《数据库系统原理》实验报告（2）					
题目：交互式 SQL(2)　DML					
学号	2154312	姓名	郑博远	日期	2023.10.17

实验环境：Docker MariaDB

实验步骤及结果截图：

1.创建并进入名为 exp2 的数据库：

```
MariaDB [(none)]> create database exp2
    -> ;
Query OK, 1 row affected (0.001 sec)

MariaDB [(none)]> use exp2
Database changed
MariaDB [exp2]>
```

2.创建四张新的 table：

```
MariaDB [exp2]> CREATE TABLE depts1(
    -> `no` INT NOT NULL AUTO_INCREMENT,
    -> `name` VARCHAR(30) NOT NULL,
    -> PRIMARY KEY (`no`)
    -> );
Query OK, 0 rows affected (0.017 sec)
```

```
MariaDB [exp2]> CREATE TABLE courses1 (
    -> `no` INT NOT NULL AUTO_INCREMENT,
    -> `name` VARCHAR(20) NOT NULL,
    -> `credit` INT NOT NULL,
    -> `d_no` INT NOT NULL,
    -> PRIMARY KEY (`no`),
    -> CONSTRAINT `co_c_1`
    -> FOREIGN KEY (`d_no`)
    -> REFERENCES depts1(`no`)
    -> );
Query OK, 0 rows affected (0.016 sec)
```

```
MariaDB [exp2]> CREATE TABLE students1 (
    ->     `no` INT NOT NULL AUTO_INCREMENT,
    ->     `name` VARCHAR(20) NOT NULL,
    ->     `gender` VARCHAR(6) NOT NULL,
    ->     CHECK(`gender`='Male' OR `gender`='Female'),
    ->     `age` INT NOT NULL,
    ->     `d_no` INT NOT NULL,
    ->     PRIMARY KEY (`no`),
    ->     CONSTRAINT `st_c_1`
    ->     FOREIGN KEY(`d_no`)
    ->     REFERENCES depts1(`no`)
    ->     );
Query OK, 0 rows affected (0.017 sec)
```

```
MariaDB [exp2]> CREATE TABLE scores1 (
    ->     `s_no` INT NOT NULL AUTO_INCREMENT,
    ->     `c_no` INT NOT NULL,
    ->     `score` INT NOT NULL,
    ->     CONSTRAINT `sc_c_1`
    ->     FOREIGN KEY (`s_no`)
    ->     REFERENCES students1(`no`),
    ->     CONSTRAINT `sc_c_2`
    ->     FOREIGN KEY (`c_no`)
    ->     REFERENCES courses1(`no`)
    ->     );
Query OK, 0 rows affected (0.012 sec)
```

3. 在各个表中插入数据：

```
MariaDB [exp2]> insert into depts1 (no,name) values (1, 'Computer Science');
Query OK, 1 row affected (0.009 sec)

MariaDB [exp2]> insert into depts1 (no,name) values (2, 'Mathematics');
Query OK, 1 row affected (0.001 sec)

MariaDB [exp2]> insert into depts1 (no,name) values (3, 'Architecture');
Query OK, 1 row affected (0.001 sec)

MariaDB [exp2]> insert into depts1 (no,name) values (4, 'Management');
Query OK, 1 row affected (0.001 sec)

MariaDB [exp2]>
MariaDB [exp2]> insert into courses1 (no, name, credit, d_no) values (1, 'DataBase', 5, 1);
Query OK, 1 row affected (0.001 sec)

MariaDB [exp2]> insert into courses1 (no, name, credit, d_no) values (2, 'Mathematics', 2, 2);
Query OK, 1 row affected (0.002 sec)

MariaDB [exp2]> insert into courses1 (no, name, credit, d_no) values (3, 'Information System', 1, 4);
Query OK, 1 row affected (0.001 sec)

MariaDB [exp2]> insert into courses1 (no, name, credit, d_no) values (4, 'Operating System', 6, 1);
Query OK, 1 row affected (0.001 sec)

MariaDB [exp2]> insert into courses1 (no, name, credit, d_no) values (5, 'Data Structure', 4, 1);
Query OK, 1 row affected (0.001 sec)
```

```
MariaDB [exp2]> insert into scores1 (s_no, c_no, score) values(200215121, 1, 92);
Query OK, 1 row affected (0.001 sec)

MariaDB [exp2]> insert into scores1 (s_no, c_no, score) values(200215121, 2, 85);
Query OK, 1 row affected (0.001 sec)

MariaDB [exp2]> insert into scores1 (s_no, c_no, score) values(200215121, 3, 88);
Query OK, 1 row affected (0.003 sec)

MariaDB [exp2]> insert into scores1 (s_no, c_no, score) values(200215122, 2, 90);
Query OK, 1 row affected (0.001 sec)

MariaDB [exp2]> insert into scores1 (s_no, c_no, score) values(200215122, 3, 80);
Query OK, 1 row affected (0.001 sec)
```

```
MariaDB [exp2]> insert into students1 (no, name, gender, age, d_no) values (200215120, 'Mike', 'Male', 21, 3);
Query OK, 1 row affected (0.007 sec)

MariaDB [exp2]> insert into students1 (no, name, gender, age, d_no) values (200215121, 'Tom', 'Male', 20, 1);
Query OK, 1 row affected (0.001 sec)

MariaDB [exp2]> insert into students1 (no, name, gender, age, d_no) values (200215122, 'Jerry', 'Female', 19, 1);
Query OK, 1 row affected (0.002 sec)

MariaDB [exp2]> insert into students1 (no, name, gender, age, d_no) values (200215123, 'Alice', 'Female', 18, 2);
Query OK, 1 row affected (0.001 sec)

MariaDB [exp2]> insert into students1 (no, name, gender, age, d_no) values (200215125, 'Bob', 'Male', 19, 3);
Query OK, 1 row affected (0.007 sec)
```

