中国科学技术大学计算机学院

数据结构实验报告

实验题目：<u>电梯模拟</u>

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完成日期：<u>2021 年 11 月 29 日</u>

计算机实验教学中心制

2020 年 09 月

1　实验题目

设计一个电梯模拟系统。这是一个离散的模拟程序，因为电梯系统是乘客和电梯等"活动体"构成的集合，虽然他们彼此交互作用，但他们的行为是基本独立的。在离散事件的模拟中，以模拟时钟决定每个活动体的动作发生的时刻和顺序，系统在某个模拟瞬间处理待完成的各种事情，然后把模拟时钟推进到某个动作预定要发生的下一时刻。在本次实验中，我实现了全部基本功能及全部扩展功能（即两部电梯）。

2　需求分析

1. 模拟某校五层教学楼的电梯系统。该楼有**两**个自动电梯，能在每层停留。五个楼层由下至上依次称为第零层、第一层、第二层、第三层和第四层，其中第一层是大楼的进出层，即是电梯的"本垒层"，电梯"空闲"时，将来该层候命。

2. 乘客可随机地进出于任何层。对每个人来说，他有一个能容忍的最长等待时间，一旦等候电梯时间过长，他将放弃。

3. 人和电梯的各种动作均要耗费一定时间。

4. 按时许显示系统状态的变化过程：发生的全部人和电梯的动作序列。

3　概要设计

3.1　电梯类型

```
enum ElevatorState {
    goingUp, goingDown, idle, preparing, opening, closing, enterOrLeave,
    acceleratingUp,acceleratingDown,deceleratingUp,deceleratingDown
};
//    bool enterOrLeave;   D1, whether man is entering or leaving elevator
//    bool idle;           D2, whether elevator has stayed for 300t
//    bool vainOpen;       D3, whether elevator door is open & nobody goes through

class Elevator {
public:
    int code;
    int currentFloor;               //current position of thr elevator
    ElevatorState state;            //current state of elevator
    MyLinkList passengers;  //use list to sort students in elevator
    int actionTime;                 //the time when next action of elevator occurs
    int station;                    //the next floor elevator need stop at
    int destination;                //the last floor where elevator end going up or down
    bool callCar[5];
    int distance[5];

    Elevator(int);
    void waitInFirstFloor();    //E1, wait in the first currentFloor

    //realised in controller function in system class
    //void changeState();       E2, determine whether to change the state

    void openDoor();            //E3, open the swing door
    void inAndOut();            //E4, let students get in and out of the elevator1
    void closeDoor();           //E5, shut the swing door
    void prepare();             //E6, prepare for moving
    void upOneFloor();          //E7, go up a currentFloor
    void downOneFloor();        //E8, go down a currentFloor
    void startDecelerate();
    int checkDistance();

    //maybe it isn't needed in this programme
    //void noAction();          E9, make D2 0

    std::string getState() const;
};
```

3.2 楼层类型

```
class Storey {
  public:
    int floor;                      //the floor of the storey
    bool callUp;                    //up button at each storey
    bool callDown;                  //down button at each storey
    MyLinkList listUp;         //list of students going up, realised by list
    MyLinkList listDown;      //list of students going down, realised by list

    explicit Storey(int);
    //make a student in queue including listUp and listDown
    void enQueue(Student &);
    //check whether there is a student who wants to give up
    void checkGiveUp();
};
```

3.3 学生类型

```
class Student {
  public:
    int inFloor;         //the floor student gets into elevator
    int outFloor;        //the floor student gets off elevator
    int giveUpTime;      //the time when student give up waiting for elevator
    int interTime;       //the time when next student occurs
    int number;          //the sequence of student
    Student*next;

    Student();
    explicit Student(int);          //M1, enter system, and prepare for next student's appearance
    //realised in storey and elevator class
//    void enterAndWait()const;    M2, press button and wait
//    void queue();                M3, wait in queue
//    void giveUp();               M4, give up
//    void enterElevator();        M5, enter the elevator
//    void leave();                M6, leave
};
```

3.4 系统类型

```
class System {
  public:
    bool hasChanged;                      //if the system has changed, it needs outputting.

    System();
    //static may result in bug
    static void Controller(Elevator &); //control elevator
    static void callElevator();         //give elevator station and destination in time
    static void outputState();          //output state of the system
    static void createStudent(int &);   //a student gets into the system
};
```

3.5 链表类型

```
class MyLinkList {
public:
    Student *head;
    Student *tail;

    MyLinkList();
    int size();
    void pop_front();
    void push_back(Student &);
    Student *erase(Student *);
    Student front();
    bool empty();
};
```

3.6 主程序

主程序是程序的主要部分, 在主程序中, 实现了对头文件的引用、全局变量的声明、时间循环控制、及电梯状态的输出。

3.7 调用关系

主程序调用系统类，系统类调用电梯类、学生类、楼层类。

4 详细设计

4.1 常量，全局变量和类型定义

```
typedef int Time;

extern Storey storey[5];                    //definition of 5 storeys
extern System system1;                      //definition of the event system
extern Elevator elevator1;                  //definition of elevator 1
extern Elevator elevator2;                  //definition of elevator 1
extern Time currentTime,occurTime;          //global time & current time

constexpr int MAX_CAPACITY(10);             //max capacity of an elevator
constexpr int UP_TIME(51);                  //time of going up a floor
constexpr int DOWN_TIME(61);                //time of going down a floor
constexpr int CLOSE_TIME(20);               //time of closing door
constexpr int OPEN_TIME(20);                //time of opening door
constexpr int ENTER_OR_LEAVE_TIME(20);      //time of the first time door open
constexpr int DURATION_TIME(1000);          //time of all the events
constexpr int IDLE_TIME(300);               //if elevator isn't used for such time, it'll be set idle
constexpr int UP_ACCELERATE_TIME(15);       //time of elevator accelerate up
constexpr int DOWN_ACCELERATE_TIME(15);     //time of elevator accelerate down
constexpr int UP_DECELERATE_TIME(14);       //time of elevator decelerate up
constexpr int DOWN_DECELERATE_TIME(23);     //time of elevator decelerate down
#endif //DATASTRUCTUREBHW1_MAIN_H
```

4.2 电梯开门

```
void Elevator::openDoor() {
//if elevator will go up, callUP canceled in current floor
//it occurs when elevator is going up, or idle, or it has reached destination of going down
if ((state == deceleratingUp
    || state == idle
    || state == deceleratingDown
       && destination == currentFloor)
   && storey[currentFloor].callUp) {
    storey[currentFloor].callUp = false;
}
    //if elevator will go down, callDOWN canceled in current floor
    //it occurs when elevator is going down, or it has reached destination of going up
else if ((state == deceleratingDown
       || state == idle
       || state == deceleratingUp
          && destination == currentFloor)
      && storey[currentFloor].callDown) {
    storey[currentFloor].callDown = false;
}
//cancel the button of current floor
callCar[currentFloor] = false;
state = opening;
actionTime = currentTime + OPEN_TIME;
system1.hasChanged = true;
}
```

