

《数据库系统》实验报告

第 1 次实验: 基本 SQL 操作

姓名: 王琨

学号: 091220103

09 级 计算机科学与技术 系 三 班

邮箱: woshibendan@stu.nju.edu.cn

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一、 数据定义

1. 建立基本表

i. student 表

创建学生表 **Student**, 由以下属性组成: 学号 **SNO** (INT 型, 主键), 姓名 **SNAME** (CHAR 型, 长度为 8, 非空), 性别 **SEX** (CHAR 型, 长度为 2), 所在系 **DEPTNO** (INT 型)。

```
create table Student
(
    sno int,
    sname char(8) not null,
    sex char(2),
    deptno int,
    primary key (sno)
);
```

ii. course 表

创建课程表 **Course**, 由以下属性组成: 课程号 **CNO** (INT 型), 课程名 **CNAME** (CHAR 型, 长度为 20, 非空), 授课教师编号 **TNO** (INT 型), 学分 **CREDIT** (INT 型)。其中 (**CNO**, **TN**) 为主键。

```
create table Course
(
    cno int,
    cname char(20) not null,
    tno int,
    credit int,
    primary key (cno, tno)
);
```

iii. sc 表

创建学生选课表 **SC**, 由以下属性组成: 学号 **SNO**, 课程号 **CNO**, 成绩 **GRADE**。所有属性均为 INT 型, 其中 (**SNO**, **CNO**) 为主键。

```
create table sc
(
    sno int,
    cno int,
    grade int,
    primary key (sno, cno)
);
```

iv. teacher 表

创建教师表 **Teacher**，由以下属性组成：教师编号 **TNO**（INT 型，主键），教师姓名 **TNAME**（CHAR 型，长度为 8，非空），所在系 **DEPTNO**（INT 型）。

```
create table teacher
(
    tno int,
    tname char(8) not null,
    deptno int
);
```

v. dept 表

创建系表 **Dept**，由以下属性组成：系号 **DEPTNO**（INT 型，主键），系名 **DNAME**（CHAR 型，长度为 20，非空）。

```
create table dept
(
    deptno int,
    dname char(20) not null
);
```

2. 修改基本表

i. student 表中加入属性 age(int)

```
alter table Student add age int;
```

ii. student 表中的属性 age 的类型改为(smallint)

```
alter table Student modify age smallint;
```

3. 删除基本表

```
drop table student, course, sc, teacher, dept;
```

二、 数据操作

1. 插入数据

i. Student 表插入数据

(1001, 张天, m, 10, 20)、(1002, 李兰, f, 10, 21)、
(1003, 陈铭, m, 10, 21)、(1004, 刘茜, f, 20, 21)、
(1005, 马阳, m, 20, 22)。

```
insert  
into student (sno, sname, sex, deptno, age)  
values (1001, '张天', 'm', 10, 20),  
       (1002, '李兰', 'f', 10, 21),  
       (1003, '陈铭', 'm', 10, 21),  
       (1004, '刘茜', 'f', 20, 21),  
       (1005, '马阳', 'm', 20, 22);
```

ii. Course 表插入数据

(1, 数据结构, 101, 4)、(2, 数据库, 102, 4)、
(3, 离散数学, 103, 4)、(4, C 语言程序设计, 101, 2)。

```
insert  
into course  
values (1, '数据结构', 101, 4),  
       (2, '数据库', 102, 4),  
       (3, '离散数学', 103, 4),  
       (4, 'C 语言程序设计', 101, 2);
```

iii. SC 表插入数据

(1001, 1, 80)、(1001, 2, 85)、(1001, 3, 78)、
(1002, 1, 78)、(1002, 2, 82)、(1002, 3, 86)、
(1003, 1, 92)、(1003, 3, 90)、(1004, 1, 87)、
(1004, 4, 90)、(1005, 1, 85)、(1005, 4, 92)。

```
insert
into sc
values (1001, 1, 80),
       (1001, 2, 85),
       (1001, 3, 78),
       (1002, 1, 78),
       (1002, 2, 82),
       (1002, 3, 86),
       (1003, 1, 92),
       (1003, 3, 90),
       (1004, 1, 87),
       (1004, 4, 90),
       (1005, 1, 85),
       (1005, 4, 92);
```

iv. Teacher 表插入数据

(101, 张星, 10)、(102, 李珊, 10)、
(103, 赵应, 10)、(104, 刘田, 20)。

```
insert
into Teacher
values (101, '张星', 10),
       (102, '李珊', 10),
       (103, '赵应', 10),
       (104, '刘田', 20);
```

v. Dept 表插入数据

(10, 计算机)、(20, 信息)。

```
insert
into Dept
values (10, '计算机'),
       (20, '信息');
```