5. 查看建立好的四张表格与对应数据：

```
MariaDB [exp2]> select * from students1
    -> ;
+-----------+-------+--------+-----+------+
| no        | name  | gender | age | d_no |
+-----------+-------+--------+-----+------+
| 200215120 | Mike  | Male   |  21 |    3 |
| 200215121 | Tom   | Male   |  20 |    1 |
| 200215122 | Jerry | Female |  19 |    1 |
| 200215123 | Alice | Female |  18 |    2 |
| 200215125 | Bob   | Male   |  19 |    3 |
+-----------+-------+--------+-----+------+
5 rows in set (0.000 sec)
```

```
MariaDB [exp2]> select * from depts1;
+----+------------------+
| no | name             |
+----+------------------+
|  1 | Computer Science |
|  2 | Mathematics      |
|  3 | Architecture     |
|  4 | Management       |
+----+------------------+
4 rows in set (0.000 sec)
```

```
MariaDB [exp2]> select * from courses1
    -> ;
+----+--------------------+--------+------+
| no | name               | credit | d_no |
+----+--------------------+--------+------+
|  1 | DataBase           |      5 |    1 |
|  2 | Mathematics        |      2 |    2 |
|  3 | Information System |      1 |    4 |
|  4 | Operating System   |      6 |    1 |
|  5 | Data Structure     |      4 |    1 |
|  6 | Data Processing    |      2 |    4 |
|  7 | PASCAL             |      3 |    1 |
+----+--------------------+--------+------+
7 rows in set (0.000 sec)
```

```
MariaDB [exp2]> select * from scores1;
+-----------+------+-------+
| s_no      | c_no | score |
+-----------+------+-------+
| 200215121 |    1 |    92 |
| 200215121 |    2 |    85 |
| 200215121 |    3 |    88 |
| 200215122 |    2 |    90 |
| 200215122 |    3 |    80 |
+-----------+------+-------+
5 rows in set (0.000 sec)
```

6. 下面是本次实验的任务：

- **No.1 查所有年龄在 21 岁以下的学生姓名及其年龄（使用比较运算符）**

```
MariaDB [exp2]> select name, age from students1
    -> where age < 21;
+-------+-----+
| name  | age |
+-------+-----+
| Tom   |  20 |
| Jerry |  19 |
| Alice |  18 |
| Bob   |  19 |
+-------+-----+
4 rows in set (0.000 sec)
```

- **No.2 查询选 2 号课程(s_no='2')且成绩在 80--90 的学生号。(BETWEEN … AND …)**

```
MariaDB [exp2]> select no
    ->     from students1 inner join scores1 on students1.no = scores1.s_no
    ->     where c_no = 2 and
    ->     score between 80 and 90;
+-----------+
| no        |
+-----------+
| 200215121 |
| 200215122 |
+-----------+
```

- **No.3 查姓名第二个字母是'e'的学生姓名。**

```
MariaDB [exp2]> select name from students1 where name like "_e%";
+-------+
| name  |
+-------+
| Jerry |
+-------+
1 row in set (0.002 sec)
```