4.3 人上下电梯

```
void Elevator::inAndOut() {
state = enterOrLeave;
//Students get off the elevator.
for (auto *iter = passengers.head->next; iter != nullptr;) {
    if (iter->outFloor == currentFloor) {
        std::cout << "\tStudent " << iter->number << " gets off elevator " << code << ".\n";
        iter = passengers.erase(iter);
    } else {
        iter = iter->next;
    }
}
//Students get into the elevator
if (!storey[currentFloor].callDown) {
    for (; !storey[currentFloor].listDown.empty()
```

```
            && passengers.size() != MAX_CAPACITY;) {
        Student s = storey[currentFloor].listDown.front();
        std::cout << "\tStudent " << s.number << " gets into elevator " << code << " .\n";
        passengers.push_back(s);
        callCar[s.outFloor] = true;
        storey[currentFloor].listDown.pop_front();
    }
}
if (!storey[currentFloor].callUp) {
    for (; !storey[currentFloor].listUp.empty()
            && passengers.size() != MAX_CAPACITY;) {
        Student s = storey[currentFloor].listUp.front();
        std::cout << "\tStudent " << s.number << " gets into elevator " << code << " .\n";
        passengers.push_back(s);
        callCar[s.outFloor] = true;
        storey[currentFloor].listUp.pop_front();
    }
}
actionTime = currentTime + ENTER_OR_LEAVE_TIME;
system1.hasChanged = true;
}
```

4.4　电梯测距

```
int Elevator::checkDistance() {
    for (int i = 0; i < 5; i++) {
        int distance1 = 100, distance2 = 100, distance3 = 100;
        //check callCar
        if (callCar[i]) {
            distance1 = abs(i - currentFloor);
        }
        //check callUp
        if (storey[i].callUp) {
            if (destination >= currentFloor) {
                if (i >= currentFloor) {
                    distance2 = i - currentFloor;
                } else {
                    distance2 = destination - i + destination - currentFloor;
                }
            } else {
                if (i < destination) {
                    distance2 = currentFloor - i;
                } else {
                    distance2 = i - destination + currentFloor - destination;
                }
            }
        }
        //check callDown
        if (storey[i].callDown) {
            if (destination >= currentFloor) {
                if (destination >= i) {
                    distance3 = destination - i + destination - currentFloor;
                } else {
                    distance3 = i - currentFloor;
                }
            } else {
                if (i > currentFloor) {
                    distance3 = i - destination + currentFloor - destination;
                } else {
                    distance3 = currentFloor - i;
                }
            }
        }
        distance[i] = std::min(std::min(distance1, distance2), distance3);
    }
}
```

4.5　人排队

```
//Enqueue students into two lists distinguished by up or down
void Storey::enQueue(Student &student) {
    if (student.outFloor > floor) {
        if (elevator1.state == enterOrLeave
            && elevator1.currentFloor == floor
            && elevator1.destination >= elevator1.currentFloor) {
            elevator1.inAndOut();
        } else if (elevator1.state == closing
                && elevator1.currentFloor == floor
                && elevator1.destination >= elevator1.currentFloor) {
```

```cpp
            elevator1.openDoor();
        } else if (elevator2.state == enterOrLeave
                && elevator2.currentFloor == floor
                && elevator2.destination >= elevator2.currentFloor) {
            elevator2.inAndOut();
        } else if (elevator2.state == closing
                && elevator2.currentFloor == floor
                && elevator2.destination >= elevator2.currentFloor) {
            elevator2.openDoor();
        } else if (elevator1.state == opening
                && elevator1.currentFloor == floor
                && elevator1.destination >= elevator1.currentFloor
                || elevator2.state == opening
                    && elevator2.currentFloor == floor
                    && elevator2.destination >= elevator2.currentFloor) {
            listUp.push_back(student);
        } else {
            listUp.push_back(student);
            callUp = true;
        }
    } else if (student.outFloor < floor) {
        if (elevator1.state == enterOrLeave
            && elevator1.currentFloor == floor
            && elevator1.destination <= elevator1.currentFloor) {
            elevator1.inAndOut();
        } else if (elevator1.state == closing
                && elevator1.currentFloor == floor
                && elevator1.destination <= elevator1.currentFloor) {
            elevator1.openDoor();
        } else if (elevator2.state == enterOrLeave
                && elevator2.currentFloor == floor
                && elevator2.destination <= elevator2.currentFloor) {
            elevator2.inAndOut();
        } else if (elevator2.state == closing
                && elevator2.currentFloor == floor
                && elevator2.destination <= elevator2.currentFloor) {
            elevator2.openDoor();
        } else if (elevator1.state == opening
                && elevator1.currentFloor == floor
                && elevator1.destination <= elevator1.currentFloor
                || elevator2.state == opening
                    && elevator2.currentFloor == floor
                    && elevator2.destination <= elevator2.currentFloor) {
            listDown.push_back(student);
        } else {
            listDown.push_back(student);
            callDown = true;
        }
    }
}
```

4.6 随机产生人

```cpp
extern "C" { errno_t rand_s(unsigned int *); }

Student::Student(int number) {
    Student::number = number;
    //although a seed is set, it is still not so randomly
    static std::mt19937_64 engine([]() -> unsigned int {
        unsigned int number;
        rand_s(&number);
        return number;
    }());
    std::uniform_real_distribution<double> random(0, 1);
    inFloor = int(random(engine) * 5);
    outFloor = int(random(engine) * 5);
    for (; inFloor == outFloor;) {
        outFloor = int(random(engine) * 5);
    }
    giveUpTime = currentTime + int(random(engine) * 100) + 300;
    interTime = int(random(engine) * 100) + 1;
    system1.hasChanged = true;
    next = nullptr;
}
```

4.7 电梯状态确定

```cpp
void System::Controller(Elevator &elevator) {
//there are several circumstances when the door need opening,
```

```cpp
//it is elevator is going up, going down, or idle & station equal to current floor,
//& button of current floor in elevator is on, or the direction of elevator is equal to
//the button which is on in current floor, or elevator has reached destination,
//or elevator is closing, but a student press button in current floor & it is equal tp
//the direction of elevator
if ((currentTime == elevator.actionTime
        && (elevator.state == deceleratingDown
            || elevator.state == deceleratingUp)
      || elevator.state == idle)
    && ((elevator.currentFloor == elevator.station
          && (elevator.callCar[elevator.currentFloor]
              || elevator.state == deceleratingDown
                  && storey[elevator.currentFloor].callDown
              || elevator.state == deceleratingUp
                  && storey[elevator.currentFloor].callUp))
        || (elevator.currentFloor == elevator.destination
            && (storey[elevator.currentFloor].callUp
                || storey[elevator.currentFloor].callDown)))
      || elevator.state == closing
          && elevator.passengers.size() != MAX_CAPACITY
          && (storey[elevator.currentFloor].callUp
              && elevator.destination > elevator.currentFloor
            || storey[elevator.currentFloor].callDown
                && elevator.destination < elevator.currentFloor)) {
    elevator.openDoor();
} else if (currentTime == elevator.actionTime
        && (goingUp == elevator.state
            && elevator.station > elevator.currentFloor
            || acceleratingUp == elevator.state)) {
    elevator.upOneFloor();
} else if (currentTime == elevator.actionTime
        && (goingDown == elevator.state
            && elevator.station < elevator.currentFloor
            || acceleratingDown == elevator.state)) {
    elevator.downOneFloor();
} else if (currentTime == elevator.actionTime
        && enterOrLeave == elevator.state) {
    elevator.closeDoor();
} else if (currentTime == elevator.actionTime
        && opening == elevator.state) {
    elevator.inAndOut();
} else if (currentTime == elevator.actionTime
        && closing == elevator.state
      || idle == elevator.state
          && elevator.destination != elevator.currentFloor
      || elevator.state == idle
      || (elevator.state == deceleratingUp
          && !elevator.callCar[elevator.currentFloor]
          && !storey[elevator.currentFloor].callDown
          && !storey[elevator.currentFloor].callUp)) {
    elevator.prepare();
} else if (currentTime == elevator.actionTime + IDLE_TIME) {
    elevator.waitInFirstFloor();
} else if (currentTime == elevator.actionTime
        && elevator.passengers.size() != MAX_CAPACITY
        && (goingDown == elevator.state
            || goingUp == elevator.state)
        && elevator.station == elevator.currentFloor) {
    elevator.startDecelerate();
}
//haven't realized waiting in first floor
}
```

