《数据管理基础》实验一：用 SQL 进行数据操作 实验报告

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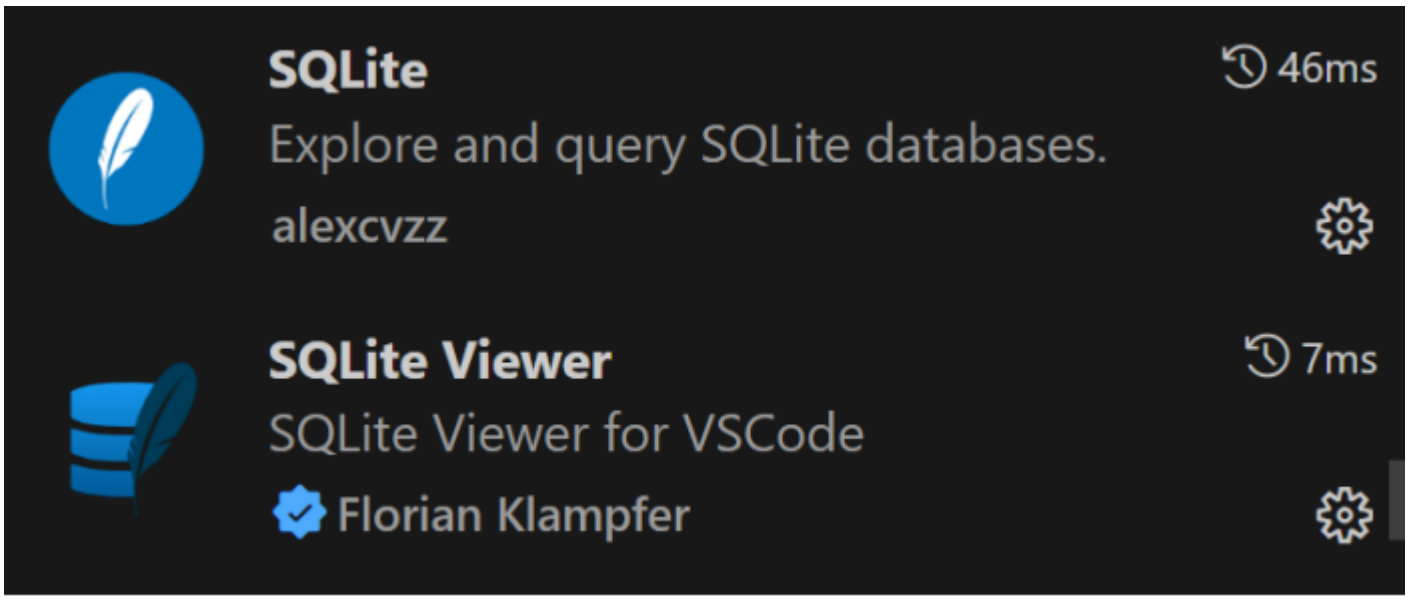
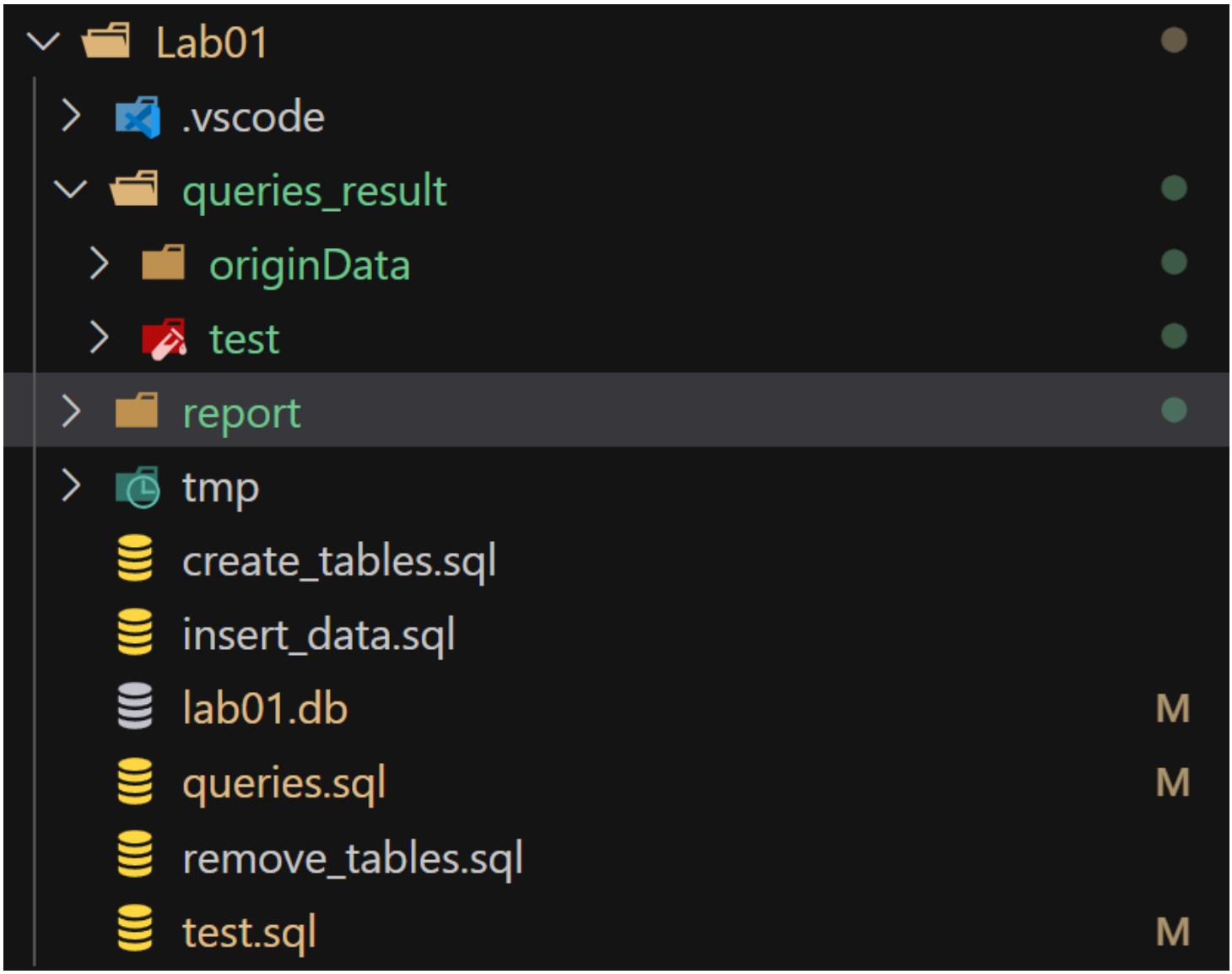
（一）实验环境