- **No.4 查询全体男学生的学号、系、年龄结果按所在的系升序排列，同一系中的学生按年龄降序排列。**

```
MariaDB [exp2]> select students1.no, depts1.name, age
    -> from students1 inner join depts1
    -> on students1.d_no = depts1.no
    -> order by d_no asc, age desc;
+-----------+------------------+-----+
| no        | name             | age |
+-----------+------------------+-----+
| 200215121 | Computer Science |  20 |
| 200215122 | Computer Science |  19 |
| 200215123 | Mathematics      |  18 |
| 200215120 | Architecture     |  21 |
| 200215125 | Architecture     |  19 |
+-----------+------------------+-----+
5 rows in set (0.001 sec)
```

- **No.5 查询女学生的总人数和平均年龄。**

```
MariaDB [exp2]> select count(distinct no), avg(age)
    ->     from students1
    ->     where gender = 'Female';
+--------------------+----------+
| count(distinct no) | avg(age) |
+--------------------+----------+
|                  2 |  18.5000 |
+--------------------+----------+
1 row in set (0.005 sec)
```

- **No.6 查询选修 3 号课程并及格【分数大于 60】的学生的最高分数、最低分及总分。**

```
MariaDB [exp2]> select max(score), min(score), sum(score)
    ->     from scores1
    ->     where c_no = 3 and
    ->     score > 60;
+------------+------------+------------+
| max(score) | min(score) | sum(score) |
+------------+------------+------------+
|         88 |         80 |        168 |
+------------+------------+------------+
1 row in set (0.001 sec)
```

- **No.7 向 Score 表中插入一条记录（200215123,1,72）。**

```
MariaDB [exp2]> insert into scores1 (s_no, c_no, score) values (200215123,1,72);
Query OK, 1 row affected (0.009 sec)
```

- **No.8 求每个学生（号）的平均成绩，并将其超过 75 分【HAVING AVG(score) > 75】的按学号输出【ORDER BY s_no】。**

```
MariaDB [exp2]> select s_no, avg(score)
    ->     from scores1
    ->     group by s_no
    ->     having avg(score) > 75
    ->     order by s_no;
+-----------+------------+
| s_no      | avg(score) |
+-----------+------------+
| 200215121 |    88.3333 |
| 200215122 |    85.0000 |
+-----------+------------+
2 rows in set (0.002 sec)
```

- **NO.9 查询选修了课程 1 或者选修了课程 2 的学生姓名。**

```
MariaDB [exp2]> select distinct students1.name from
    -> students1 inner join scores1
    -> on students1.no = scores1.s_no
    -> where c_no = 1 or c_no = 2;
+-------+
| name  |
+-------+
| Tom   |
| Alice |
| Jerry |
+-------+
```

- **NO.10 查询既选修了课程 1 又选修了课程 2 的学生姓名 【mysql 模拟 intersect: 用 DISTINCT,INNER JOIN 或 DISTINCT,WHERE 等方式，可以实现交集操作即可】。**

```
MariaDB [exp2]> select distinct students1.name from
    ->     students1 inner join scores1
    ->     on students1.no = scores1.s_no
    ->     where c_no = 1
    ->     and students1.no in (
    ->         select distinct s_no from
    ->         scores1
    ->         where c_no = 2
    ->     );
+------+
| name |
+------+
| Tom  |
+------+
```

- **NO.11 查询选修 Database 这门课最高分学生所在的系名。**

```
MariaDB [exp2]> select depts1.name
    ->     from students1 inner join depts1
    ->     on students1.d_no = depts1.no
    ->     where students1.no in (
    ->         select s_no from
    ->             scores1 inner join courses1
    ->             on scores1.c_no = courses1.no
    ->             where courses1.name = 'Database'
    ->             and score = (
    ->                 select max(score) from
    ->                 scores1 inner join courses1
    ->                 on scores1.c_no = courses1.no
    ->                 where courses1.name = 'Database'
    ->             )
    ->     );
+------------------+
| name             |
+------------------+
| Computer Science |
+------------------+
1 row in set (0.001 sec)
```