4.8 电梯调度

```cpp
void System::callElevator() {
  elevator1.checkDistance();
  elevator2.checkDistance();
  int minDistance = 100, station_t = elevator1.currentFloor;
  //set station of elevator 1
  if (elevator1.state != acceleratingUp
      && elevator1.state != deceleratingUp
      && elevator1.state != acceleratingDown
      && elevator1.state != deceleratingDown) {
    for (int i = 0; i < 5; i++) {
      if (elevator1.distance[i] < minDistance
          && !(i == elevator1.currentFloor
              && (elevator1.state == enterOrLeave
                  || elevator1.state == opening
                  || elevator1.state == closing))) {
        minDistance = elevator1.distance[i];
```

```
                station_t = i;
            }
        }
        elevator1.station = station_t;
        //set destination of elevator 1
        if (elevator1.station > elevator1.currentFloor
            || elevator1.station == elevator1.currentFloor
              && elevator1.destination > elevator1.currentFloor) {
            for (int i = 4; i >= elevator1.station; i--) {
                if (elevator1.callCar[i]
                    || storey[i].callDown
                    || storey[i].callUp) {
                    elevator1.destination = i;
                    break;
                }
            }
        } else if (elevator1.station < elevator1.currentFloor
                  || elevator1.station == elevator1.currentFloor
                    && elevator1.destination < elevator1.currentFloor) {
            for (int i = 0; i <= elevator1.station; i++) {
                if (elevator1.callCar[i]
                    || storey[i].callDown
                    || storey[i].callUp) {
                    elevator1.destination = i;
                    break;
                }
            }
        }
    }
}
//set station of elevator 2
if (elevator1.state != acceleratingUp
    && elevator1.state != deceleratingUp
    && elevator1.state != acceleratingDown
    && elevator1.state != deceleratingDown) {
    minDistance = 100, station_t = elevator2.currentFloor;
    for (int i = 0; i < 5; i++) {
        if (elevator2.distance[i] < minDistance
            && !(i == elevator2.currentFloor
                && (elevator2.state == enterOrLeave
                    || elevator2.state == opening
                    || elevator2.state == closing))
            && (elevator2.callCar[i]
                || elevator1.currentFloor <= elevator1.destination
                    && i != elevator1.destination
                    && (elevator1.currentFloor > i
                        || i > elevator1.destination
                        || storey[i].callDown)
                || elevator1.currentFloor > elevator1.destination
                    && i != elevator1.destination
                    && (elevator1.currentFloor < i
                        || i < elevator1.destination
                        || storey[i].callUp))) {
            minDistance = elevator2.distance[i];
            station_t = i;
        }
    }
    elevator2.station = station_t;
    //set destination of elevator 2

    if (elevator2.station > elevator2.currentFloor
        || elevator2.station == elevator2.currentFloor
          && elevator2.destination > elevator2.currentFloor) {
        elevator2.destination = 4;
        for (int i = 4; i >= elevator2.station; i--) {
            if (elevator2.callCar[i]
                || elevator2.station == i
                || (storey[i].callDown
                    || storey[i].callUp)
                    && (elevator1.currentFloor <= elevator1.destination
                        && i != elevator1.destination
                        && (elevator1.currentFloor > i
                            || i > elevator1.destination
                            || storey[i].callDown)
                    || elevator1.currentFloor > elevator1.destination
                        && i != elevator1.destination
                        && (elevator1.currentFloor < i
                            || i < elevator1.destination
                            || storey[i].callUp))) {
                elevator2.destination = i;
                break;
            }
        }
```

```
        } else if (elevator2.station < elevator2.currentFloor
                || elevator2.station == elevator2.currentFloor
                    && elevator2.destination < elevator2.currentFloor) {
            elevator2.destination = 0;
            for (int i = 0; i <= elevator2.station; i++) {
                if (elevator2.callCar[i]
                        || elevator2.station == i
                        || (storey[i].callDown
                            || storey[i].callUp)
                            && (elevator1.currentFloor <= elevator1.destination
                                && (elevator1.currentFloor > i
                                    || i > elevator1.destination)
                                || elevator1.currentFloor > elevator1.destination
                                    && (elevator1.currentFloor < i
                                        || i < elevator1.destination))) {
                    elevator2.destination = i;
                    break;
                }
            }
        }
    }
}
```

5　调试分析

本次实验中调试花费大量时间。主要由于电梯状态判断复杂、尤其在两部电梯时情况更难判断。每次我都将运行结果标准输出后仔细地一行一行阅读，找到逻辑问题后将 bug 逐一改正。长达 1000 行的输出我看了数十次，终于将各种问题一一解决。其中的 bug 没有典型性，故不在此列举。

