数据库工程作业报告

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1 项目信息（10分）

1.1 项目名称

Urban_Traffic_System

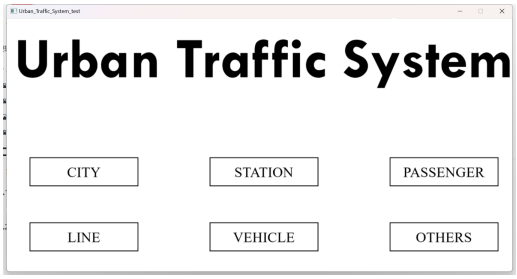
1.2 必备环境

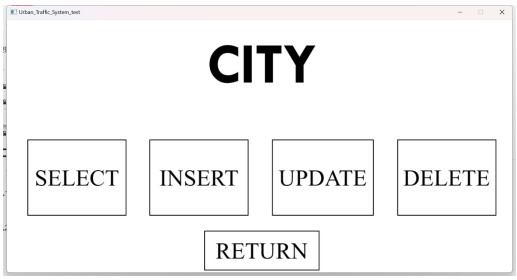
MySQL，Visual Studio 2022

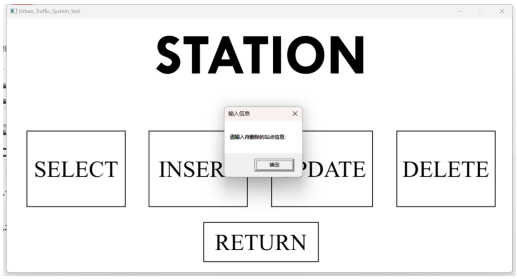
1.3 系统主要功能简介（4分）

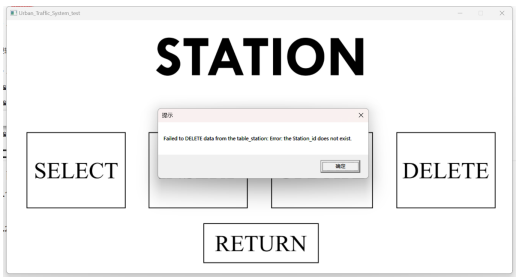
实现了一个简单的城市交通系统数据库的创建与运行。涵盖了包括城市、车站、乘客、线路、车辆等的信息，实现了各类信息的增删改查操作，并按照实际关系添加了彼此间的逻辑约束。

1.4 系统主要页面截图（6分）









2 系统配置（10分）

2.1 配置步骤（2分）

2.1.1 DBMS

百度搜索下载MySQL，下载并安装即可。

2.1.2 高级语言——C++

本次工程作业使用C++语言借助EASYX图形库、mysql库在VS2022上完成。配置过程主要参考 c\c++如何连接mysql数据库（超易上手）_c连接mysql数据库完成。

2.2 连接串分析（6分）

```
MYSQL* mysql_real_connect(MYSQL *mysql, const char *host, const char *user, const char *passwd, const char *database_name, unsigned int port, const char *unix_socket, unsigned long clientflag);
```

序号	名称	功能说明	取值
1	mysql	一个 MYSQL结构的指针，表示MySQL连接句柄。	mysql_init(NULL)
2	host	要连接的MySQL服务器主机名或IP地址。	127.0.0.1
3	user	连接MySQL服务器的用户名。	root
4	passwd	连接MySQL服务器的密码。	LXMliu2002
5	database_name	要连接的数据库名称。	urban_traffic_system
6	port	MySQL服务器的端口号。	3306
7	unix_socket	UNIX套接字的路径，用于连接到本地套接字。	NULL
8	clientflag	连接标志，可以通过位掩码设置不同的选项。	0

