode<student>* itor;
    for (itor = _list.begin(); itor != _list.end(); itor = itor->next()) {
        if (itor->data().number() == number) {
            student s = itor->data();
            std::cout << "The candidate information you deleted is: " << s;
            _list.erase(itor);
            return true;
        }
    }
    if (itor == _list.end()) {
        std::cout << "Failed to delete!" << '\n';
        return false;
    }
    return false;
}

template<typename T>
bool List<T>::erase(ListNode<T>* itor) {
    if (itor == this->_head)
        return false;
    itor->_pre->_next = itor->_next;
    itor->_next->_pre = itor->_pre;
    this->_len--;
    delete itor;
    return true;
}
```

3.2.3 删除功能截屏示例

```
root@iZbp180dvecytxjnhuzrznZ:~/css_design/subject# ./pl.out
First, please establish a candidate information system!
Please enter the number of candidates:2
Please enter the candidate's exam number, name, gender, age and application type in turn
!
1 stu1 女 20 软件设计师
2 stu2 男 21 软件开发师

test numbername      sex      age      application type
1      stu1      女      20      软件设计师
2      stu2      男      21      软件开发师
Please select the operation you want to perform (1 means insert, 2 means delete, 3 means
search, 4 means modify, 5 means statistics, 0 means cancel operation)

Please choose what you want to do: 2
Please enter the candidate number of the candidate to be deleted: 1
The candidate information you deleted is: 1      stu1      女      20      软件设计
师

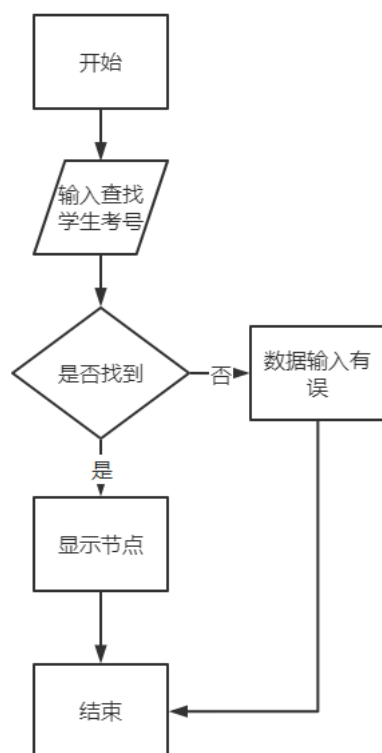
test numbername      sex      age      application type
2      stu2      男      21      软件开发师
Please choose what you want to do: 2
Please enter the candidate number of the candidate to be deleted: 2
The candidate information you deleted is: 2      stu2      男      21      软件开
发师

test numbername      sex      age      application type
Please choose what you want to do: 2
Please enter the candidate number of the candidate to be deleted: 3
Failed to delete!

test numbername      sex      age      application type
Please choose what you want to do: █
```

3.3 查找功能的实现

3.3.1 查找功能流程图



3.3.2 查找功能核心代码

```
bool EMIS::seek() {
    std::cout << "Please enter the candidate number of the candidate you are looking for:";
    int number = 0;
    std::cin >> number;
    ListNode<student>* itor;
    for (itor = _list.begin(); itor != _list.end(); itor = itor->next()) {
        if (itor->data().number() == number) {
            //std::cout.setf(std::ios::left);
            std::cout << std::setiosflags(std::ios::left)<< std::setw(blank-
space_num) << "test number" << std::setw(blankspace_num) << "name"
                << std::setw(blankspace_num) << "sex" << std::setw(blankspace_num) << "age"
                << std::setw(blankspace_num) << "application type" << "\n";
            std::cout << itor->data();
            return true;
        }
    }
    if (itor == _list.end()) {
        std::cout << "The candidate information system does not have the candidate infor-
mation!" << "\n";
        return false;
    }
    return false;
}
```

3.3.3 查找功能截图示例

```
root@iZbp180dvecytxjnhuzrznZ:~/css_design/subject# ./p1.out
First, please establish a candidate information system!
Please enter the number of candidates:3
Please enter the candidate's exam number, name, gender, age and application type in turn
!
1 stu1 女 20 软件设计师
2 stu2 男 21 软件开发师
3 stu3 男 20 软件设计师

test numbername      sex      age      application type
1      stu1      女      20      软件设计师
2      stu2      男      21      软件开发师
3      stu3      男      20      软件设计师
Please select the operation you want to perform (1 means insert, 2 means delete, 3 means
search, 4 means modify, 5 means statistics, 0 means cancel operation)