6　用户手册

直接运行查看输出即可。

7　测试结果

```
C:\Users\GoldenLengendWindows\CLionProjects\DataStructureBHW1\cmake-build-debug\DataStructureBHW1.exe
student 0 appears!
From:    3        To:      0
Give up time:    322     Next student time:10
Current time:    0
Elevator1:       At floor 1      State:  ACCELERATING UP
0 student in it.         Action time:    15
Station:         3       Destination:    3
Elevator2:       At floor 1      State:  IDLE
0 student in it.         Action time:    0
Station:         1       Destination:    1
Storey0:         0 student for up         0 student for down
Storey1:         0 student for up         0 student for down
Storey2:         0 student for up         0 student for down
Storey3:         0 student for up         1 student for down
Storey4:         0 student for up         0 student for down

student 1 appears!
From:    1        To:      0
Give up time:    407     Next student time:94
Current time:    10
Elevator1:       At floor 1      State:  ACCELERATING UP
0 student in it.         Action time:    15
Station:         3       Destination:    3
Elevator2:       At floor 1      State:  OPENING
0 student in it.         Action time:    30
Station:         1       Destination:    1
Storey0:         0 student for up         0 student for down
Storey1:         0 student for up         1 student for down
Storey2:         0 student for up         0 student for down
Storey3:         0 student for up         1 student for down
Storey4:         0 student for up         0 student for down
```

```
Current time:   15
Elevator1:      At floor 2      State:  GOING UP
0 student in it.        Action time:    66
Station:        3       Destination:    3
Elevator2:      At floor 1      State:  OPENING
0 student in it.        Action time:    30
Station:        1       Destination:    1
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        1 student for down
Storey2:        0 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        0 student for down

Student 1 gets into elevator 2 .
Current time:   30
Elevator1:      At floor 2      State:  GOING UP
0 student in it.        Action time:    66
Station:        3       Destination:    3
Elevator2:      At floor 1      State:  ENTER OR LEAVE
1 student in it.        Action time:    50
Station:        1       Destination:    1
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        0 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        0 student for down

Current time:   50
Elevator1:      At floor 2      State:  GOING UP
0 student in it.        Action time:    66
Station:        3       Destination:    3
Elevator2:      At floor 1      State:  CLOSING
1 student in it.        Action time:    70
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        0 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        0 student for down

Current time:   66
Elevator1:      At floor 3      State:  GOING UP
0 student in it.        Action time:    117
Station:        3       Destination:    3
Elevator2:      At floor 1      State:  CLOSING
1 student in it.        Action time:    70
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        0 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        0 student for down

Current time:   70
Elevator1:      At floor 3      State:  GOING UP
0 student in it.        Action time:    117
Station:        3       Destination:    3
Elevator2:      At floor 1      State:  ACCELERATING DOWN
1 student in it.        Action time:    85
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        0 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        0 student for down

Current time:   85
Elevator1:      At floor 3      State:  GOING UP
0 student in it.        Action time:    117
Station:        3       Destination:    3
Elevator2:      At floor 0      State:  GOING DOWN
1 student in it.        Action time:    146
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        0 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        0 student for down

student 2 appears!
From:   4       To:     0
```

```
Give up time:    468      Next student time:193
Current time:    94
Elevator1:       At floor 3       State:  GOING UP
0 student in it.          Action time:     117
Station:         3       Destination:     3
Elevator2:       At floor 0       State:  GOING DOWN
1 student in it.          Action time:     146
Station:         0       Destination:     0
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        0 student for down
Storey3:         0 student for up        1 student for down
Storey4:         0 student for up        1 student for down

Current time:    117
Elevator1:       At floor 3       State:  DECELERATING UP
0 student in it.          Action time:     131
Station:         3       Destination:     3
Elevator2:       At floor 0       State:  GOING DOWN
1 student in it.          Action time:     146
Station:         0       Destination:     0
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        0 student for down
Storey3:         0 student for up        1 student for down
Storey4:         0 student for up        1 student for down

Current time:    131
Elevator1:       At floor 3       State:  OPENING
0 student in it.          Action time:     151
Station:         3       Destination:     3
Elevator2:       At floor 0       State:  GOING DOWN
1 student in it.          Action time:     146
Station:         0       Destination:     0
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        0 student for down
Storey3:         0 student for up        1 student for down
Storey4:         0 student for up        1 student for down

Current time:    146
Elevator1:       At floor 3       State:  OPENING
0 student in it.          Action time:     151
Station:         4       Destination:     4
Elevator2:       At floor 0       State:  DECELERATING DOWN
1 student in it.          Action time:     169
Station:         0       Destination:     0
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        0 student for down
Storey3:         0 student for up        1 student for down
Storey4:         0 student for up        1 student for down

Student 0 gets into elevator 1 .
Current time:    151
Elevator1:       At floor 3       State:  ENTER OR LEAVE
1 student in it.          Action time:     171
Station:         4       Destination:     4
Elevator2:       At floor 0       State:  DECELERATING DOWN
1 student in it.          Action time:     169
Station:         0       Destination:     0
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        0 student for down
Storey3:         0 student for up        0 student for down
Storey4:         0 student for up        1 student for down

Current time:    169
Elevator1:       At floor 3       State:  ENTER OR LEAVE
1 student in it.          Action time:     171
Station:         4       Destination:     4
Elevator2:       At floor 0       State:  OPENING
1 student in it.          Action time:     189
Station:         0       Destination:     0
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        0 student for down
Storey3:         0 student for up        0 student for down
Storey4:         0 student for up        1 student for down

Current time:    171
Elevator1:       At floor 3       State:  CLOSING
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1 student in it.        Action time:     191
Station:        4       Destination:     4
Elevator2:      At floor 0      State:  OPENING
1 student in it.        Action time:     189
Station:        0       Destination:     0
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        0 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        1 student for down


Student 1 gets off elevator 2 .
Current time:   189
Elevator1:      At floor 3      State:  CLOSING
1 student in it.        Action time:     191
Station:        4       Destination:     4
Elevator2:      At floor 0      State:  ENTER OR LEAVE
0 student in it.        Action time:     209
Station:        0       Destination:     0
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        0 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        1 student for down


Current time:   191
Elevator1:      At floor 3      State:  ACCELERATING UP
1 student in it.        Action time:     206
Station:        4       Destination:     4
Elevator2:      At floor 0      State:  ENTER OR LEAVE
0 student in it.        Action time:     209
Station:        0       Destination:     0
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        0 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        1 student for down


student 3 appears!
From:   2       To:     4
Give up time:   493     Next student time:257
Current time:   193
Elevator1:      At floor 3      State:  ACCELERATING UP
1 student in it.        Action time:     206
Station:        4       Destination:     4
Elevator2:      At floor 0      State:  ENTER OR LEAVE
0 student in it.        Action time:     209
Station:        0       Destination:     0
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        1 student for down


Current time:   206
Elevator1:      At floor 4      State:  GOING UP
1 student in it.        Action time:     257
Station:        4       Destination:     4
Elevator2:      At floor 0      State:  ENTER OR LEAVE
0 student in it.        Action time:     209
Station:        0       Destination:     0
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        1 student for down


Current time:   209
Elevator1:      At floor 4      State:  GOING UP
1 student in it.        Action time:     257
Station:        4       Destination:     4
Elevator2:      At floor 0      State:  CLOSING
0 student in it.        Action time:     229
Station:        2       Destination:     2
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        1 student for down


Current time:   229
Elevator1:      At floor 4      State:  GOING UP
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1 student in it.        Action time:    257
Station:        4       Destination:    4
Elevator2:      At floor 0      State:  ACCELERATING UP
0 student in it.        Action time:    244
Station:        2       Destination:    2
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        1 student for down


Current time:   244
Elevator1:      At floor 4      State:  GOING UP
1 student in it.        Action time:    257
Station:        4       Destination:    4
Elevator2:      At floor 1      State:  GOING UP
0 student in it.        Action time:    295
Station:        2       Destination:    2
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        1 student for down


student 4 appears!
From:   2       To:     4
Give up time:   644     Next student time:306
Current time:   257
Elevator1:      At floor 4      State:  DECELERATING UP
1 student in it.        Action time:    271
Station:        4       Destination:    4
Elevator2:      At floor 1      State:  GOING UP
0 student in it.        Action time:    295
Station:        2       Destination:    2
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        1 student for down


Current time:   271
Elevator1:      At floor 4      State:  OPENING
1 student in it.        Action time:    291
Station:        4       Destination:    4
Elevator2:      At floor 1      State:  GOING UP
0 student in it.        Action time:    295
Station:        2       Destination:    2
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        1 student for down


Student 2 gets into elevator 1 .
Current time:   291
Elevator1:      At floor 4      State:  ENTER OR LEAVE
2 student in it.        Action time:    311
Station:        0       Destination:    0
Elevator2:      At floor 1      State:  GOING UP
0 student in it.        Action time:    295
Station:        2       Destination:    2
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        0 student for down


Current time:   295
Elevator1:      At floor 4      State:  ENTER OR LEAVE
2 student in it.        Action time:    311
Station:        0       Destination:    0
Elevator2:      At floor 2      State:  GOING UP
0 student in it.        Action time:    346
Station:        2       Destination:    2
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        0 student for down


student 5 appears!
From:   3       To:     4
```

```
Give up time:    645     Next student time:355
Current time:    306
Elevator1:       At floor 4      State:  ENTER OR LEAVE
2 student in it.         Action time:    311
Station:         0       Destination:    0
Elevator2:       At floor 2      State:  GOING UP
0 student in it.         Action time:    346
Station:         2       Destination:    2
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         2 student for up        0 student for down
Storey3:         1 student for up        0 student for down
Storey4:         0 student for up        0 student for down


Current time:    311
Elevator1:       At floor 4      State:  CLOSING
2 student in it.         Action time:    331
Station:         0       Destination:    0
Elevator2:       At floor 2      State:  GOING UP
0 student in it.         Action time:    346
Station:         2       Destination:    2
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         2 student for up        0 student for down
Storey3:         1 student for up        0 student for down
Storey4:         0 student for up        0 student for down


Current time:    331
Elevator1:       At floor 4      State:  ACCELERATING DOWN
2 student in it.         Action time:    346
Station:         0       Destination:    0
Elevator2:       At floor 2      State:  GOING UP
0 student in it.         Action time:    346
Station:         2       Destination:    2
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         2 student for up        0 student for down
Storey3:         1 student for up        0 student for down
Storey4:         0 student for up        0 student for down


Current time:    346
Elevator1:       At floor 3      State:  GOING DOWN
2 student in it.         Action time:    407
Station:         0       Destination:    0
Elevator2:       At floor 2      State:  DECELERATING UP
0 student in it.         Action time:    360
Station:         2       Destination:    2