2. 单表查询

i. 查询所有学生的信息

```
select *  
from student;
```

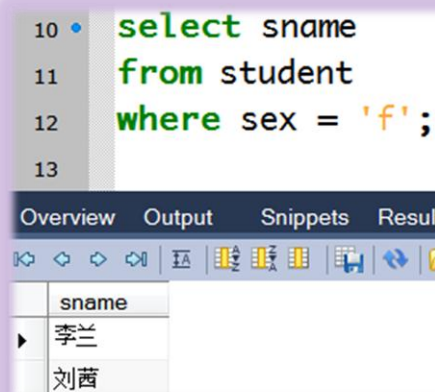


The screenshot shows a SQL query in the editor: `/* [1] 查询所有学生的信息 */
select *
from student;` Below the editor, the 'Result (19)' tab is active, displaying a table with 5 columns: sno, sname, sex, deptno, and age. The table contains 5 rows of student data.

sno	sname	sex	deptno	age
1001	张天	m	10	20
1002	李兰	f	10	21
1003	陈铭	m	10	21
1004	刘茜	f	20	21
1005	马阳	m	20	22

ii. 查询所有女生的姓名

```
select sname  
from student  
where sex = 'f';
```



The screenshot shows a SQL query in the editor: `select sname
from student
where sex = 'f';` Below the editor, the 'Result (19)' tab is active, displaying a table with 1 column: sname. The table contains 2 rows of student names.

sname
李兰
刘茜

iii. 查询成绩在 80 到 89 之间的所有学生的选课记录 查询结果按成绩的降序排列。

```
select *
from sc
where grade between 80 and 90
order by grade DESC;
```

```
18 • select *
19   from sc
20   where grade between 80 and 90
21   order by grade DESC;
22
```

	sno	cno	grade
▶	1003	3	90
	1004	4	90
	1004	1	87
	1002	3	86
	1001	2	85
	1005	1	85
	1002	2	82
	1001	1	80

iv. 查询各个系的学生人数

```
select dname, COUNT(sno)
from student, dept
where student.deptno = dept.deptno
group by student.deptno;
```

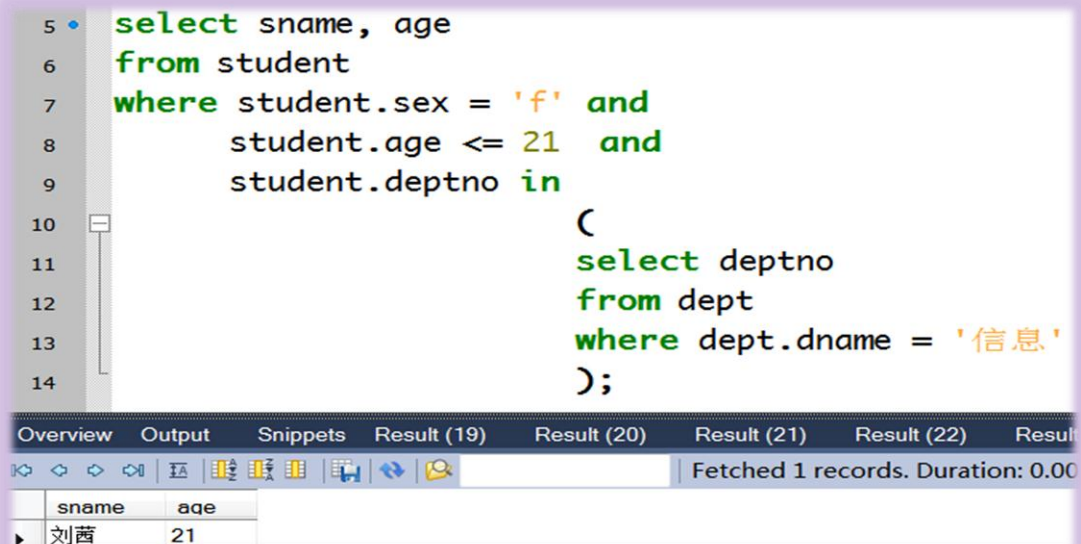
```
24  /* [4] 查询各个系的学生人数 */
25 • select dname, COUNT(sno)
26   from student, dept
27   where student.deptno = dept.deptno
28   group by student.deptno;
```

	dname	COUNT(sno)
▶	计算机	3
	信息	2

3. 连接查询

- i. 查询信息系年龄 21 岁以下（含 21 岁）的女生姓名及年龄

```
select sname, age
from student
where student.sex = 'f' and
      student.age <= 21 and
      student.deptno in
      (
        select deptno
        from dept
        where dept.dname = '信息'
      );
```