Please choose what you want to do: 3
Please enter the candidate number of the candidate you are looking for:1
test numbername      sex      age      application type
1      stu1      女      20      软件设计师

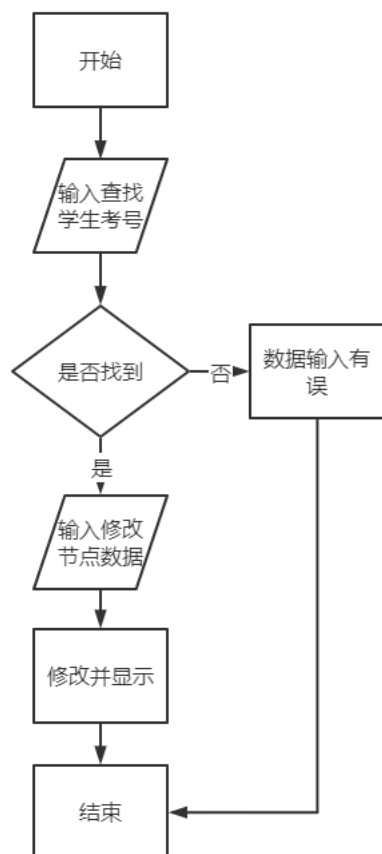
Please choose what you want to do: 3
Please enter the candidate number of the candidate you are looking for:2
test numbername      sex      age      application type
2      stu2      男      21      软件开发师

Please choose what you want to do: 3
Please enter the candidate number of the candidate you are looking for:4
The candidate information system does not have the candidate information!

Please choose what you want to do: █
```

3.4 修改功能的实现

3.4.1 修改功能流程图



3.4.2 修改功能核心代码

```
bool EMIS::revise() {
    std::cout << "Please enter the candidate number of the candidate to be modified: ";
    int number = 0;
    std::cin >> number;
    ListNode<student>* itor;
    for (itor = _list.begin(); itor != _list.end(); itor = itor->next()) {
        if (itor->data().number() == number) {
            std::cout << "Please enter the name, gender, age and application type of the candidate to be modified! " << '\n';
            student a;
            std::cin >> a._name >> a._sex >> a._age >> a._type;
            a._number = number;
            _list.change(a, itor);
            return true;
        }
    }
    if (itor == _list.end()) {
        std::cout << "The candidate information system does not have the candidate information" << '\n';
        return false;
    }
    return false;
}

bool List<T>::change(const T& newitem, ListNode<T>* itor) {
    if (!itor || itor == this->_head)
        return false;
    itor->setData(newitem);
    return true;
}

void setData(T d) { _data = d; } //设置数据
```

3.4.3 修改功能截屏示例

```
root@iZbp180dvecytxjnhuzrdrnZ:~/css_design/subject# ./pl.out
First, please establish a candidate information system!
Please enter the number of candidates:3
Please enter the candidate's exam number, name, gender, age and application type in turn
!
1 stu1 女 20 软件设计师
2 stu2 男 21 软件开发师
3 stu3 男 20 软件设计师

test numbername    sex    age    application type
1      stu1      女     20      软件设计师
2      stu2      男     21      软件开发师
3      stu3      男     20      软件设计师
Please select the operation you want to perform (1 means insert, 2 means delete, 3 means
search, 4 means modify, 5 means statistics, 0 means cancel operation)

Please choose what you want to do: 4
Please enter the candidate number of the candidate to be modified: 1
Please enter the name, gender, age and application type of the candidate to be modified!
stu4 男 22 软件开发师

test numbername    sex    age    application type
1      stu4      男     22      软件开发师
2      stu2      男     21      软件开发师
3      stu3      男     20      软件设计师
Please choose what you want to do: 4
Please enter the candidate number of the candidate to be modified: 0
The candidate information system does not have the candidate information