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         2 student for up        0 student for down
Storey3:         1 student for up        0 student for down
Storey4:         0 student for up        0 student for down

student 6 appears!
From:   2       To:     3
Give up time:    728     Next student time:408
Current time:    355
Elevator1:       At floor 3      State:  GOING DOWN
2 student in it.         Action time:    407
Station:         0       Destination:    0
Elevator2:       At floor 2      State:  DECELERATING UP
0 student in it.         Action time:    360
Station:         2       Destination:    2
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         3 student for up        0 student for down
Storey3:         1 student for up        0 student for down
Storey4:         0 student for up        0 student for down


Current time:    360
Elevator1:       At floor 3      State:  GOING DOWN
2 student in it.         Action time:    407
Station:         0       Destination:    0
Elevator2:       At floor 2      State:  OPENING
0 student in it.         Action time:    380
Station:         2       Destination:    2
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         3 student for up        0 student for down
Storey3:         1 student for up        0 student for down
Storey4:         0 student for up        0 student for down
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Student 3 gets into elevator 2 .
Student 4 gets into elevator 2 .
Student 6 gets into elevator 2 .
Current time:    380
Elevator1:       At floor 3       State:  GOING DOWN
2 student in it.          Action time:    407
Station:         0       Destination:    0
Elevator2:       At floor 2       State:  ENTER OR LEAVE
0 student in it.          Action time:    400
Station:         3       Destination:    3
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        0 student for down
Storey3:         1 student for up        0 student for down
Storey4:         0 student for up        0 student for down


Current time:    400
Elevator1:       At floor 3       State:  GOING DOWN
2 student in it.          Action time:    407
Station:         0       Destination:    0
Elevator2:       At floor 2       State:  CLOSING
0 student in it.          Action time:    420
Station:         3       Destination:    4
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        0 student for down
Storey3:         1 student for up        0 student for down
Storey4:         0 student for up        0 student for down


Current time:    407
Elevator1:       At floor 2       State:  GOING DOWN
2 student in it.          Action time:    468
Station:         0       Destination:    0
Elevator2:       At floor 2       State:  CLOSING
0 student in it.          Action time:    420
Station:         3       Destination:    4
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        0 student for down
Storey3:         1 student for up        0 student for down
Storey4:         0 student for up        0 student for down


student 7 appears!
From:   2       To:     0
Give up time:   789     Next student time:469
Current time:    408
Elevator1:       At floor 2       State:  GOING DOWN
2 student in it.          Action time:    468
Station:         2       Destination:    0
Elevator2:       At floor 2       State:  CLOSING
0 student in it.          Action time:    420
Station:         3       Destination:    4
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        1 student for down
Storey3:         1 student for up        0 student for down
Storey4:         0 student for up        0 student for down


Current time:    420
Elevator1:       At floor 2       State:  GOING DOWN
2 student in it.          Action time:    468
Station:         2       Destination:    0
Elevator2:       At floor 2       State:  ACCELERATING UP
0 student in it.          Action time:    435
Station:         3       Destination:    4
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        1 student for down
Storey3:         1 student for up        0 student for down
Storey4:         0 student for up        0 student for down


Current time:    435
Elevator1:       At floor 2       State:  GOING DOWN
2 student in it.          Action time:    468
Station:         2       Destination:    0
Elevator2:       At floor 3       State:  GOING UP
0 student in it.          Action time:    486
Station:         3       Destination:    4
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         0 student for up        1 student for down
Storey3:         1 student for up        0 student for down
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Storey4:　　　　0 student for up　　　0 student for down

Current time:　468
Elevator1:　　At floor 2　　State:　DECELERATING DOWN
2 student in it.　　　Action time:　491
Station:　　　2　　Destination:　0
Elevator2:　　At floor 3　　State:　GOING UP
0 student in it.　　　Action time:　486
Station:　　　3　　Destination:　4
Storey0:　　　0 student for up　　0 student for down
Storey1:　　　0 student for up　　0 student for down
Storey2:　　　0 student for up　　1 student for down
Storey3:　　　1 student for up　　0 student for down
Storey4:　　　0 student for up　　0 student for down

student 8 appears!
From:　2　　To:　　4
Give up time:　814　　Next student time:530
Current time:　469
Elevator1:　　At floor 2　　State:　DECELERATING DOWN
2 student in it.　　　Action time:　491
Station:　　　2　　Destination:　0
Elevator2:　　At floor 3　　State:　GOING UP
0 student in it.　　　Action time:　486
Station:　　　3　　Destination:　4
Storey0:　　　0 student for up　　0 student for down
Storey1:　　　0 student for up　　0 student for down
Storey2:　　　1 student for up　　1 student for down
Storey3:　　　1 student for up　　0 student for down
Storey4:　　　0 student for up　　0 student for down

Current time:　486
Elevator1:　　At floor 2　　State:　DECELERATING DOWN
2 student in it.　　　Action time:　491
Station:　　　2　　Destination:　0
Elevator2:　　At floor 3　　State:　DECELERATING UP
0 student in it.　　　Action time:　500
Station:　　　3　　Destination:　4
Storey0:　　　0 student for up　　0 student for down
Storey1:　　　0 student for up　　0 student for down
Storey2:　　　1 student for up　　1 student for down
Storey3:　　　1 student for up　　0 student for down
Storey4:　　　0 student for up　　0 student for down

Current time:　491
Elevator1:　　At floor 2　　State:　OPENING
2 student in it.　　　Action time:　511
Station:　　　2　　Destination:　0
Elevator2:　　At floor 3　　State:　DECELERATING UP
0 student in it.　　　Action time:　500
Station:　　　3　　Destination:　4
Storey0:　　　0 student for up　　0 student for down
Storey1:　　　0 student for up　　0 student for down
Storey2:　　　1 student for up　　1 student for down
Storey3:　　　1 student for up　　0 student for down
Storey4:　　　0 student for up　　0 student for down

Current time:　500
Elevator1:　　At floor 2　　State:　OPENING
2 student in it.　　　Action time:　511
Station:　　　0　　Destination:　0
Elevator2:　　At floor 3　　State:　OPENING
0 student in it.　　　Action time:　520
Station:　　　3　　Destination:　4
Storey0:　　　0 student for up　　0 student for down
Storey1:　　　0 student for up　　0 student for down
Storey2:　　　1 student for up　　1 student for down
Storey3:　　　1 student for up　　0 student for down
Storey4:　　　0 student for up　　0 student for down

Student 7 gets into elevator 1 .
Current time:　511
Elevator1:　　At floor 2　　State:　ENTER OR LEAVE
3 student in it.　　　Action time:　531
Station:　　　0　　Destination:　0
Elevator2:　　At floor 3　　State:　OPENING
0 student in it.　　　Action time:　520
Station:　　　4　　Destination:　4
Storey0:　　　0 student for up　　0 student for down
Storey1:　　　0 student for up　　0 student for down
Storey2:　　　1 student for up　　0 student for down
Storey3:　　　1 student for up　　0 student for down

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Storey4:         0 student for up        0 student for down


Student 5 gets into elevator 2 .
Current time:    520
Elevator1:       At floor 2       State:  ENTER OR LEAVE
3 student in it.         Action time:    531
Station:         0       Destination:    0
Elevator2:       At floor 3       State:  ENTER OR LEAVE
0 student in it.         Action time:    540
Station:         4       Destination:    4
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         1 student for up        0 student for down
Storey3:         0 student for up        0 student for down
Storey4:         0 student for up        0 student for down


student 9 appears!
From:    2       To:     1
Give up time:    907     Next student time:570
Current time:    530
Elevator1:       At floor 2       State:  ENTER OR LEAVE
3 student in it.         Action time:    550
Station:         0       Destination:    0
Elevator2:       At floor 3       State:  ENTER OR LEAVE
0 student in it.         Action time:    540
Station:         4       Destination:    4
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         1 student for up        0 student for down
Storey3:         0 student for up        0 student for down
Storey4:         0 student for up        0 student for down


Current time:    540
Elevator1:       At floor 2       State:  ENTER OR LEAVE
3 student in it.         Action time:    550
Station:         0       Destination:    0
Elevator2:       At floor 3       State:  CLOSING
0 student in it.         Action time:    560
Station:         4       Destination:    4
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         1 student for up        0 student for down
Storey3:         0 student for up        0 student for down
Storey4:         0 student for up        0 student for down


Current time:    550
Elevator1:       At floor 2       State:  CLOSING
3 student in it.         Action time:    570
Station:         0       Destination:    0
Elevator2:       At floor 3       State:  CLOSING
0 student in it.         Action time:    560
Station:         4       Destination:    4
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         1 student for up        0 student for down
Storey3:         0 student for up        0 student for down
Storey4:         0 student for up        0 student for down


Current time:    560
Elevator1:       At floor 2       State:  CLOSING
3 student in it.         Action time:    570
Station:         0       Destination:    0
Elevator2:       At floor 3       State:  ACCELERATING UP
0 student in it.         Action time:    575
Station:         4       Destination:    4
Storey0:         0 student for up        0 student for down
Storey1:         0 student for up        0 student for down
Storey2:         1 student for up        0 student for down
Storey3:         0 student for up        0 student for down
Storey4:         0 student for up        0 student for down


student 10 appears!
From:    1       To:     0
Give up time:    969     Next student time:668
Current time:    570
Elevator1:       At floor 2       State:  ACCELERATING DOWN
3 student in it.         Action time:    585
Station:         1       Destination:    0
Elevator2:       At floor 3       State:  ACCELERATING UP
0 student in it.         Action time:    575
Station:         4       Destination:    4
Storey0:         0 student for up        0 student for down
```

```
Storey1:         0 student for up          1 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          0 student for down
Storey4:         0 student for up          0 student for down


Current time:    575
Elevator1:       At floor 2       State:  ACCELERATING DOWN
3 student in it.         Action time:   585
Station:        1        Destination:   0
Elevator2:       At floor 4       State:  GOING UP
0 student in it.         Action time:   626
Station:        4        Destination:   4
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          1 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          0 student for down
Storey4:         0 student for up          0 student for down


Current time:    585
Elevator1:       At floor 1       State:  GOING DOWN
3 student in it.         Action time:   646
Station:        1        Destination:   0
Elevator2:       At floor 4       State:  GOING UP
0 student in it.         Action time:   626
Station:        4        Destination:   4
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          1 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          0 student for down
Storey4:         0 student for up          0 student for down


Current time:    626
Elevator1:       At floor 1       State:  GOING DOWN
3 student in it.         Action time:   646
Station:        1        Destination:   0
Elevator2:       At floor 4       State:  DECELERATING UP
0 student in it.         Action time:   640
Station:        4        Destination:   4
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          1 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          0 student for down
Storey4:         0 student for up          0 student for down


Current time:    640
Elevator1:       At floor 1       State:  GOING DOWN
3 student in it.         Action time:   646
Station:        1        Destination:   0
Elevator2:       At floor 4       State:  OPENING
0 student in it.         Action time:   660
Station:        4        Destination:   4
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          1 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          0 student for down
Storey4:         0 student for up          0 student for down


Current time:    646
Elevator1:       At floor 1       State:  DECELERATING DOWN
3 student in it.         Action time:   669
Station:        1        Destination:   0
Elevator2:       At floor 4       State:  OPENING
0 student in it.         Action time:   660
Station:        2        Destination:   2
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          1 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          0 student for down
Storey4:         0 student for up          0 student for down


Current time:    660
Elevator1:       At floor 1       State:  DECELERATING DOWN
3 student in it.         Action time:   669
Station:        1        Destination:   0
Elevator2:       At floor 4       State:  ENTER OR LEAVE
0 student in it.         Action time:   680
Station:        2        Destination:   2
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          1 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          0 student for down
Storey4:         0 student for up          0 student for down
```