2.3 连接串代码（2分）

```
Manager::Manager()
{
    con = mysql_init(NULL);
    //设置字符编码
    mysql_options(con, MYSQL_SET_CHARSET_NAME, "GBK");
    //连接数据库，若连接失败则报错
    if (!mysql_real_connect(con, host, user, pw, database_name, port, NULL, 0))
    {
        fprintf(stderr, "Failed to connect to database : Error:%s\n", mysql_error(con));
        cout << endl;
        return;
    }
}
```

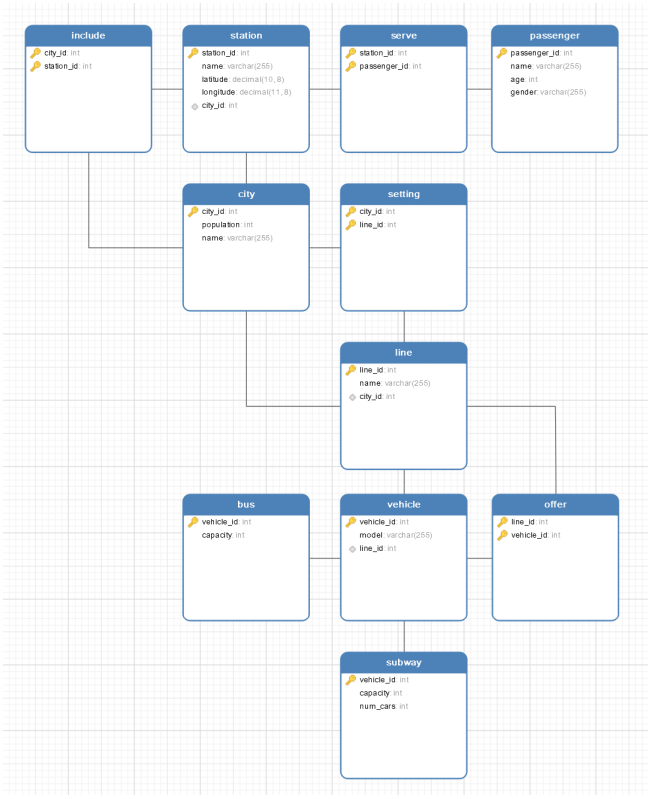
3 数据库设计（14分）

3.1 数据表（10分）

创建顺序	数据表	主键	参照属性	被参照表及属性
1	City	city_id		Station(city_id),Include(city_id),Line(city_id),Setting(city_id)

创建顺序	数据表	主键	参照属性	被参照表及属性
2	Station	station_id	city_id	Include(station_id),Serve(station_id)
3	Include	(city_id, station_id)	city_id,station_id	
4	Passenger	passenger_id		Serve(passenger_id)
5	Serve	(station_id, passenger_id)	station_id,passenger_id	
6	Line	line_id	city_id	Setting(line_id),Offer(line_id),Vehicle(line_id)
7	Setting	(city_id, line_id)	city_id,line_id	
8	Vehicle	vehicle_id	line_id	Offer(vehicle_id),Bus(vehicle_id),Subway(vehicle_id)
9	Offer	(line_id, vehicle_id)	line_id,vehicle_id	
10	Bus	vehicle_id	vehicle_id	
11	Subway	vehicle_id	vehicle_id	

3.2 关系图（4分）



4 含有事务应用的删除操作（13分）

4.1 功能描述（1分）

将某一站点从数据库中删除。

4.2 涉及的表（2分）

- Station
- Include
- Serve

4.3 表连接涉及字段（1分）

- ```
  WHERE include.station_id = station_id
  ```
- ```
  WHERE Serve.station_id = station_id
  ```

4.4 删除条件字段描述（1分）

4.4.1 删除Include

```
DELETE FROM Include WHERE city_id = city_id AND station_id = station_id;
```

删除Include表中station_id与给定值相同的行。

4.4.2 删除Serve

```
DELETE FROM Serve WHERE station_id = station_id AND passenger_id = passenger_id;
```