test numbername    sex    age    application type
1      stu4      男     22      软件开发师
2      stu2      男     21      软件开发师
3      stu3      男     20      软件设计师
Please choose what you want to do: █
```

3.5 统计功能的实现

3.5.1 统计功能流程图

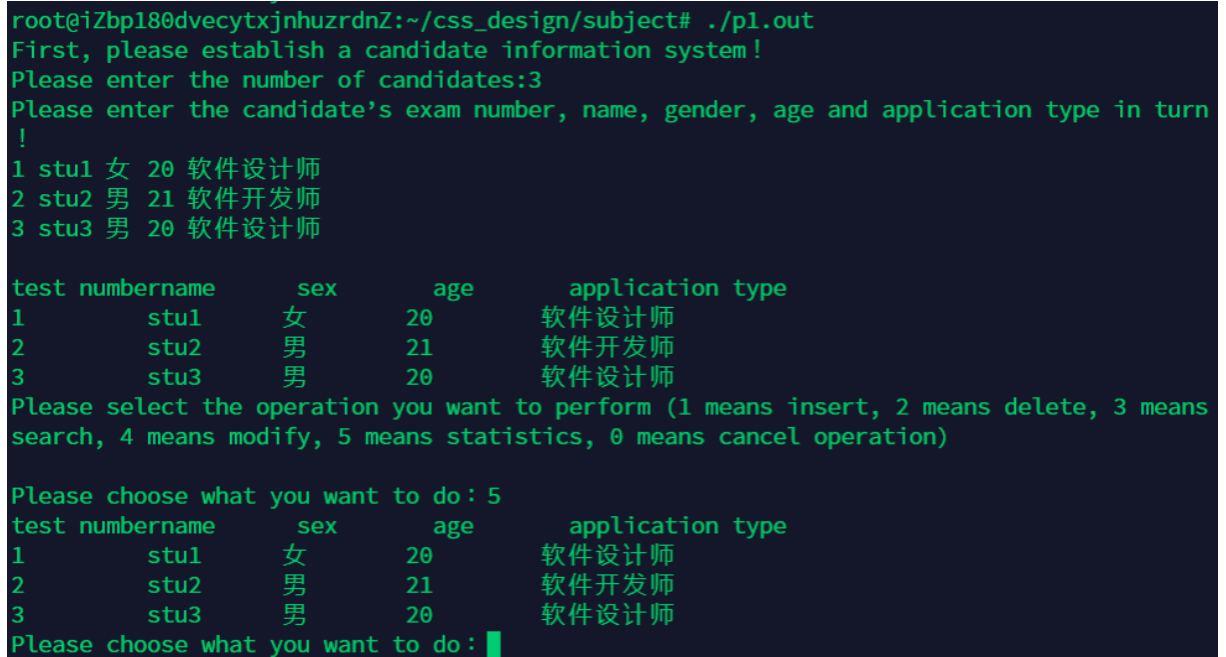


3.5.2 统计功能核心代码

```
void EMIS::statistics()const{
    print();
}

void EMIS::print() const {
    //std::cout.setf(std::ios::left);
    std::cout << std::setiosflags(std::ios::left)<<std::setw(blank-
space_num) << "test number" << std::setw(blankspace_num) << "name"
    << std::setw(blankspace_num) << "sex" << std::setw(blank-
space_num) << "age"
    << std::setw(blankspace_num) << "application type" << '\n';
    ListNode<student>* itor;
    for (itor = this->_list.begin(); itor != this->_list.end(); itor = itor-
>next()) {
        std::cout << itor->data();
    }
}
```

3.5.3 统计功能截屏示例



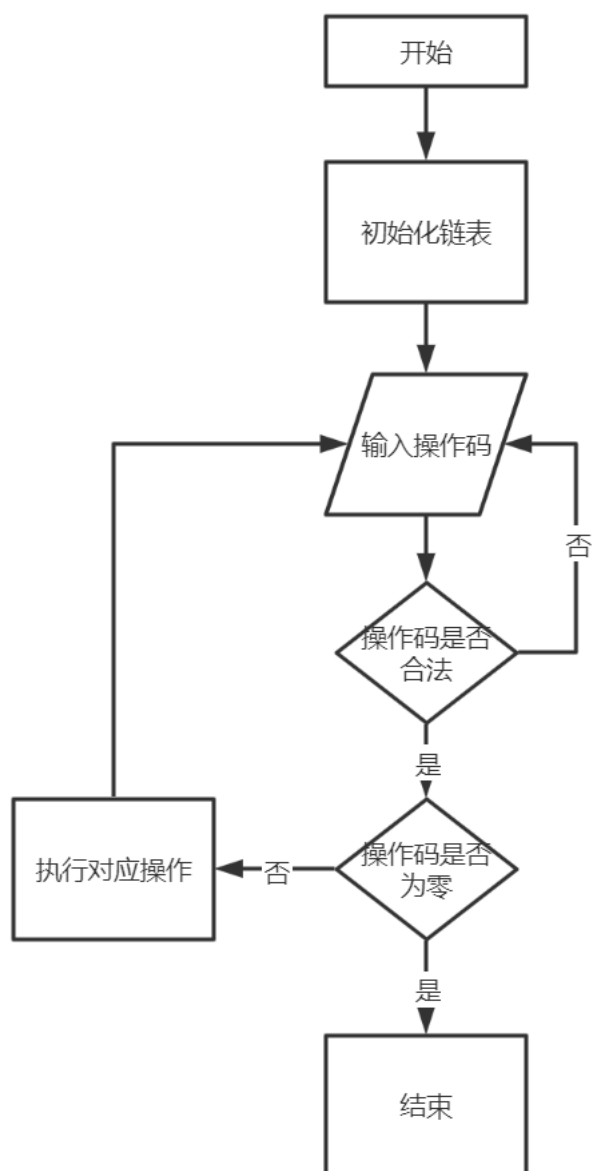
```
root@iZbp180dvecytxjnhuzrdnZ:~/css_design/subject# ./pl.out
First, please establish a candidate information system!
Please enter the number of candidates:3
Please enter the candidate's exam number, name, gender, age and application type in turn
!
1 stu1 女 20 软件设计师
2 stu2 男 21 软件开发师
3 stu3 男 20 软件设计师