- **NO.12 建立一个包含学生学号，姓名，年龄，以及所在系名的视图（赋予列名为 sno,sname,sage,deptname）【create view】**

```
MariaDB [exp2]> create view students_detail as
    ->     select students1.no as sno, students1.name as sname, students1.age as sage, depts1.name as deptname
    ->     from students1 inner join depts1
    ->     on students1.d_no = depts1.no;
Query OK, 0 rows affected (0.016 sec)

MariaDB [exp2]> desc students_detail;
+----------+-------------+------+-----+---------+-------+
| Field    | Type        | Null | Key | Default | Extra |
+----------+-------------+------+-----+---------+-------+
| sno      | int(11)     | NO   |     | 0       |       |
| sname    | varchar(20) | NO   |     | NULL    |       |
| sage     | int(11)     | NO   |     | NULL    |       |
| deptname | varchar(30) | NO   |     | NULL    |       |
+----------+-------------+------+-----+---------+-------+
4 rows in set (0.005 sec)

MariaDB [exp2]> select * from students_detail;
+-----------+-------+------+------------------+
| sno       | sname | sage | deptname         |
+-----------+-------+------+------------------+
| 200215120 | Mike  |   21 | Architecture     |
| 200215121 | Tom   |   20 | Computer Science |
| 200215122 | Jerry |   19 | Computer Science |
| 200215123 | Alice |   18 | Mathematics      |
| 200215125 | Bob   |   19 | Architecture     |
+-----------+-------+------+------------------+
5 rows in set (0.001 sec)
```

出现的问题：

1. **字符串错用“``”符号：**

```
MariaDB [exp2]> CREATE TABLE students1 (
    ->     `no` INT NOT NULL AUTO_INCREMENT,
    ->     `name` VARCHAR(20) NOT NULL,
    ->     `gender` VARCHAR(6) NOT NULL,
    ->     CHECK(`gender`=`Male` OR `gender`=`Female`),
    ->     `age` INT NOT NULL,
    ->     `d_no` INT NOT NULL,
    ->     PRIMARY KEY (`no`),
    ->     CONSTRAINT `st_c_1`
    ->     FOREIGN KEY(`d_no`)
    ->     REFERENCES depts1(`no`)
    ->     );
ERROR 1054 (42S22): Unknown column 'Male' in 'CHECK'
```

2. 插入学号错误，导致不满足约束：

```
MariaDB [exp2]> insert into scores1 (s_no, c_no, score) values(2002151221, 1, 92);
ERROR 1452 (23000): Cannot add or update a child row: a foreign key constraint fails (`exp2`.`scores1`, CONSTRAINT `sc_c_1` FOREIGN K
EY (`s_no`) REFERENCES `students1` (`no`))
MariaDB [exp2]> insert into scores1 (s_no, c_no, score) values(2002151221, 2, 85);
ERROR 1452 (23000): Cannot add or update a child row: a foreign key constraint fails (`exp2`.`scores1`, CONSTRAINT `sc_c_1` FOREIGN K
EY (`s_no`) REFERENCES `students1` (`no`))
MariaDB [exp2]> insert into scores1 (s_no, c_no, score) values(2002151221, 3, 88);
ERROR 1452 (23000): Cannot add or update a child row: a foreign key constraint fails (`exp2`.`scores1`, CONSTRAINT `sc_c_1` FOREIGN K
EY (`s_no`) REFERENCES `students1` (`no`))
MariaDB [exp2]> insert into scores1 (s_no, c_no, score) values(2002151221, 2, 90);
ERROR 1452 (23000): Cannot add or update a child row: a foreign key constraint fails (`exp2`.`scores1`, CONSTRAINT `sc_c_1` FOREIGN K
EY (`s_no`) REFERENCES `students1` (`no`))
MariaDB [exp2]> insert into scores1 (s_no, c_no, score) values(2002151221, 3, 80);
ERROR 1452 (23000): Cannot add or update a child row: a foreign key constraint fails (`exp2`.`scores1`, CONSTRAINT `sc_c_1` FOREIGN K
EY (`s_no`) REFERENCES `students1` (`no`))
```

3. 错误的使用 join：

```
MariaDB [exp2]> select no from
    -> students1 natural join scores1
    -> where c_no = 2 and score between 80 and 90;
+-----------+
| no        |
+-----------+
| 200215121 |
| 200215121 |
| 200215122 |
| 200215122 |
| 200215123 |
| 200215123 |
| 200215120 |
| 200215120 |
| 200215125 |
| 200215125 |
+-----------+
10 rows in set (0.001 sec)
```

4. 字符匹配方式错误：

```
MariaDB [exp2]> select name
    -> from students1
    -> where name[1] = 'e';
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MariaDB server version for the ri
ght syntax to use near '[1] = 'e'' at line 3
```

解决方案：

1. 使用“’’”包裹字符串，而非“``”；
2. 在 scores1 表插入新的数据前，要确保 s_id 和 c_id 的外键约束满足；
3. 两个表中的属性名称不统一，不能直接使用 natural join。可以使用 inner join 搭配 on；
4. 应该使用 like 的方式进行字符匹配，而非数组下标。