删除Serve表中station_id与给定值相同的行。

4.4.3 删除Station

```
DELETE FROM Station WHERE station_id = station_id;
```

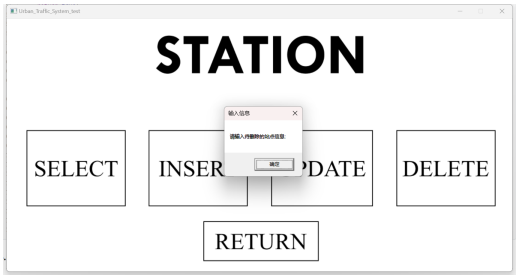
删除Station表中station_id与给定值相同的行。

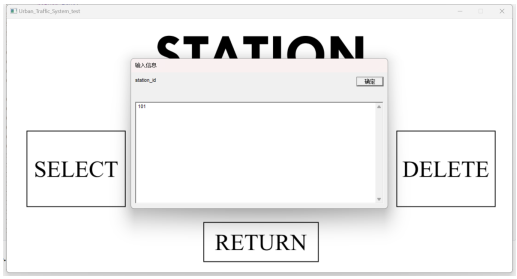
4.5 代码（4分）

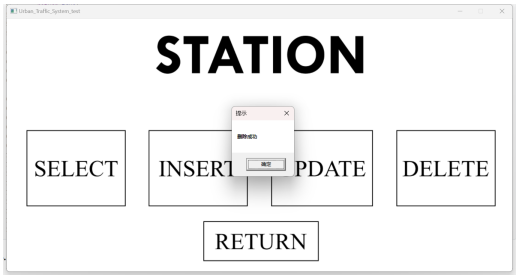
```
//级联删除 Serve Include
bool Manager::Delete_Station(int Station_id)
{
    //检查数据库中是否有station.station_id，若没有，则报错，说明无法删除
    if (Check_Station_station_id(Station_id))
    {
        HWND hwnd = GetHwnd(); // 获取窗口句柄
        MessageBox(hwnd, "Failed to DELETE data from the table_station: Error: the Station_id does not exist.", "提示", MB_OK);
        return false;
    }

    //级联删除 Includee
    Manager::GetInstance()->Delete_Include(Manager::GetInstance()->Get_Stations_City_id(Station_id), Station_id);
    //级联删除 Serve
    vector<int>tmp = Manager::GetInstance()->Get_Serves_Passenger_id(Station_id);
    int tmpsize = tmp.size();
    while (tmpsize > 0)
    {
        Manager::GetInstance()->Delete_Serve(Station_id, tmp[--tmpsize]);
```

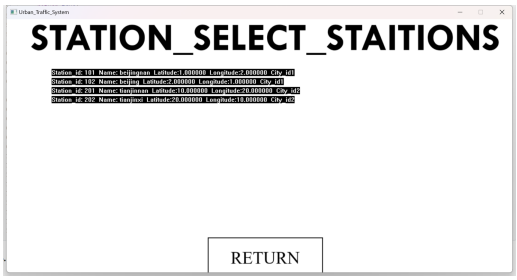
```
    }

    char sql[2000];
    sprintf_s(sql, "DELETE FROM station WHERE station_id=%d", Station_id);
    //若无法删除，则报错并中断程序
    if (mysql_query(con, sql))
    {
        HWND hwnd = GetHWnd(); // 获取窗口句柄
        MessageBox(hwnd, "Failed to DELETE data from the table_station.", "提示", MB_OK);
        return false;
    }


    return true;
}
bool Manager::Delete_Include(int City_id, int Station_id)
{
    //检查数据库中是否有City_id和Station_id，若没有，则报错，说明无法删除
    if (Check_Include_city_id_station_id(City_id, Station_id))
    {
        HWND hwnd = GetHWnd(); // 获取窗口句柄
        MessageBox(hwnd, "Failed to DELETE data from the table_include: Error: the City_id or Station_id does not exist.", "提示", MB_OK);
        return false;
    }

    char sql[2000];
    sprintf_s(sql, "DELETE FROM include WHERE city_id=%d AND station_id=%d", City_id, Station_id);
    //若无法删除，则报错并中断程序
    if (mysql_query(con, sql))
    {
        HWND hwnd = GetHWnd(); // 获取窗口句柄
        MessageBox(hwnd, "Failed to DELETE data to the table_include.", "提示", MB_OK);
        return false;
    }

    return true;
}
bool Manager::Delete_Serve(int Station_id, int Passenger_id)
{
    //检查数据库中是否有Station_id和Passenger_id，若没有，则报错，说明无法删除
    if (Check_Serve_station_id_passenger_id(Station_id, Passenger_id))
    {
        HWND hwnd = GetHWnd(); // 获取窗口句柄
        MessageBox(hwnd, "Failed to DELETE data from the table_serve: Error: the Station_id or Passenger_id does not exist.", "提示", MB_OK);
        return false;
    }

    char sql[2000];
    sprintf_s(sql, "DELETE FROM serve WHERE station_id=%d AND passenger_id=%d", Station_id, Passenger_id);
    //若无法删除，则报错并中断程序
    if (mysql_query(con, sql))
    {
        HWND hwnd = GetHWnd(); // 获取窗口句柄
        MessageBox(hwnd, "Failed to DELETE data from the table_serve.", "提示", MB_OK);
        return false;
    }

    return true;
}
```