17

```
student 11 appears!
From:    3      To:      0
Give up time:    969      Next student time:706
Current time:    668
Elevator1:       At floor 1       State:  DECELERATING DOWN
3 student in it.          Action time:     669
Station:         1        Destination:     0
Elevator2:       At floor 4       State:  ENTER OR LEAVE
0 student in it.          Action time:     680
Station:         2        Destination:     2
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          1 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          1 student for down
Storey4:         0 student for up          0 student for down


Current time:    669
Elevator1:       At floor 1       State:  OPENING
3 student in it.          Action time:     689
Station:         1        Destination:     0
Elevator2:       At floor 4       State:  ENTER OR LEAVE
0 student in it.          Action time:     680
Station:         2        Destination:     2
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          1 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          1 student for down
Storey4:         0 student for up          0 student for down


Current time:    680
Elevator1:       At floor 1       State:  OPENING
3 student in it.          Action time:     689
Station:         0        Destination:     0
Elevator2:       At floor 4       State:  CLOSING
0 student in it.          Action time:     700
Station:         3        Destination:     2
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          1 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          1 student for down
Storey4:         0 student for up          0 student for down


Student 10 gets into elevator 1 .
Current time:    689
Elevator1:       At floor 1       State:  ENTER OR LEAVE
4 student in it.          Action time:     709
Station:         0        Destination:     0
Elevator2:       At floor 4       State:  CLOSING
0 student in it.          Action time:     700
Station:         3        Destination:     2
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          0 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          1 student for down
Storey4:         0 student for up          0 student for down


Current time:    700
Elevator1:       At floor 1       State:  ENTER OR LEAVE
4 student in it.          Action time:     709
Station:         0        Destination:     0
Elevator2:       At floor 4       State:  ACCELERATING DOWN
0 student in it.          Action time:     715
Station:         3        Destination:     2
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          0 student for down
Storey2:         1 student for up          0 student for down
Storey3:         0 student for up          1 student for down
Storey4:         0 student for up          0 student for down


student 12 appears!
From:    4      To:      1
Give up time:    1092     Next student time:709
Current time:    706
Elevator1:       At floor 1       State:  ENTER OR LEAVE
4 student in it.          Action time:     709
Station:         0        Destination:     0
Elevator2:       At floor 4       State:  ACCELERATING DOWN
0 student in it.          Action time:     715
Station:         4        Destination:     2
Storey0:         0 student for up          0 student for down
Storey1:         0 student for up          0 student for down
```