操作系统：Windows11
数据库：SQLite + VsCode 插件



> **SQLite** 是执行sql语句并查看结果的插件
> **SQLite Viewer** 是浏览数据库和的插件

（二）实验目录一览



文件夹/文件 名	解释
lab01.db	SQLite 数据库
create_tables.sql	创建表的语句
insert_data.sql	插入数据的语句
queries.sql	查询语句
remove_tables.sql	删除表的语句
test.sql	插入自身构造用于测试的数据的语句
queries_result	originData 存放 查询结果，test 中 存放 插入 test.sql 中的数据后的查询结果

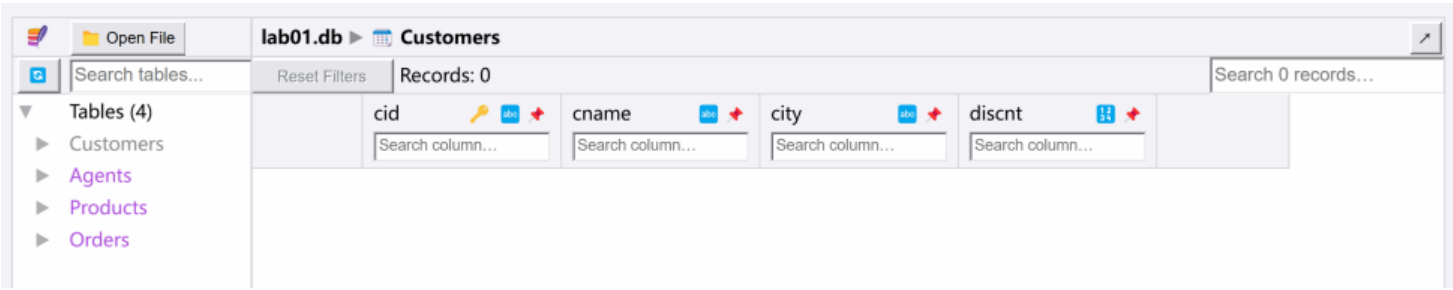
文件夹/文件 名	解释
report	report.md & image
tmp	无关
.vscode	无关

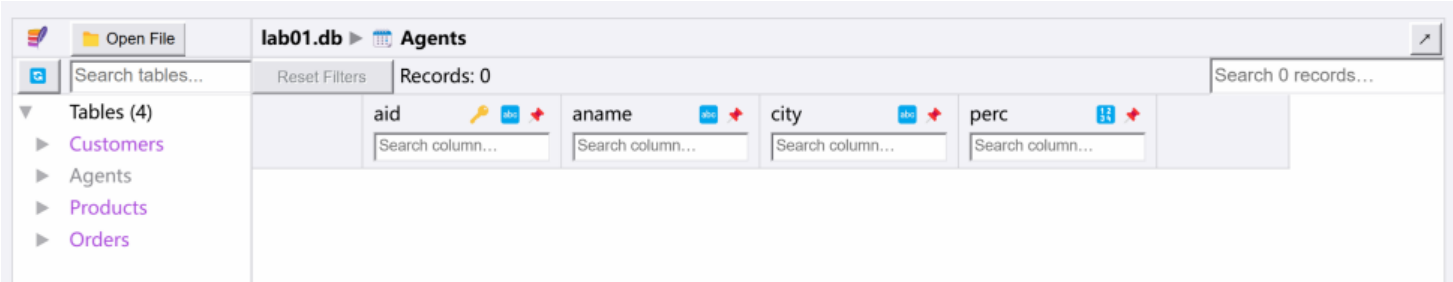
（三）实验过程

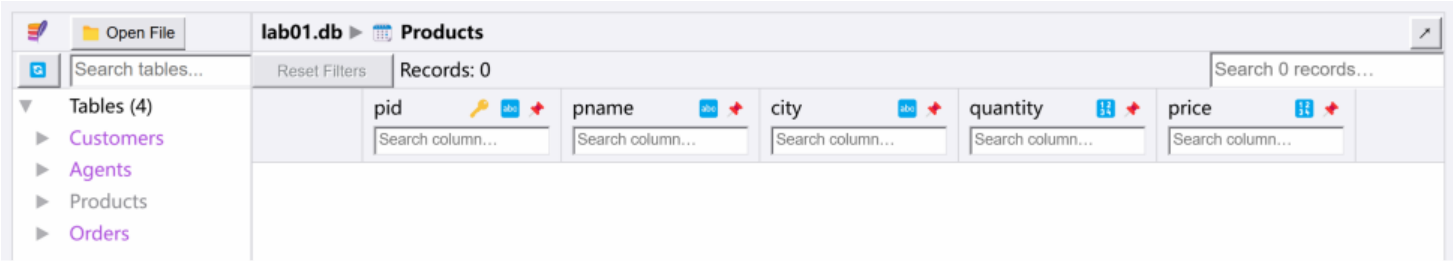
(A) 创建表

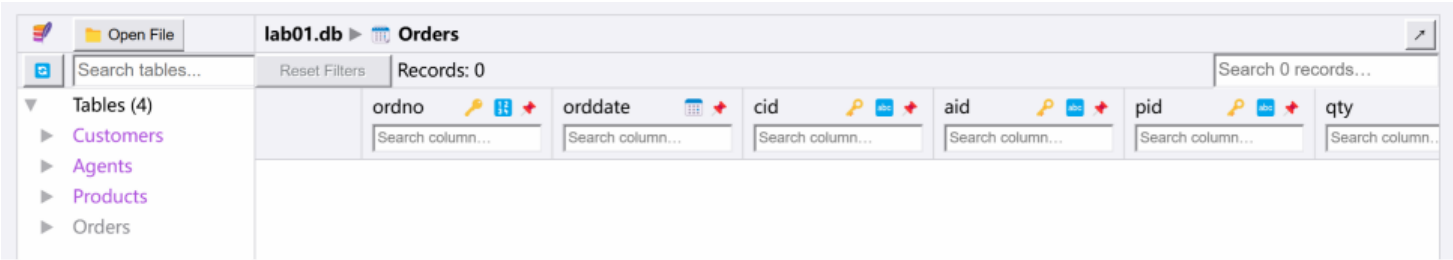
```
/* 创建 用户表 */
CREATE TABLE
    IF NOT EXISTS Customers (
        cid CHAR(4) NOT NULL PRIMARY KEY -- 编号 主键
,
        cname CHAR(20) NOT NULL -- 姓名
,
        city CHAR(20) -- 城市
,
        discnt REAL -- 折扣
    );


/* 创建 经销商 表 */
CREATE TABLE
    IF NOT EXISTS Agents (
        aid CHAR(3) NOT NULL PRIMARY KEY -- 编号 主键
,
        aname CHAR(20) NOT NULL -- 名称
,
        city CHAR(20) -- 城市
,
        perc SMALLINT -- 佣金比例
    );


/* 创建 商品表 */
CREATE TABLE
    IF NOT EXISTS Products (
        pid CHAR(3) NOT NULL PRIMARY KEY -- 编号 主键
,
        pname CHAR(20) NOT NULL -- 名称
,
        city CHAR(20) -- 城市
,
        quantity INT NOT NULL -- 存货数量
,
        price REAL NOT NULL -- 单价
```