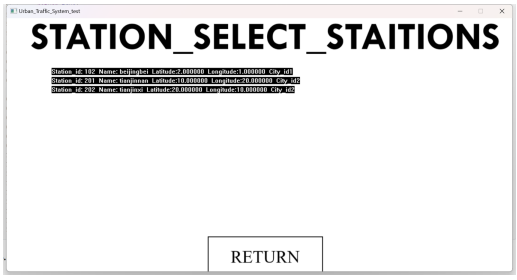
4.6 程序演示（4分）











5 触发器控制下的添加操作（20分）

5.1 功能描述（1分）

添加约束条件，保证数据插入时数据表能维持外键约束。

5.2 触发器描述（2分）

通过对待插入station数据中的city_id的检索，判断City表中是否存在该city_id，若不存在，则弹窗报错，插入失败；若存在，则检索该(station_id,city_id)组合是否存在，若存在则不予插入，若不存在，则正常插入。

5.3 涉及的表（1分）

- City
- Station

5.4 输入数据（2分）

- 不违背触发器：100，beijingbei，1，1，1
- 违背触发器：100，beijingbei，1，1，0

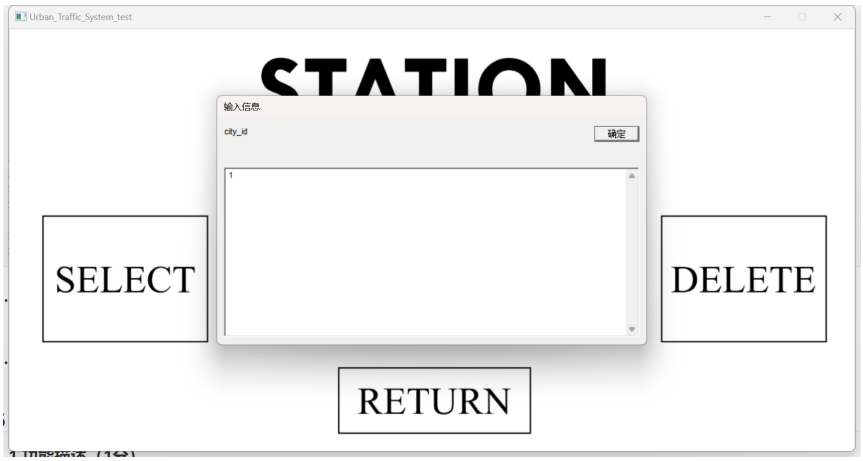
5.5 插入操作源码（3分）

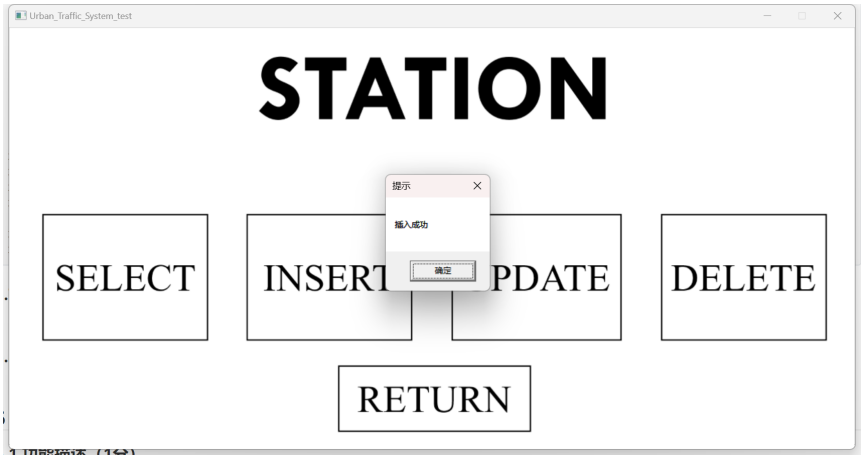
```
char sql[2000];
sprintf_s(sql, "INSERT into station (station_id, name, latitude, longitude, city_id)
values(%d,'%s',%f,%f,%d)",     station.station_id, station.name.c_str(), station.latitude,
station.longitude, station.city_id);
//若无法插入，则报错并中断程序
if (mysql_query(con, sql))
{
    HWND hwnd = GetHWnd(); // 获取窗口句柄
    MessageBox(hwnd, "Failed to INSERT data to the table_station.", "提示", MB_OK);