Storey2:　　　　1 student for up　　　0 student for down
Storey3:　　　　0 student for up　　　1 student for down
Storey4:　　　　0 student for up　　　1 student for down

student 13 appears!
From:　　0　　　To:　　　1
Give up time:　　1106　　　Next student time:761
Current time:　　709
Elevator1:　　　At floor 1　　　State: CLOSING
4 student in it.　　　　Action time:　　729
Station:　　　　0　　　Destination:　　0
Elevator2:　　　At floor 4　　　State: ACCELERATING DOWN
0 student in it.　　　　Action time:　　715
Station:　　　　4　　　Destination:　　2
Storey0:　　　　1 student for up　　　0 student for down
Storey1:　　　　0 student for up　　　0 student for down
Storey2:　　　　1 student for up　　　0 student for down
Storey3:　　　　0 student for up　　　1 student for down
Storey4:　　　　0 student for up　　　1 student for down

Current time:　　715
Elevator1:　　　At floor 1　　　State: CLOSING
4 student in it.　　　　Action time:　　729
Station:　　　　0　　　Destination:　　0
Elevator2:　　　At floor 3　　　State: GOING DOWN
0 student in it.　　　　Action time:　　776
Station:　　　　4　　　Destination:　　2
Storey0:　　　　1 student for up　　　0 student for down
Storey1:　　　　0 student for up　　　0 student for down
Storey2:　　　　1 student for up　　　0 student for down
Storey3:　　　　0 student for up　　　1 student for down
Storey4:　　　　0 student for up　　　1 student for down

Current time:　　729
Elevator1:　　　At floor 1　　　State: ACCELERATING DOWN
4 student in it.　　　　Action time:　　744
Station:　　　　0　　　Destination:　　0
Elevator2:　　　At floor 3　　　State: GOING DOWN
0 student in it.　　　　Action time:　　776
Station:　　　　3　　　Destination:　　2
Storey0:　　　　1 student for up　　　0 student for down
Storey1:　　　　0 student for up　　　0 student for down
Storey2:　　　　1 student for up　　　0 student for down
Storey3:　　　　0 student for up　　　1 student for down
Storey4:　　　　0 student for up　　　1 student for down

Current time:　　744
Elevator1:　　　At floor 0　　　State: GOING DOWN
4 student in it.　　　　Action time:　　805
Station:　　　　0　　　Destination:　　0
Elevator2:　　　At floor 3　　　State: GOING DOWN
0 student in it.　　　　Action time:　　776
Station:　　　　3　　　Destination:　　2
Storey0:　　　　1 student for up　　　0 student for down
Storey1:　　　　0 student for up　　　0 student for down
Storey2:　　　　1 student for up　　　0 student for down
Storey3:　　　　0 student for up　　　1 student for down
Storey4:　　　　0 student for up　　　1 student for down

student 14 appears!
From:　　2　　　To:　　　3
Give up time:　　1148　　　Next student time:762
Current time:　　761
Elevator1:　　　At floor 0　　　State: GOING DOWN
4 student in it.　　　　Action time:　　805
Station:　　　　0　　　Destination:　　0
Elevator2:　　　At floor 3　　　State: GOING DOWN
0 student in it.　　　　Action time:　　776
Station:　　　　3　　　Destination:　　2
Storey0:　　　　1 student for up　　　0 student for down
Storey1:　　　　0 student for up　　　0 student for down
Storey2:　　　　2 student for up　　　0 student for down
Storey3:　　　　0 student for up　　　1 student for down
Storey4:　　　　0 student for up　　　1 student for down

student 15 appears!
From:　　0　　　To:　　　4
Give up time:　　1143　　　Next student time:784
Current time:　　762
Elevator1:　　　At floor 0　　　State: GOING DOWN
4 student in it.　　　　Action time:　　805
Station:　　　　0　　　Destination:　　0

```
Elevator2:      At floor 3      State:  GOING DOWN
0 student in it.        Action time:    776
Station:        3        Destination:    2
Storey0:        2 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        1 student for down


Current time:   776
Elevator1:      At floor 0      State:  GOING DOWN
4 student in it.        Action time:    805
Station:        0        Destination:    0
Elevator2:      At floor 3      State:  DECELERATING DOWN
0 student in it.        Action time:    799
Station:        3        Destination:    2
Storey0:        2 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        1 student for down


student 16 appears!
From:   4       To:     2
Give up time:   1160    Next student time:827
Current time:   784
Elevator1:      At floor 0      State:  GOING DOWN
4 student in it.        Action time:    805
Station:        0        Destination:    0
Elevator2:      At floor 3      State:  DECELERATING DOWN
0 student in it.        Action time:    799
Station:        3        Destination:    2
Storey0:        2 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        2 student for down


Current time:   799
Elevator1:      At floor 0      State:  GOING DOWN
4 student in it.        Action time:    805
Station:        0        Destination:    0
Elevator2:      At floor 3      State:  OPENING
0 student in it.        Action time:    819
Station:        3        Destination:    2
Storey0:        2 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        2 student for down


Current time:   805
Elevator1:      At floor 0      State:  DECELERATING DOWN
4 student in it.        Action time:    828
Station:        0        Destination:    0
Elevator2:      At floor 3      State:  OPENING
0 student in it.        Action time:    819
Station:        2        Destination:    2
Storey0:        2 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        2 student for down


Student 8 gives up at storey 2
Current time:   814
Elevator1:      At floor 0      State:  DECELERATING DOWN
4 student in it.        Action time:    828
Station:        0        Destination:    0
Elevator2:      At floor 3      State:  OPENING
0 student in it.        Action time:    819
Station:        2        Destination:    2
Storey0:        2 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        1 student for down
Storey4:        0 student for up        2 student for down


Student 11 gets into elevator 2 .
Current time:   819
Elevator1:      At floor 0      State:  DECELERATING DOWN
4 student in it.        Action time:    828
```

