数据库原理与应用：测试

1.1

SQL语句：

```sql
SELECT t.id, COUNT(*) AS section_count
FROM teaches t
GROUP BY t.id
ORDER BY section_count DESC;
```

1.2

SQL语句：

```sql
SELECT i.ID AS instructor_id, COUNT(t.ID) AS section_count
FROM instructor i
LEFT JOIN teaches t 1<->0..n: ON i.ID = t.ID
GROUP BY i.ID
ORDER BY section_count DESC;
```

1.3

SQL语句：

```sql
SELECT i.ID AS instructor_id,
       (SELECT COUNT(*)
        FROM teaches t
        JOIN section s 1..n<->1: ON t.course_id = s.course_id
                    AND t.sec_id = s.sec_id
                    AND t.semester = s.semester
                    AND t.year = s.year
        WHERE t.ID = i.ID) AS section_count
FROM instructor i
ORDER BY section_count DESC;
```

1.4原因：

在这个查询中追加natural join section不会影响结果，因为查询已经通过course_id、semester、year和sec_id这些关键字段完整定义了分组逻辑，而这些字段正是连接section表的自然连接条件，且section表中的每个课程段记录都是唯一的，所以连接操作既不会改变分组基数也不会影响聚合计算和筛选条件，最终结果保持不变。

1.5

SQL语句：

```sql
SELECT *
FROM section JOIN classroom
1..n<->1: USING (building, room_number);
```

2.1

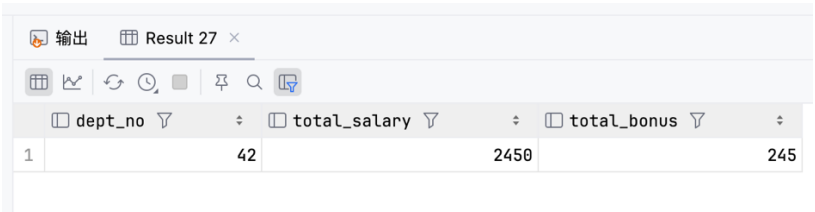
创建emp与emp_bonus两个关系，并导入数据SQL语句：

```
CREATE TABLE emp_bonus(
    emp_no NUMERIC(4),
    receive DATE,
    type NUMERIC(1)
);

INSERT INTO emp_bonus VALUES( emp_no 7934, receive to_date('17-MAR-2005', 'DD-MON-YYYY'), type 1);
INSERT INTO emp_bonus VALUES( emp_no 7934, receive to_date('15-FEB-2005', 'DD-MON-YYYY'), type 2);
INSERT INTO emp_bonus VALUES( emp_no 7839, receive to_date('15-FEB-2005', 'DD-MON-YYYY'), type 3);
INSERT INTO emp_bonus VALUES( emp_no 7782, receive to_date('15-FEB-2005', 'DD-MON-YYYY'), type 1);

CREATE TABLE emp (
    emp_no NUMERIC(4) PRIMARY KEY,
    ename VARCHAR(10),
    sal NUMERIC(7,2),
    dept_no NUMERIC(2)
);

INSERT INTO emp VALUES ( emp_no 7934, ename 'SMITH', sal 800, dept_no 42);
INSERT INTO emp VALUES ( emp_no 7839, ename 'KING', sal 5000, dept_no 41);
INSERT INTO emp VALUES ( emp_no 7782, ename 'CLARK', sal 2450, dept_no 42);
INSERT INTO emp VALUES ( emp_no 7566, ename 'JONES', sal 2975, dept_no 41);
```

2.2

SQL语句：

```
SELECT
    e.dept_no,
    SUM(e.sal) AS total_salary,
    SUM(CASE
        WHEN b.type = 1 THEN e.sal * 0.1
        WHEN b.type = 2 THEN e.sal * 0.2
        WHEN b.type = 3 THEN e.sal * 0.3
        ELSE 0
    END) AS total_bonus
FROM
    emp e
LEFT JOIN
    emp_bonus b ON e.emp_no = b.emp_no
WHERE
    e.dept_no = 42
GROUP BY
    e.dept_no;
```



根据我们导入的数据，42部门的员工ID为7782，他的工资为2450，奖金类型属于1，那么他的总奖金应该为 $2450 * 10\% = 245$，与输出结果相符。