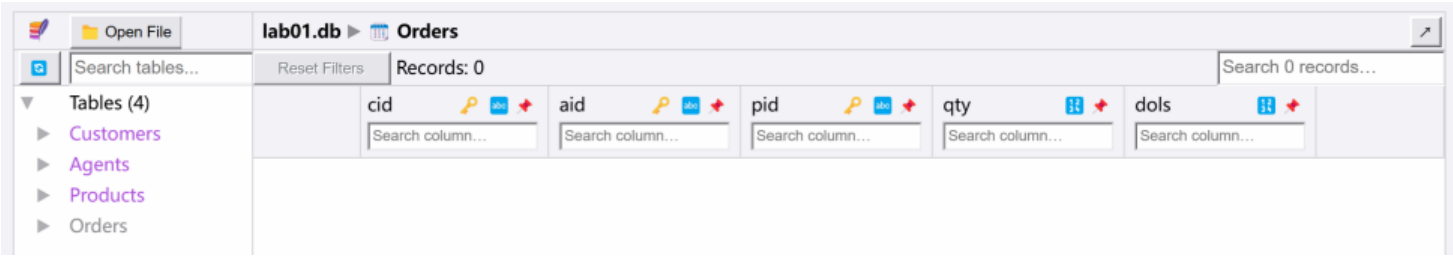
```
    );


/* 创建 订单表 注意这里 我 认为 需要使用 一下 外码 如果更新删除了那么就一同更新删除*/
CREATE TABLE
    IF NOT EXISTS Orders (
        ordno INT NOT NULL PRIMARY KEY -- 订单编号
,
        orddate DATE NOT NULL -- 订单日期
,
        cid CHAR(4) NOT NULL -- 顾客编号
,
        aid CHAR(3) NOT NULL -- 经销商编号
,
        pid CHAR(3) NOT NULL -- 商品编号
,
        qty INT -- 数量
,
        dols REAL -- 金额 这里规定的应该是这笔交易的总金额
,
        Foreign KEY (cid) REFERENCES Customers (cid) ON UPDATE CASCADE ON DELETE CASCADE,
        Foreign KEY (aid) REFERENCES Agents (aid) ON UPDATE CASCADE ON DELETE CASCADE,
        Foreign KEY (pid) REFERENCES Products (pid) ON UPDATE CASCADE ON DELETE CASCADE
    );
```





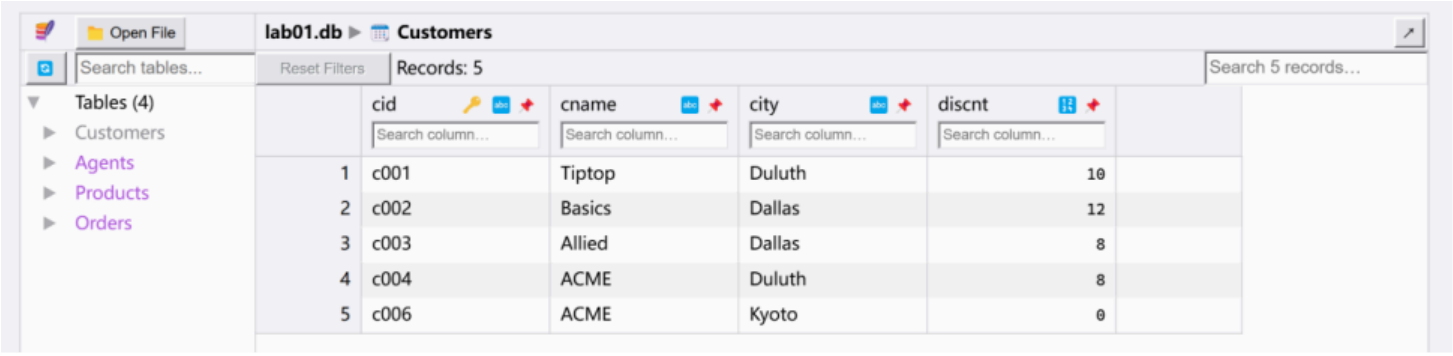

Open File
lab01.db ▶ Products
Search tables...
Reset Filters
Records: 0
Search 0 records...
Tables (4)
Customers
Agents
Products
Orders
pid
pname
city
quantity
price
Search column...


Open File
lab01.db ▶ Orders
Search tables...
Reset Filters
Records: 0
Search 0 records...
Tables (4)
Customers
Agents
Products
Orders
ordno
orddate
cid
aid
pid
qty
Search column...


Open File
lab01.db ▶ Orders
Search tables...
Reset Filters
Records: 0
Search 0 records...
Tables (4)
Customers
Agents
Products
Orders
cid
aid
pid
qty
dols
Search column...