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```
Station:         0        Destination:      0
Elevator2:       At floor 3      State:   ENTER OR LEAVE
0 student in it.         Action time:      839
Station:         2        Destination:      2
Storey0:        2 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down

student 17 appears!
From:    0       To:      1
Give up time:    1163     Next student time:828
Current time:    827
Elevator1:       At floor 0      State:   DECELERATING DOWN
4 student in it.         Action time:      828
Station:         0        Destination:      0
Elevator2:       At floor 3      State:   ENTER OR LEAVE
0 student in it.         Action time:      839
Station:         2        Destination:      2
Storey0:        3 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down

student 18 appears!
From:    1       To:      2
Give up time:    1143     Next student time:874
Current time:    828
Elevator1:       At floor 0      State:   OPENING
4 student in it.         Action time:      848
Station:         0        Destination:      0
Elevator2:       At floor 3      State:   ENTER OR LEAVE
0 student in it.         Action time:      839
Station:         2        Destination:      2
Storey0:        3 student for up        0 student for down
Storey1:        1 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down

Current time:    839
Elevator1:       At floor 0      State:   OPENING
4 student in it.         Action time:      848
Station:         1        Destination:      4
Elevator2:       At floor 3      State:   CLOSING
0 student in it.         Action time:      859
Station:         0        Destination:      0
Storey0:        3 student for up        0 student for down
Storey1:        1 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down

Student 0 gets off elevator 1 .
Student 2 gets off elevator 1 .
Student 7 gets off elevator 1 .
Student 10 gets off elevator 1 .
Student 13 gets into elevator 1 .
Student 15 gets into elevator 1 .
Student 17 gets into elevator 1 .
Current time:    848
Elevator1:       At floor 0      State:   ENTER OR LEAVE
0 student in it.         Action time:      868
Station:         1        Destination:      4
Elevator2:       At floor 3      State:   CLOSING
0 student in it.         Action time:      859
Station:         0        Destination:      0
Storey0:        0 student for up        0 student for down
Storey1:        1 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down

Current time:    859
Elevator1:       At floor 0      State:   ENTER OR LEAVE
0 student in it.         Action time:      868
Station:         1        Destination:      4
Elevator2:       At floor 3      State:   ACCELERATING DOWN
0 student in it.         Action time:      874
Station:         0        Destination:      0
```

```
Storey0:        0 student for up        0 student for down
Storey1:        1 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down


Current time:   868
Elevator1:      At floor 0      State:  CLOSING
0 student in it.        Action time:    888
Station:        1       Destination:    4
Elevator2:      At floor 3      State:  ACCELERATING DOWN
0 student in it.        Action time:    874
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        1 student for up        0 student for down
Storey2:        1 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down


student 19 appears!
From:   2       To:     3
Give up time:   1233    Next student time:954
Current time:   874
Elevator1:      At floor 0      State:  CLOSING
0 student in it.        Action time:    888
Station:        1       Destination:    4
Elevator2:      At floor 2      State:  GOING DOWN
0 student in it.        Action time:    935
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        1 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down


Current time:   888
Elevator1:      At floor 0      State:  ACCELERATING UP
0 student in it.        Action time:    903
Station:        1       Destination:    4
Elevator2:      At floor 2      State:  GOING DOWN
0 student in it.        Action time:    935
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        1 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down


Current time:   903
Elevator1:      At floor 1      State:  GOING UP
0 student in it.        Action time:    954
Station:        1       Destination:    4
Elevator2:      At floor 2      State:  GOING DOWN
0 student in it.        Action time:    935
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        1 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down


Current time:   935
Elevator1:      At floor 1      State:  GOING UP
0 student in it.        Action time:    954
Station:        1       Destination:    4
Elevator2:      At floor 1      State:  GOING DOWN
0 student in it.        Action time:    996
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        1 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down


student 20 appears!
From:   1       To:     4
Give up time:   1329    Next student time:997
Current time:   954
Elevator1:      At floor 1      State:  DECELERATING UP
0 student in it.        Action time:    968
Station:        1       Destination:    4
Elevator2:      At floor 1      State:  GOING DOWN
```

```
0 student in it.        Action time:    996
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        2 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down

Current time:   968
Elevator1:      At floor 1      State:  OPENING
0 student in it.        Action time:    988
Station:        1       Destination:    4
Elevator2:      At floor 1      State:  GOING DOWN
0 student in it.        Action time:    996
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        2 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down

Student 18 gets into elevator 1 .
Student 20 gets into elevator 1 .
Current time:   988
Elevator1:      At floor 1      State:  ENTER OR LEAVE
0 student in it.        Action time:    1008
Station:        2       Destination:    4
Elevator2:      At floor 1      State:  GOING DOWN
0 student in it.        Action time:    996
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down

Current time:   996
Elevator1:      At floor 1      State:  ENTER OR LEAVE
0 student in it.        Action time:    1008
Station:        2       Destination:    4
Elevator2:      At floor 0      State:  GOING DOWN
0 student in it.        Action time:    1057
Station:        0       Destination:    0
Storey0:        0 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down

student 21 appears!
From:   0       To:     2
Give up time:   1368    Next student time:1030
Current time:   997
Elevator1:      At floor 1      State:  ENTER OR LEAVE
0 student in it.        Action time:    1008
Station:        2       Destination:    4
Elevator2:      At floor 0      State:  GOING DOWN
0 student in it.        Action time:    1057
Station:        0       Destination:    0
Storey0:        1 student for up        0 student for down
Storey1:        0 student for up        0 student for down
Storey2:        2 student for up        0 student for down
Storey3:        0 student for up        0 student for down
Storey4:        0 student for up        2 student for down


Process finished with exit code 0
```

测试了 1000 个时间单位，经过人工检验，确定结果完全符合设计。

8　附录

源程序文件名清单：

```
Elevator.h
Elevator.cpp
MyLinkList.h
MyLinkList.cpp
Storey.h
```

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```
Story.cpp
Student.h
Student.cpp
System.h
System.cpp
main.h
main.cpp
```