The screenshot shows a SQL IDE with a query editor on the left and a results pane on the right. The query is the same as the one in the previous block. The results pane shows a table with two columns: 'sname' and 'age'. The first row contains the values '刘茜' and '21'. The status bar at the bottom indicates 'Fetched 1 records. Duration: 0.00'.

```
5 • select sname, age
6   from student
7   where student.sex = 'f' and
8         student.age <= 21 and
9         student.deptno in
10        (
11          select deptno
12          from dept
13          where dept.dname = '信息'
14        );
```

sname	age
刘茜	21

Overview Output Snippets Result (19) Result (20) Result (21) Result (22) Result (23)

Fetched 1 records. Duration: 0.00

4. 嵌套查询

- i. 查询修课总学分在 10 分以下的学生姓名

```
select sname
from student
where sno in
      (
        select sno
        from sc, course
        where sc.cno = course.cno
        group by sno
        having sum(course.credit) < 10
      );
```

```

5 • select sname
6   from student
7  where sno in
8      (
9          select sno
10         from sc, course
11        where sc.cno = course.cno
12        group by sno
13        having sum(course.credit) < 10
14      );

```

Overview Output Snippets Result (19) Result (20) Result (21) Result (22)

Fetches 3 records. Duration: 0.0

sname
陈铭
刘茜
马阳

ii. 查询各门课程取得最高成绩的学生姓名及其成绩

```

select student.sname, sc1.cno, sc1.grade
from student, sc sc1
where student.sno = sc1.sno and
      sc1.grade in (
          SELECT max(sc2.grade)
          FROM sc sc2
          where sc1.cno = sc2.cno
          group by cno
      );

```

```

18 • select student.sname, sc1.cno, sc1.grade
19   from student, sc sc1
20  where student.sno = sc1.sno and
21        sc1.grade in (
22            SELECT max(sc2.grade)
23            FROM sc sc2
24           where sc1.cno = sc2.cno
25           group by cno
26        );

```

Overview Output Snippets Result (19) Result (20) Result (21) Result (22) Result (23)

Fetches 4 records. Duration: 0.0

sname	cno	grade
张天	2	85
陈铭	1	92
陈铭	3	90
马阳	4	92

PS: 为了阅读查询结果的方便, 在select语句中, 增加cno (课程号) 属性。

下面是另一种实现方式:

```
select student.sname, sc1.cno, sc1.grade
from student, sc sc1,
(
    select cno, max(grade) grade
    from sc sc2
    group by sc2.cno
) temp
where sc1.sno = student.sno and
      sc1.cno = temp.cno and
      sc1.grade = temp.grade;
```

```
29 • select student.sname, sc1.cno, sc1.grade
30 from student, sc sc1,
31 (
32     select cno, max(grade) grade
33     from sc sc2
34     group by sc2.cno
35 ) temp
36 where sc1.sno = student.sno and
37       sc1.cno = temp.cno and
38       sc1.grade = temp.grade;
```

Overview Output Snippets Result (19) Result (20) Result (21) Result

Fetches 4 records. D

sname	cno	grade
张天	2	85
陈铭	1	92
陈铭	3	90
马阳	4	92

两种查询结果一致, 证明查询语句的正确性。

iii. 查询选修了 1001 学生选课的全部课程的学生学号

```
select sno
from sc
where not exists
(
    select sc2.cno
    from sc sc2
    where sc2.sno = 1001 and not exists
        (
            select sc1.cno
            from sc sc1
            where sc1.sno =
                sc.sno and
                    sc1.cno =
                        sc2.cno
        )
)
```

```
59 • select sno
60 from sc
61 where not exists
62 (
63     select sc2.cno
64     from sc sc2
65     where sc2.sno = 1001 and not exists
66         (
67             select sc1.cno
68             from sc sc1
69             where sc1.sno = sc.sno and
70                 sc1.cno = sc2.cno
71         )
72     )
73 group by sno;
```