(B) 插入数据

```
INSERT INTO Customers VALUES ('c001', 'Tiptop', 'Duluth',   10.00);
INSERT INTO Customers VALUES ('c002', 'Basics', 'Dallas',   12.00);
INSERT INTO Customers VALUES ('c003', 'Allied', 'Dallas',   8.00);
INSERT INTO Customers VALUES ('c004', 'ACME',   'Duluth',   8.00);
INSERT INTO Customers VALUES ('c006', 'ACME',   'Kyoto',    0.00);

INSERT INTO Agents VALUES ('a01', 'Smith',  'New York', 6);
INSERT INTO Agents VALUES ('a02', 'Jones',  'Newark',   6);
INSERT INTO Agents VALUES ('a03', 'Brown',  'Tokyo',    7);
INSERT INTO Agents VALUES ('a04', 'Gray',   'New York', 6);
INSERT INTO Agents VALUES ('a05', 'Otasi',  'Duluth',   5);
INSERT INTO Agents VALUES ('a06', 'Smith',  'Dallas',   5);

INSERT INTO Products VALUES ('p01', 'comb',     'Dallas', 111400, 0.50);
INSERT INTO Products VALUES ('p02', 'brush',    'Newark', 203000, 0.50);
INSERT INTO Products VALUES ('p03', 'razor',    'Duluth', 150600, 1.00);
INSERT INTO Products VALUES ('p04', 'pen',      'Duluth', 125300, 1.00);
INSERT INTO Products VALUES ('p05', 'pencil',   'Dallas', 221400, 1.00);
INSERT INTO Products VALUES ('p06', 'folder',   'Dallas', 123100, 2.00);
INSERT INTO Products VALUES ('p07', 'case',     'Newark', 100500, 1.00);

INSERT INTO Orders VALUES (1011, '2016-01-08', 'c001', 'a01', 'p01', 1000, 450.00);
INSERT INTO Orders VALUES (1012, '2016-01-12', 'c001', 'a01', 'p01', 1000, 450.00);
INSERT INTO Orders VALUES (1019, '2016-02-24', 'c001', 'a02', 'p02', 400,  180.00);
INSERT INTO Orders VALUES (1017, '2016-02-10', 'c001', 'a06', 'p03', 600,  540.00);
INSERT INTO Orders VALUES (1018, '2016-02-16', 'c001', 'a03', 'p04', 600,  540.00);
INSERT INTO Orders VALUES (1023, '2016-03-12', 'c001', 'a04', 'p05', 500,  450.00);
INSERT INTO Orders VALUES (1022, '2016-03-08', 'c001', 'a05', 'p06', 400,  720.00);
INSERT INTO Orders VALUES (1025, '2016-04-07', 'c001', 'a05', 'p07', 800,  720.00);
INSERT INTO Orders VALUES (1013, '2016-01-13', 'c002', 'a03', 'p03', 1000, 880.00);
INSERT INTO Orders VALUES (1026, '2016-05-20', 'c002', 'a05', 'p03', 800,  704.00);
INSERT INTO Orders VALUES (1015, '2016-01-23', 'c003', 'a03', 'p05', 1200, 1104.00);
INSERT INTO Orders VALUES (1014, '2016-01-18', 'c003', 'a03', 'p05', 1200, 1104.00);
INSERT INTO Orders VALUES (1021, '2016-02-28', 'c004', 'a06', 'p01', 1000, 460.00);
INSERT INTO Orders VALUES (1016, '2016-01-25', 'c006', 'a01', 'p01', 1000, 500.00);
INSERT INTO Orders VALUES (1020, '2016-02-05', 'c006', 'a03', 'p07', 600,  600.00);
INSERT INTO Orders VALUES (1024, '2016-03-12', 'c006', 'a06', 'p01', 800,  400.00);
```

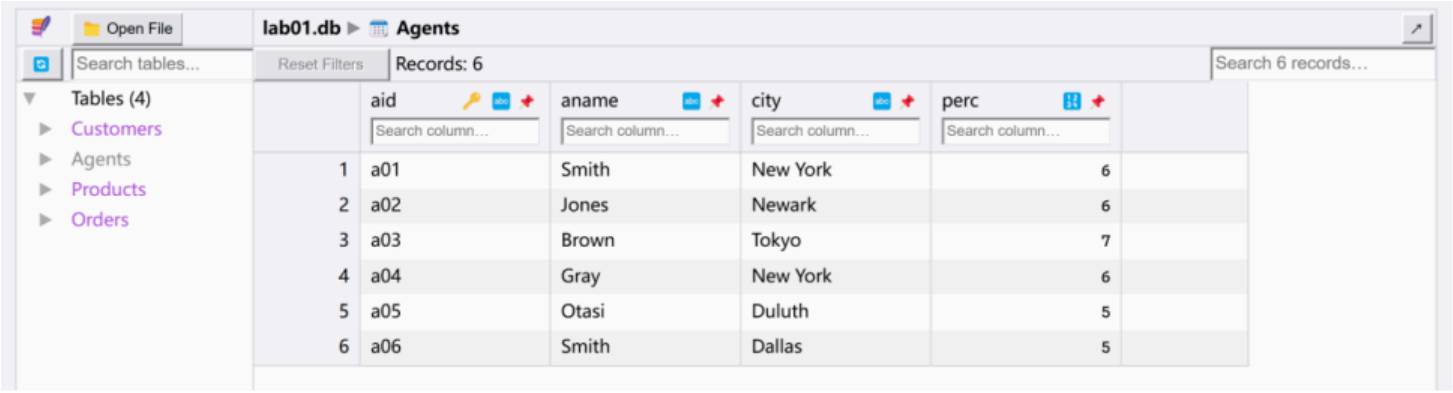


Open File | lab01.db ▶ Customers

Search tables... | Reset Filters | Records: 5 | Search 5 records...

Tables (4)
- Customers
- Agents
- Products
- Orders

	cid	cname	city	discnt
1	c001	Tiptop	Duluth	10
2	c002	Basics	Dallas	12
3	c003	Allied	Dallas	8
4	c004	ACME	Duluth	8
5	c006	ACME	Kyoto	0

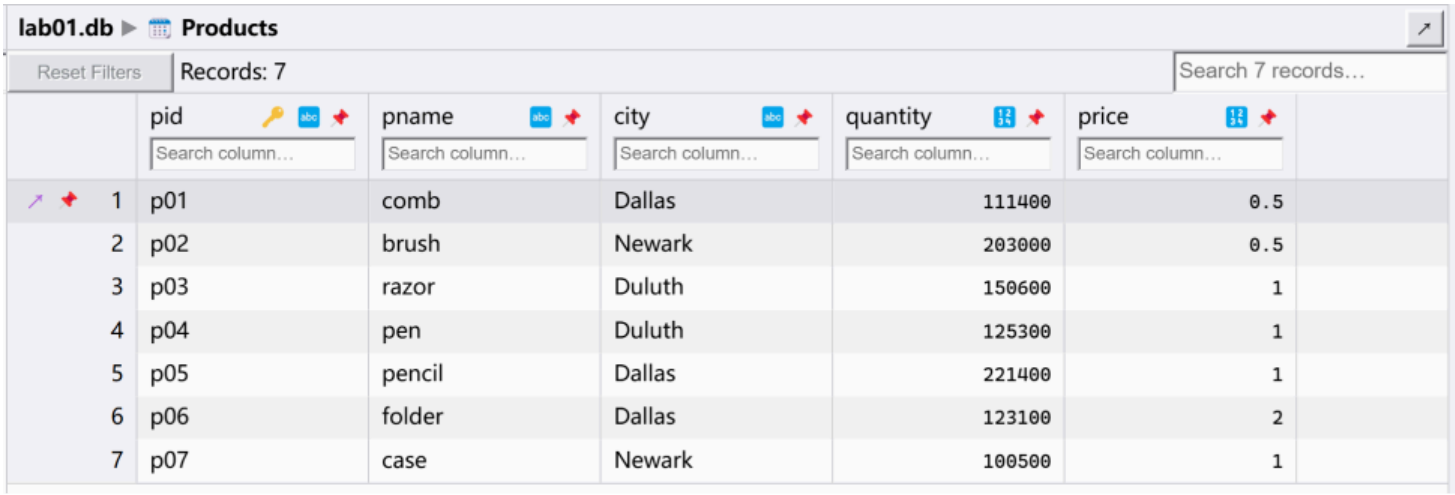


Open File | lab01.db ▶ Agents

Search tables... | Reset Filters | Records: 6 | Search 6 records...