    return false;
}
//级联插入 Include
Include tmp_include(station.city_id, station.station_id);
Manager::GetInstance()->Insert_Include(tmp_include);
```

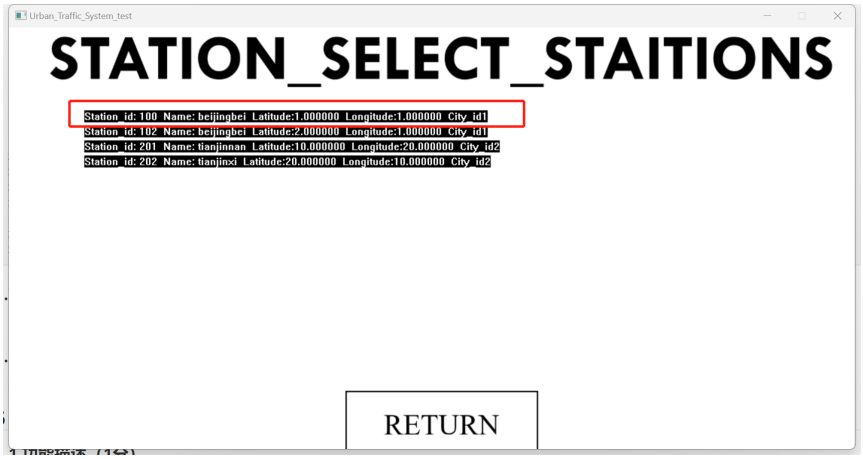
5.6 触发器源码（3分）

```
//检查数据库中是否有该station.city_id，若没有，则报错，说明无法插入
if (Check_City_city_id(station.city_id))
{
    HWND hwnd = GetHWnd(); // 获取窗口句柄
    MessageBox(hwnd, "Failed to INSERT data to the table_station: Error: the station.city_id does not
exist.", "提示", MB_OK);
    return false;
}

//检查数据库中是否有station.station_id和station.city_id，若有，则报错，说明无法插入
if (!Check_Station_station_id_city_id(station.station_id, station.city_id))
{
    HWND hwnd = GetHWnd(); // 获取窗口句柄
    MessageBox(hwnd, "Failed to INSERT data to the table_station: Error: the station.station_id and
station.city_id have existed already.", "提示", MB_OK);
    return false;
}
```