Result (20) Result (21) Result (22) Result (23) Result (24) Result (46) Result (51) Result (58) Result (65) emb

Fetches 2 records. Duration: 0.000 sec, fetched in: 0.000 sec

sno
1001
1002

iv. 查询选修了张星老师开设的全部课程的学生姓名

```
select sname
from student
where not exists
(
    select course.cno
    from teacher, course
    where course.tno = teacher.tno and
          teacher.tname = '张星' and
          not exists
          (
              select sc.cno
              from sc
              where student.sno = sc.sno and
                    sc.cno = course.cno
          )
);
```

```
93 • select sname
94 from student
95 where not exists
96     (
97         select course.cno
98         from teacher, course
99         where course.tno = teacher.tno and
100             teacher.tname = '张星' and
101             not exists
102                 (
103                     select sc.cno
104                     from sc
105                     where student.sno = sc.sno and
106                         sc.cno = course.cno
107                 )
108     );
```

Result (20) Result (21) Result (22) Result (23) Result (24) Result (46) Result (51) Result (52)

Fetches 2 records. Duration: 0.000 sec, fetched 2 records.

sname
刘茜
马阳

5. 修改数据

- i. 将张星老师数据结构课的学生成绩全部加 2 分

```
update sc
set grade = grade + 2
where sc.cno in
(
select course.cno
from course, teacher
where course.cname = '数据结构' and
      course.tno = teacher.tno and
      teacher.tname = '张星'
);
```

修改前

	sno	cno	grade
▶	1001	1	80
	1001	2	85
	1001	3	78
	1002	1	78
	1002	2	82
	1002	3	86
	1003	1	92
	1003	3	90
	1004	1	87
	1004	4	90
	1005	1	85
	1005	4	92

修改后

	sno	cno	grade
▶	1001	1	82
	1001	2	85
	1001	3	78
	1002	1	80
	1002	2	82
	1002	3	86
	1003	1	94
	1003	3	90
	1004	1	89
	1004	4	90
	1005	1	87
	1005	4	92

6. 删除数据

i. 删除马阳同学的所有选课记录

```
delete
from   sc
where  sno in
      (
        select sno
        from   student
        where  student.sname = '马阳'
      );
```

SQL File 5 Result								
Fetches 2 records								
	sno	cno	grade	sno	sname	sex	deptno	age
▶	1005	1	87	1005	马阳	m	20	22
	1005	4	92	1005	马阳	m	20	22

修改前

	sno	cno	grade	sno	sname	sex	deptno	age
--	-----	-----	-------	-----	-------	-----	--------	-----

修改后

三、 视图操作

1. 建立视图

- i. **Student** 表上为计算机科学与技术系的学生记录建立视图

CS_STUDENT

```
create view cs_student (sno, sname, age, sex)
as
select sno, sname, age, sex
from student, dept
where student.deptno = dept.deptno and
      dept.dname = '计算机';
```

```
8  /*
9  create view cs_student (sno, sname, age, sex)
10 as
11 select sno, sname, age, sex
12 from student, dept
13 where student.deptno = dept.deptno and
14       dept.dname = '计算机';
15 */
16 • select *
17 from cs_student;
18
```

SQL File 6 Result SQL File 7 Result SQL File 8 Result modify_data.sql Result Query

Fetches 3 records. Duration: 0

sno	sname	age	sex
1001	张天	20	m
1002	李兰	21	f
1003	陈铭	21	m

2. 删除视图

- i. 删除视图 **CS_STUDENT**

```
drop view cs_student;
```


四、 问题 & 思考

在做“嵌套查询”[点击此处查看](#)时，第三和四小题比较麻烦。

最初的想法是使用“contains”语句表示集合的包含关系：

```
select sc.sno
from sc
where
    contains(
        (
            select sc1.cno
            from sc sc1
            where sc1.sno = sc.sno
        ),
        (
            select sc2.cno
            from sc sc2
            where sc2.sno = 1001
        )
    )
group by sno;
```

基本想法如下：

先查询“1001号学生所选的全部课程”，生成集合S2。然后以每个学生为基本单位（group by）生成集合S1。我们使用contains查看包含关系，显然，如果S1包含S2，那么S1集合的学生一定是查询目标。*语法无法通过。。。。*

后来想到可以使用except（集合求差）对S1和S2进行运算，然而MySQL对except并不支持，虽然我们也可以使用union产生和except相同的效果，但是没有进一步尝试。