Tables (4)
- Customers
- Agents
- Products
- Orders

	aid	aname	city	perc
1	a01	Smith	New York	6
2	a02	Jones	Newark	6
3	a03	Brown	Tokyo	7
4	a04	Gray	New York	6
5	a05	Otasi	Duluth	5
6	a06	Smith	Dallas	5



lab01.db ▶ Products

Reset Filters | Records: 7 | Search 7 records...

	pid	pname	city	quantity	price
1	p01	comb	Dallas	111400	0.5
2	p02	brush	Newark	203000	0.5
3	p03	razor	Duluth	150600	1
4	p04	pen	Duluth	125300	1
5	p05	pencil	Dallas	221400	1
6	p06	folder	Dallas	123100	2
7	p07	case	Newark	100500	1

lab01.db ▶ Orders

Reset Filters | Records: 16 | Search 16 records...

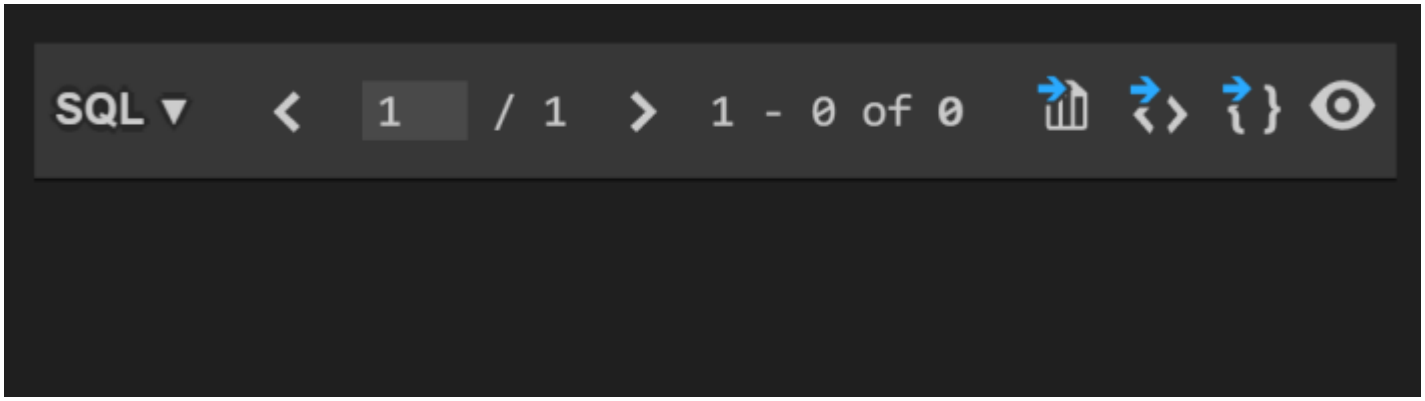
	ordno	orddate	cid	aid	pid	qty	dols
	Search column...	Search column...	Search column...	Search column...	Search column...	Search column...	Search column...
1	1011	2016-01-08	c001	a01	p01	1000	450
2	1012	2016-01-12	c001	a01	p01	1000	450
3	1019	2016-02-24	c001	a02	p02	400	180
4	1017	2016-02-10	c001	a06	p03	600	540
5	1018	2016-02-16	c001	a03	p04	600	540
6	1023	2016-03-12	c001	a04	p05	500	450
7	1022	2016-03-08	c001	a05	p06	400	720
8	1025	2016-04-07	c001	a05	p07	800	720
9	1013	2016-01-13	c002	a03	p03	1000	880
10	1026	2016-05-20	c002	a05	p03	800	704
11	1015	2016-01-23	c003	a03	p05	1200	1104
12	1014	2016-01-18	c003	a03	p05	1200	1104
13	1021	2016-02-28	c004	a06	p01	1000	460
14	1016	2016-01-25	c006	a01	p01	1000	500
15	1020	2016-02-05	c006	a03	p07	600	600
16	1024	2016-03-12	c006	a06	p01	800	400

（C）查询

> **查询结果**: 以 **html** 的格式存放在 ../queries_result/originData 和 ../queries_result/test中，其中 **test** 是加入了自定义数据后的查询结果.
> **命名意义**: *q1* 代表了第一个查询。如果有多个实现方法，如*q2-m2* 代表的是第二个查询的第二种方法。

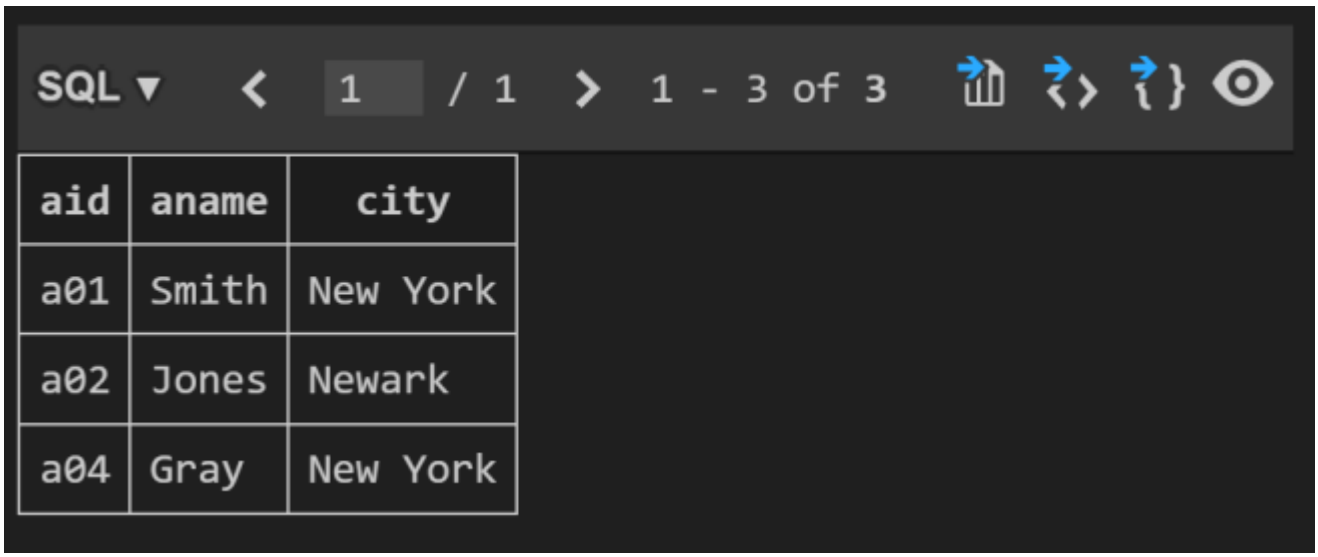
q1 查询没有为居住在 Duluth 的任何顾客订购过任何商品的经销商的编号

```sql
SELECT
    a.aid
FROM
    Agents a
WHERE
    NOT EXISTS (
        SELECT
            *
        FROM
            Customers c
        WHERE
            c.city = 'Duluth'
            AND EXISTS (
                SELECT
                    *
                FROM
                    orders o
                WHERE
                    o.cid = c.cid
                    AND o.aid = a.aid
            )
    );
```



