哈尔滨工业大学

<<数据库系统>>

实验报告一

(2023 年度春季学期**)**

姓名:	符兴
学号:	**7203610316**
学院:	计算学部
教师:	李东博

实验一

一、实验目的

掌握 MySQL 关系数据库管理系统的基本命令，并熟练使用 SQL 语言管理 MySQL 数据库。掌握 SQL 语言的使用方法，学会使用 SQL 语言进行关系数据库查询，特别是聚集查询、连接查询和嵌套查询。

二、实验环境

Windows 11 操作系统、MySQL8.0.32、PhpMyAdmin

三、实验过程及结果

1. 创建“company”数据库并创建相关表。

```
PS D:\DBMS> mysql -u root -p
Enter password: ***
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 5746
Server version: 8.0.31 MySQL Community Server - GPL

Copyright (c) 2000, 2022, Oracle and/or its affiliates.

Oracle is a registered trademark of Oracle Corporation and/or its
affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input st
atement.

mysql> create database company;
Query OK, 1 row affected (0.01 sec)
```

图 1 创建“company”数据库

```
mysql> show tables;
+------------------+
| Tables_in_company |
+------------------+
| department       |
| employee         |
| project          |
| works_on         |
+------------------+
4 rows in set (0.00 sec)
```

图 2 创建相关表

2. 查询参加了项目名为“SQL Project”的员工名字。

```sql
select ename from employee
where essn in (
    select essn from project, works_on
    where project.pno=works_on.pno
    and pname="SQL" and hours>0
);
```

图 3-1 SQL 语句

```
mysql> use company;
Database changed
mysql> select ename from employee
    -> where essn in(
    -> select essn from project, works_on
    -> where project.pno=works_on.pno
    -> and pname="SQL" and hours>0);
+--------+
| ename  |
+--------+
| 王大一 |
| 王小二 |
| 王三   |
| 王四   |
| 王五   |
| 王六   |
| 王七   |
| 王十   |
| 孙小二 |
+--------+
9 rows in set (0.02 sec)

mysql>
```

图 3-2 查询结果

3. 查询在“研发部”工作且工资低于 3000 元的员工名字和地址。

```sql
select ename, address from employee, department
where employee.dno=department.dno
and dname="研发部" and salary<3000;
```

图 4-1 SQL 语句

```
mysql> select ename, address from employee, department
    -> where employee.dno=department.dno
    -> and dname="研发部" and salary<3000;
+----------+---------+
| ename    | address |
+----------+---------+
| 孙四     | 孙村    |
| 孙五     | 孙村    |
| 孙六     | 孙村    |
| 孙张红十 | 孙村    |
+----------+---------+
4 rows in set (0.00 sec)
```

图 4-2 查询结果

4.查询没有参加项目编号为 P1 的项目的员工姓名。

```sql
select ename from employee
where essn not in (
    select essn from works_on
    where pno="P1" and hours>0);
```

图 5-1 SQL 语句

```
mysql> select ename from employee
    -> where essn not in (
    -> select essn from works_on
    -> where pno="P1" and hours>0);
+----------+
| ename    |
+----------+
| 王八     |
| 王九     |
| 张大一   |
| 张小二   |
| 张三     |
| 张四     |
| 张五     |
| 张六     |
| 张七     |
| 张八     |
| 张九     |
```

图 5-2 查询结果

5. 查询由张红领导的工作人员的姓名和所在部门的名字。

```sql
select ename, dname from employee, department
where employee.dno=department.dno
and superssn in (
select essn
    from employee
    where ename="张红");
```

图 6-1 SQL 语句

```
mysql> select ename, dname from employee, department
    -> where employee.dno=department.dno
    -> and superssn in (
    -> select essn
    -> from employee
    -> where ename="张红");
+--------+------------+
| ename  | dname      |
+--------+------------+
| 张大一 | 甲类二车间 |
| 张小二 | 甲类二车间 |
| 张三   | 甲类二车间 |
| 张四   | 甲类二车间 |
| 张五   | 甲类二车间 |
| 张六   | 甲类二车间 |
| 张七   | 甲类二车间 |
| 张八   | 甲类二车间 |
| 张九   | 甲类二车间 |
| 张红   | 甲类二车间 |
+--------+------------+
10 rows in set (0.00 sec)
```

图 6-2 查询结果

6. 查询至少参加了项目编号为 P1 和 P2 的项目的员工号。

```
select essn from works_on
where pno="P1" and hours>0 and essn in (
    select essn from works_on
    where pno="P2" and hours>0);
```

图 7-1 SQL 语句

```
mysql> select essn from works_on
    -> where pno="P1" and hours>0 and essn in (
    -> select essn from works_on
    -> where pno="P2" and hours>0);
+-------------------+
| essn              |
+-------------------+
| 131181199901012113 |
| 131181199901022113 |
| 131181199901032113 |
| 131181199901042113 |
| 131181199901052113 |
| 131181199901062113 |
| 131181199901072113 |
| 131181199905022153 |
+-------------------+
8 rows in set (0.00 sec)
```

图 7-2 查询结果

7. 查询参加了全部项目的员工号码和姓名。

```sql
select essn, ename from employee
where not exists (
    select pno from project
    where not exists (
        select * from works_on
        where works_on.pno=project.pno
        and works_on.essn=employee.essn));
```