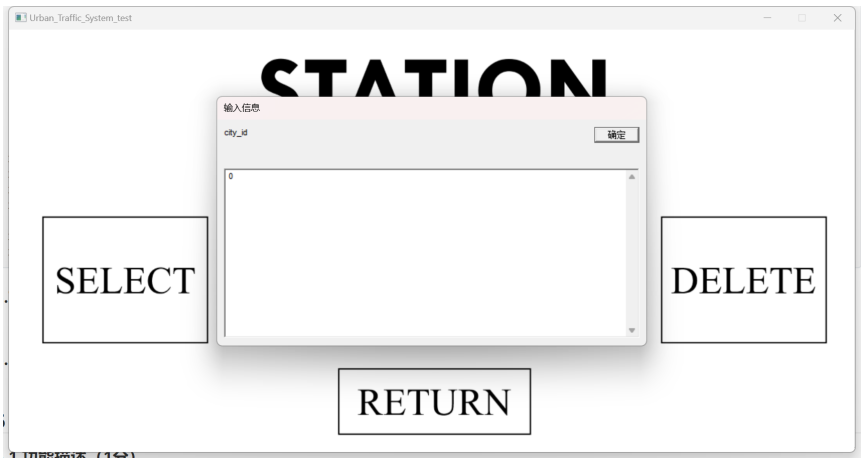
5.7 程序演示：不违背触发器能够执行插入操作（4分）

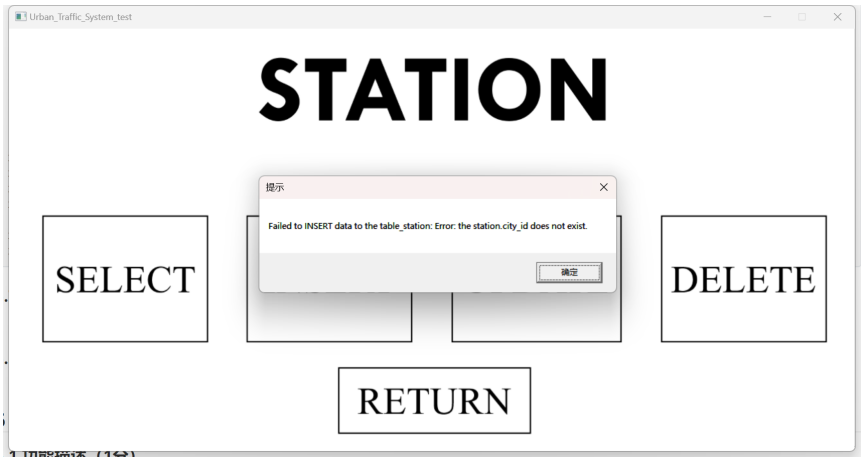


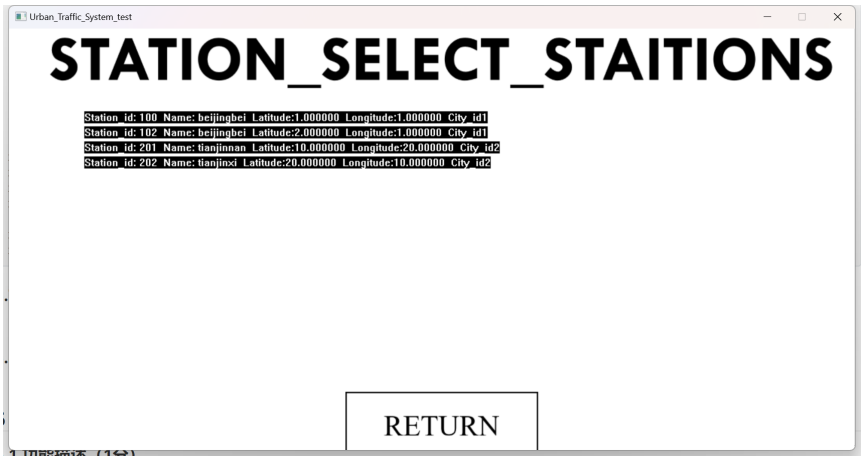




5.8 程序演示：违背触发器要求，不能够执行插入操作，系统报错（4分）







6 存储过程控制下的更新操作（18分）

6.1 功能描述（1分）

按照给定city_id更新其population数据。

6.2 存储过程功能描述（1分）

给定city_id后，按照给定的population值更新其属性，保证name不发生变动。

6.3 涉及的关系表（2分）

- City

6.4 表连接涉及字段（1分）

- city_id

6.5 更改字段（2分）

- population