q2 查询城市名称中含有字符串'New'的经销商的编号、名称和所在城市

```
SELECT
    aid,
    aname,
    city
FROM
    Agents
WHERE
    city LIKE "%New%";
```



aid	aname	city
a01	Smith	New York
a02	Jones	Newark
a04	Gray	New York

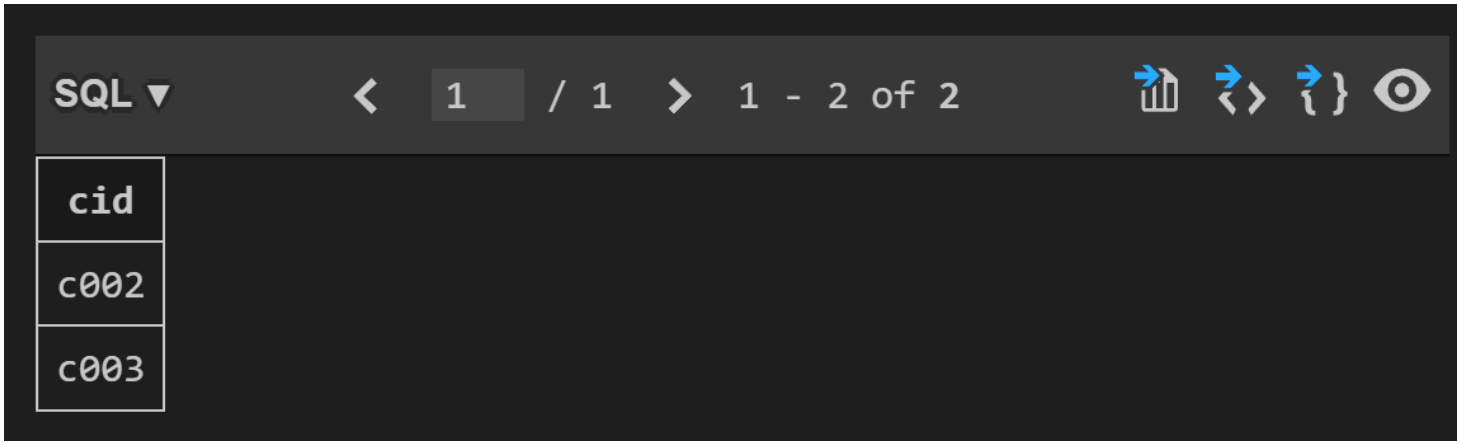
q3 查询仅通过 a03 和 a05 两个经销商订购过商品的顾客编号

q3-m1

```sql
-- Method 1
SELECT
    c.cid
FROM
    Customers c
WHERE
    c.cid IN (
        SELECT
            cid
        FROM
            Orders
    )
    AND NOT EXISTS (
        SELECT
            *
        FROM
            Orders o
        WHERE
            o.cid = c.cid
            AND o.aid NOT IN ('a03', 'a05')
    );
```

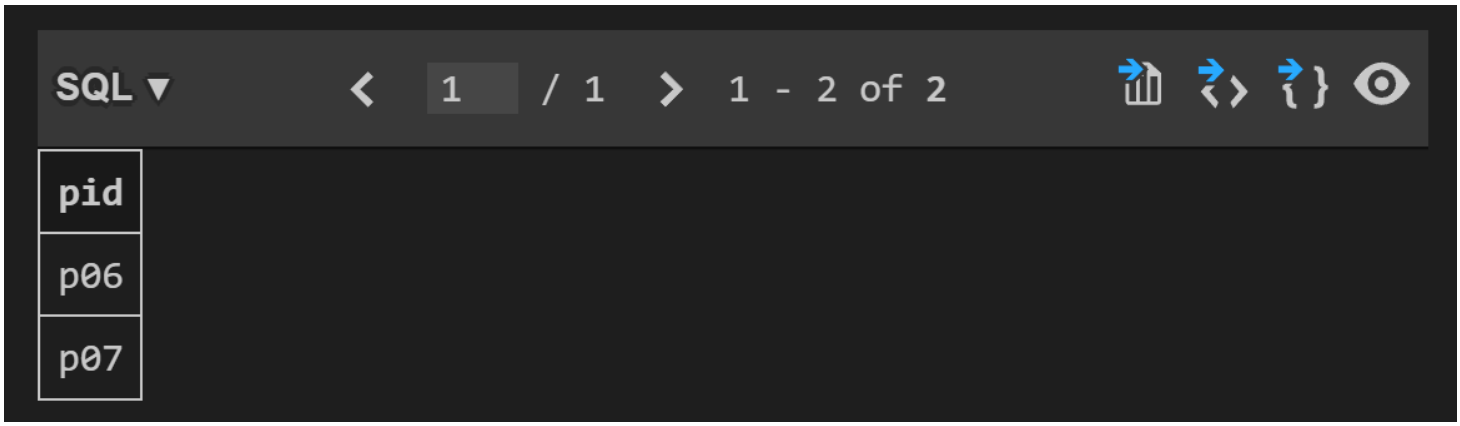
q3-m2

```sql
-- Method2
SELECT
    cid
FROM
    Orders
GROUP BY
    cid
HAVING
    COUNT(DISTINCT aid) <= 2
    AND MAX(aid) IN ('a03', 'a05')
    AND MIN(aid) IN ('a03', 'a05');
```



q4 查询符合下述条件的商品的编号：至少有一个顾客通过与该顾客位于同一个城市的经销商订购过该商品

```sql
SELECT DISTINCT
    o.pid
FROM
    Orders o,
    Customers c,
    Agents a
WHERE
    o.aid = a.aid
    AND o.cid = c.cid
    AND c.city = a.city;
```