test numbername      sex      age      application type
1      stu1      女      20      软件设计师
2      stu2      男      21      软件开发师
3      stu3      男      20      软件设计师
Please select the operation you want to perform (1 means insert, 2 means delete, 3 means
search, 4 means modify, 5 means statistics, 0 means cancel operation)

Please choose what you want to do: 5
test numbername      sex      age      application type
1      stu1      女      20      软件设计师
2      stu2      男      21      软件开发师
3      stu3      男      20      软件设计师
Please choose what you want to do: █
```

3.6 总体系统的实现

3.6.1 总体系统流程图



3.6.2 总体系统核心代码

```

void solve() {
    EMIS stus;
    std::cout << "First, please establish a candidate information system! " << '\n';
    int num = 0;
    std::cout << "Please enter the number of candidates:";
    std::cin >> num;
    while (num < 0) {
        std::cout << "Please enter a natural number: ";
        std::cin >> num;
    }
    std::cout << "Please enter the candidate's exam number, name, gender, age and applicati
on type in turn! " << '\n';
    for (int i = 1; i <= num;) {
        student stu;
        std::cin >> stu;
        if (std::cin.fail()) {
            std::cin.clear();
            std::cin.ignore(100, '\n');
        }
        else {
            stus.push(stu); i++;
        }
    }
    std::cout << '\n';
    stus.print();
    std::cout << "Please select the operation you want to perform (1 means insert, 2 means d
elete, 3 means search, 4 means modify, 5 means statistics, 0 means cancel operation)" << '\
n' << '\n';
    while (true)
    {
        if (std::cin.fail()) {
            std::cin.clear();
            std::cin.ignore(100, '\n');
        }
        int order = 6;
        std::cout << "Please choose what you want to do: ";
        std::cin >> order;
        if (order < 0 || order > 5) {
            std::cout << "Input errors, please re-enter" << '\n';
            continue;
        }
        if (std::cin.fail()) {
            std::cin.clear();

```

```
        std::cin.ignore(100, '\n');
        std::cout << "Input errors, please re-enter" << '\n';
        continue;
    }
    if (order == 1) {
        stus.insert();
        std::cout << '\n';
        stus.print();
    }
    else if (order == 2) {
        stus.del();
        std::cout << '\n';
        stus.print();
    }
    else if (order == 3) {
        stus.seek();
        std::cout << '\n';
    }
    else if (order == 4) {
        stus.revise();
        std::cout << '\n';
        stus.print();
    }
    else if (order == 5) {
        stus.statistics();
    }
    else if (order == 0)
        break;
}
}
```

3.6.3 总体系统截屏示例

```
root@iZbp180dvecytxjnhuzrdnZ:~/css_design/subject# ./p1.out
First, please establish a candidate information system!
Please enter the number of candidates:█
```