6.6 更新代码（3分）

```sql
UPDATE City SET population = new_population WHERE city_id = new_city_id;
```

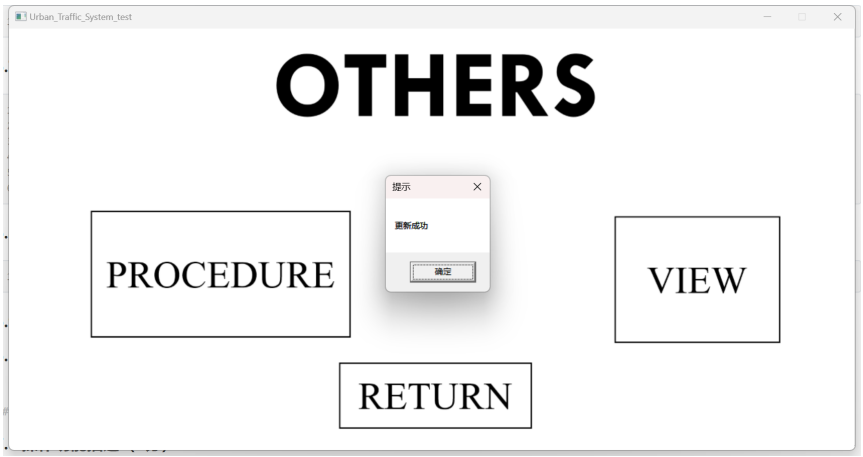
6.7 创建存储过程源码（3分）

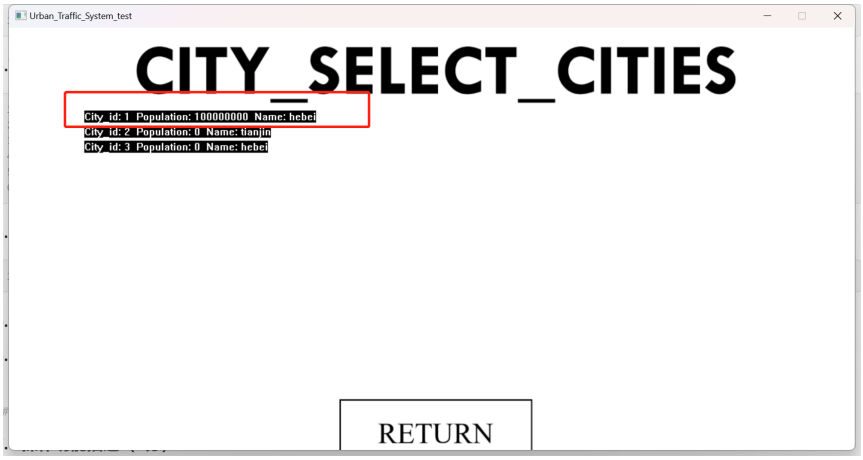
```
DELIMITER \\
CREATE PROCEDURE UpdatePopulation(IN new_city_id INT, IN new_population INT)
BEGIN
UPDATE City SET population = new_population WHERE city_id = new_city_id;
end; \\
DELIMITER ;
```