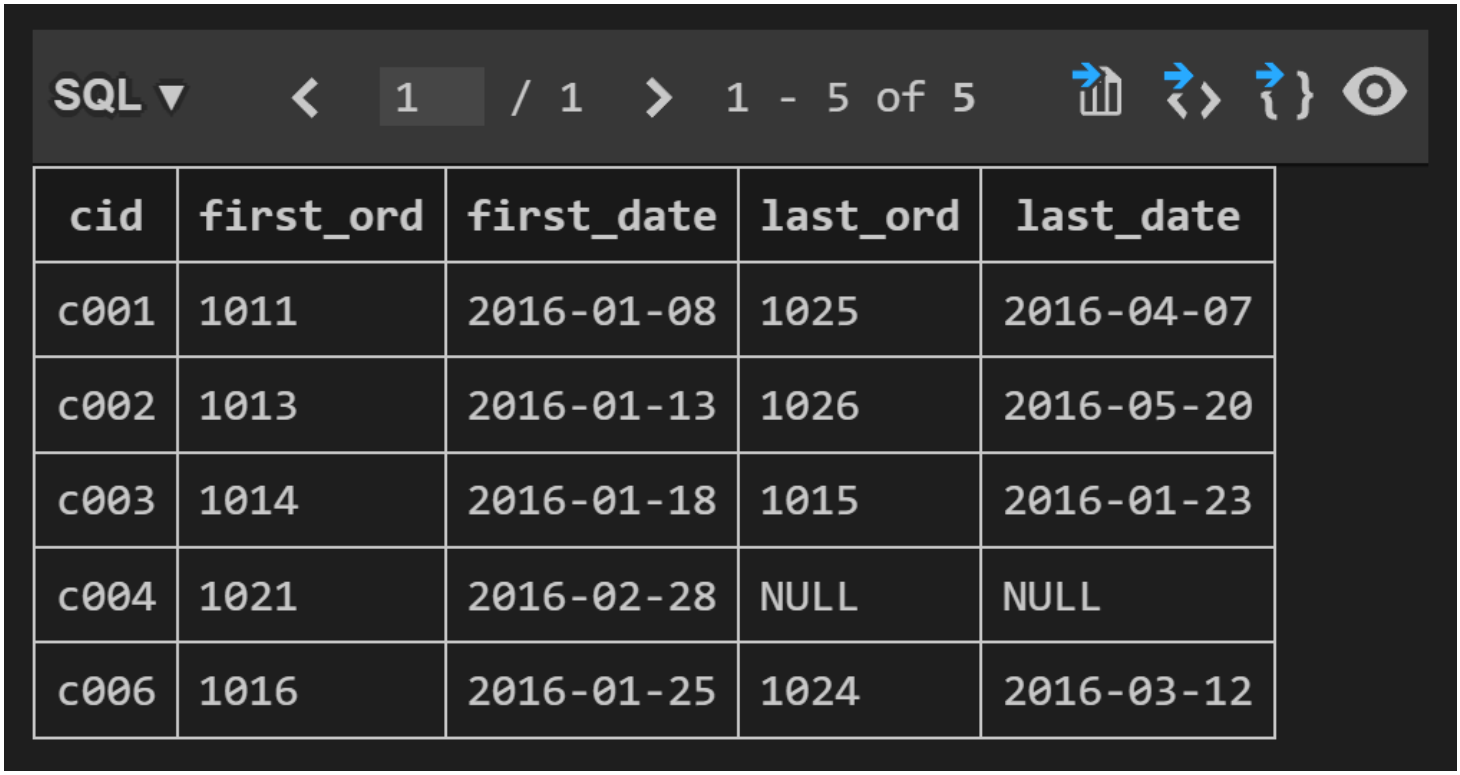
q5 返回每一个顾客的第一份订单和最后一份订单，结果返回顾客编号、第一份订单及最后一份订单的订单编号和订购日期；（按照订单编号的大小区分订单的先后；如果一个顾客只有一份订单，那么该订

单作为该顾客的第一份订单，他的最后一份订单属性返回空值；不需要考虑没有订单的顾客）

q5-m1

```
SELECT
    x.cid,
    x.ordno AS first_ord,
    x.orddate AS first_date,
    y.ordno AS last_ord,
    y.orddate AS last_date
FROM
    orders x,
    orders y
WHERE
    x.cid = y.cid
    AND x.ordno < y.ordno
    AND NOT EXISTS (
        SELECT
            *
        FROM
            orders z
        WHERE
            z.cid = x.cid
            AND (
                z.ordno < x.ordno
                OR z.ordno > y.ordno
            )
    )
UNION
SELECT
    o1.cid,
    o1.ordno,
    o1.orddate,
    NULL,
    NULL
FROM
    orders o1
WHERE
    NOT EXISTS (
        SELECT
            *
        FROM
```

```
        orders o2
    WHERE
        o2.cid = o1.cid
        AND o2.ordno <> o1.ordno
);
```



cid	first_ord	first_date	last_ord	last_date
c001	1011	2016-01-08	1025	2016-04-07
c002	1013	2016-01-13	1026	2016-05-20
c003	1014	2016-01-18	1015	2016-01-23
c004	1021	2016-02-28	NULL	NULL
c006	1016	2016-01-25	1024	2016-03-12

q5-m2

```sql
-- Method 2
SELECT
    c.cid,
    t.first_ord,
    t.first_date,
    t.last_ord,
    t.last_date
FROM
    Customers c
    LEFT JOIN (
        SELECT
            cid,
            MIN(ordno) AS first_ord,
            MIN(orddate) AS first_date,
            CASE
                WHEN COUNT(ordno) = 1 THEN NULL
                ELSE MAX(ordno)
            END AS last_ord,
            CASE
                WHEN COUNT(ordno) = 1 THEN NULL
                ELSE MAX(orddate)
            END AS last_date
        FROM
            orders
        GROUP BY
            cid
    ) t ON c.cid = t.cid;
```