图 8-1 SQL 语句

```
mysql> select essn, ename from employee
    -> where not exists (
    -> select pno from project
    -> where not exists (
    -> select * from works_on
    -> where works_on.pno=project.pno
    -> and works_on.essn=employee.essn));
+-------------------+--------+
| essn              | ename  |
+-------------------+--------+
| 131181199905022153 | 孙小二 |
+-------------------+--------+
1 row in set (0.00 sec)
```

图 8-2 查询结果

8. 查询员工平均工资低于 3000 元的部门名称。

```
select dname from department
where dno in (
    select dno from employee
    group by dno having avg(salary)<3000);
```

图 9-1 SQL 语句

```
mysql> select dname from department
    -> where dno in (
    -> select dno from employee
    -> group by dno having avg(salary)<3000);
+------------+
| dname      |
+------------+
| 乙类二车间 |
+------------+
1 row in set (0.01 sec)
```

图 9-2 查询结果

9. 查询至少参与了 3 个项目且工作总时间不超过 8 小时的员工名字。

```
select ename from employee
where essn in (
    select essn from works_on
    group by essn having count(pno)>=3
    and sum(hours)<=8);
```

图 10-1 SQL 语句

```
mysql> select ename from employee
    -> where essn in (
    -> select essn from works_on
    -> group by essn having count(pno)>=3
    -> and sum(hours)<=8);
+--------+
| ename  |
+--------+
| 王大一 |
| 王小二 |
| 王四   |
| 王六   |
| 王十   |
| 李大一 |
| 李七   |
| 李八   |
| 李十   |
+--------+
9 rows in set (0.00 sec)
```

图 10-2 查询结果

10. 查询每个部门的员工小时平均工资。

```sql
select sums.dno, sumsalary/sumhours as hoursavgsalary
from (
    select dno, sum(salary) as sumsalary
    from employee group by dno
) as sums, (
    select dno, sum(hours) as sumhours
    from works_on join employee
    on works_on.essn = employee.essn
    group by dno
) as sumh
where sums.dno=sumh.dno;
```

图 11-1 SQL 语句

```
+------+----------------+
| dno  | hoursavgsalary |
+------+----------------+
| A01  |       439.0244 |
| A02  |       652.1739 |
| B01  |       685.3933 |
| B02  |       638.7097 |
| C10  |       858.9153 |
+------+----------------+
5 rows in set (0.00 sec)
```

图 11-2 查询结果

11. 查询所有干过非自己部门任务的员工的姓名和小时平均工资。

```sql
select ename, avgsalary from
(select ename, salary/sum(hours) as avgsalary, dno, employee.essn
 from works_on join employee on works_on.essn = employee.essn
 where hours > 0
 group by employee.essn) as tmp_employee
where exists(
    select pno from works_on
    where works_on.essn = tmp_employee.essn and
    pno not in (select pno from project where project.dno = tmp_employee.dno)
);
```

图 12-1 SQL 语句

思路：首先将 employee 表和 works_on 两个表进行连接查询，记为 tmp_employee；在这个表中记录了每一个员工的编号、具体工作时长、总工资、部门等等信息，同时需要判断在某个项目上的工作不为 0；然后通过 exists 判断某个员工是否干过非自己部门的项目；如果结果非空，会将该元组投影出来。

```
mysql> select ename, avgsalary from
    -> (select ename, salary/sum(hours) as avgsalary, dno, employee.essn
    ->  from works_on join employee on works_on.essn = employee.essn
    ->  group by employee.essn) as tmp_employee
    -> where exists(
    ->     select pno from works_on
    ->     where works_on.essn = tmp_employee.essn and pno not in (select pno
from project where project.dno = tmp_employee.dno)
    -> );
+--------+-----------+
| ename  | avgsalary |
+--------+-----------+
| 孙小二 |  444.4444 |
+--------+-----------+
1 row in set (0.00 sec)
```

图 12-2 查询结果

12. 查询小时平均工资超过 1000 的员工姓名和小时平均工资

```sql
select * from
(select ename, salary/sum(hours) as avgsalary
 from works_on join employee on works_on.essn = employee.essn
 where hours > 0
 group by employee.essn) as tmp_employee
where avgsalary > 1000;
```

图 13-1 SQL 语句

```
mysql> select * from
    -> (select ename, salary/sum(hours) as avgsalary
    ->  from works_on join employee on works_on.essn = employee.essn
    ->  group by employee.essn) as tmp_employee
    -> where avgsalary > 1000;
+--------+-----------+
| ename  | avgsalary |
+--------+-----------+
| 王大一 | 1166.6667 |
| 李大一 | 1250.0000 |
| 孙三   | 1428.5714 |
| 孙七   | 2000.0000 |
| 孙八   | 1500.0000 |
| 孙九   | 1150.0000 |
+--------+-----------+
6 rows in set (0.00 sec)
```

图 13-2 查询结果

思路：基本沿用 11 中连接查询的思路，然后通过 where 语句筛选出平均工资超过 1000 的员工元组。

四、实验心得

1. 掌握了如何在 MySQL 中创建新的数据库和关系表。

2. 掌握了使用 SQL 语句对各个任务进行查询，且基本掌握了投影查询、选择查询、分组查询、聚集查询、连接查询、嵌套查询等查询方法的原理及应用。