6.8 存储过程执行源码（1分）

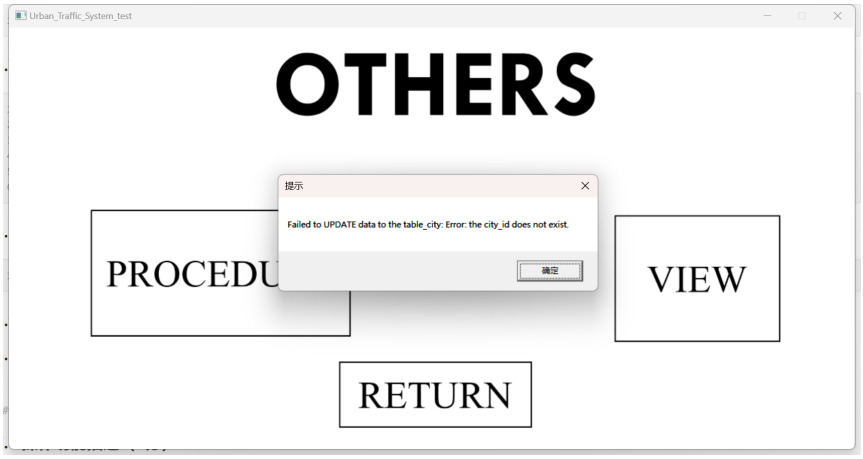
```
CALL UpdateCityPopulation(city_id, population);
```

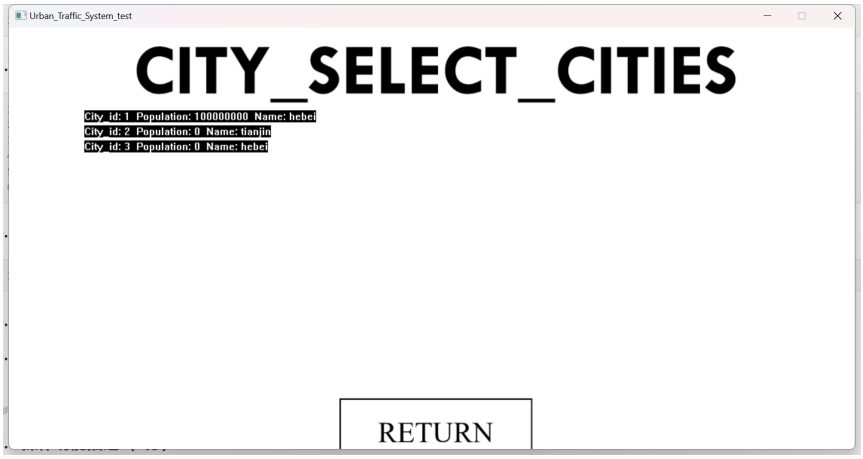
6.9 程序演示：不违背存储过程，能够执行更新操作（2分）





6.10 程序演示：违背存储过程，系统报错（2分）





7 含有视图的查询操作（15分）

7.1 操作功能描述（1分）

查看一个城市中建立的车站数。

7.2 视图功能描述（1分）

将City与Station表连接，建立可动态更新的视图Station_Count，实现城市中车站数量的动态更新。

7.3 涉及的关系表（2分）

- City
- Station

7.4 表连接字段（1分）

```
GROUP BY city_id
```

7.5 创建视图代码（3分）

```
char sql1[2000];
sprintf_s(sql1, "CREATE VIEW Station_Count(city_id, countstations) AS SELECT city_id, COUNT(*) FROM station GROUP BY city_id;");
mysql_query(con, sql1);
```

7.6 查询代码（3分）

```
char sql2[2000];
sprintf_s(sql2, "SELECT * FROM Station_Count");
mysql_query(con, sql2);
```

7.7 程序演示（4分）