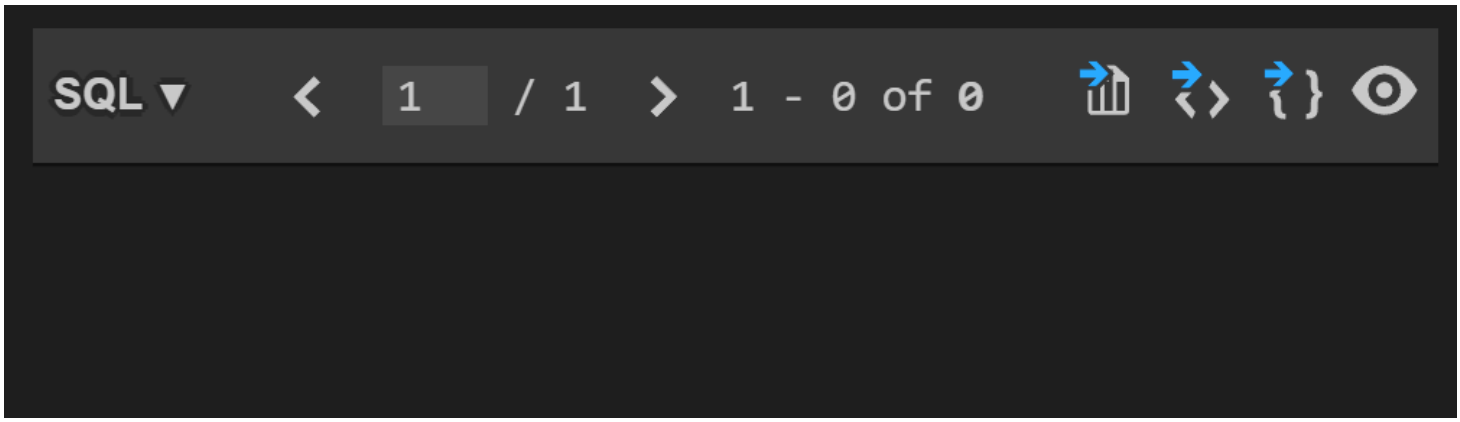
SQL ▼ 1 / 1 1 - 5 of 5

cid	first_ord	first_date	last_ord	last_date
c001	1011	2016-01-08	1025	2016-04-07
c002	1013	2016-01-13	1026	2016-05-20
c003	1014	2016-01-18	1015	2016-01-23
c004	1021	2016-02-28	NULL	NULL
c006	1016	2016-01-25	1024	2016-03-12

q6 在所有有顾客的城市中都被销售过的商品的编号

q6-m1

```
-- Method 1
SELECT
    p.pid
FROM
    Products p
WHERE
    p.pid IN (
        SELECT DISTINCT
            pid
        FROM
            Orders
    )
    AND NOT EXISTS (
        SELECT
            *
        FROM
            (
                SELECT DISTINCT
                    city
                FROM
                    Customers
            ) t
        WHERE
            t.city NOT IN (
                SELECT DISTINCT
                    c.city
                FROM
                    Orders o,
                    Customers c
                WHERE
                    p.pid = o.pid
                    AND o.cid = c.cid
            )
    );
```



q6-m2

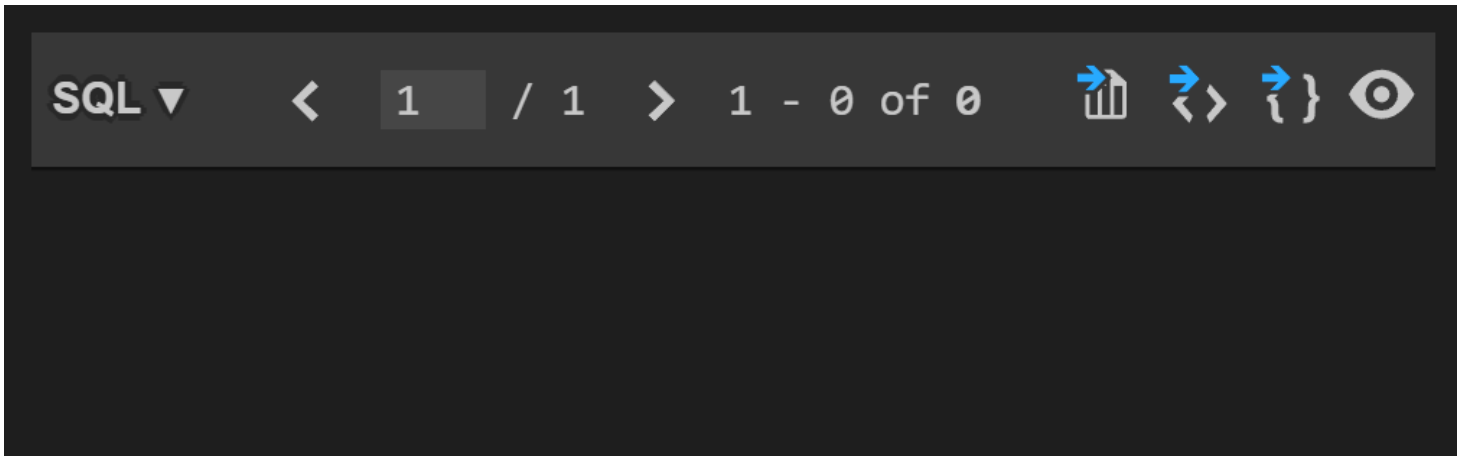
```sql
-- Method 2
SELECT
    t.pid
FROM
    (
        SELECT
            o.pid,
            COUNT(DISTINCT c.city) AS city_num
        FROM
            Orders o,
            Customers c
        WHERE
            o.cid = c.cid
        GROUP BY
            o.pid
    ) t
WHERE
    t.city_num = (
        SELECT
            COUNT(DISTINCT city)
        FROM
            Customers
    );
```


SQL
1
/ 1
1 - 0 of 0

q7 查询居住在 Dallas 的所有顾客都订购过的商品编号

q7-m1

```sql
-- Method 1
SELECT
    p.pid
FROM
    Products p
WHERE
    NOT EXISTS (
        SELECT
            *
        FROM
            (
                SELECT
                    *
                FROM
                    Customers c
                WHERE
                    c.city = 'Dallas'
            ) t
        WHERE
            t.cid NOT IN (
                SELECT DISTINCT
                    o.cid
                FROM
                    Orders o
                WHERE
                    o.pid = p.pid
            )
    );
```



q7-m2

```sql
-- Method 2
SELECT
    o.pid
FROM
    Orders o, Customers c
WHERE
    c.cid = o.cid
    AND c.city = 'Dallas'
GROUP BY
    o.pid
HAVING
    COUNT(DISTINCT c.cid) = (
        SELECT
            COUNT(DISTINCT cid)
        FROM
            Customers WHERE city = 'Dallas'
    );
```

q8 查询享有最高销售提成比例的经销商

q8-m1

```sql
-- Method 1
SELECT
    *
FROM
    Agents
WHERE
    perc = (
        SELECT
            MAX(perc)
        FROM
            Agents
    );
```

aid	aname	city	perc
a03	Brown	Tokyo	7

q8-m2

```sql
-- Method 2
SELECT
    *
FROM
    Agents
WHERE
    aid NOT IN (
        SELECT
            a1.aid
        FROM
            Agents a1,
            Agents a2
        WHERE
            a1.aid <> a2.aid
            AND a1.perc < a2.perc
    );
```

aid	aname	city	perc
a03	Brown	Tokyo	7

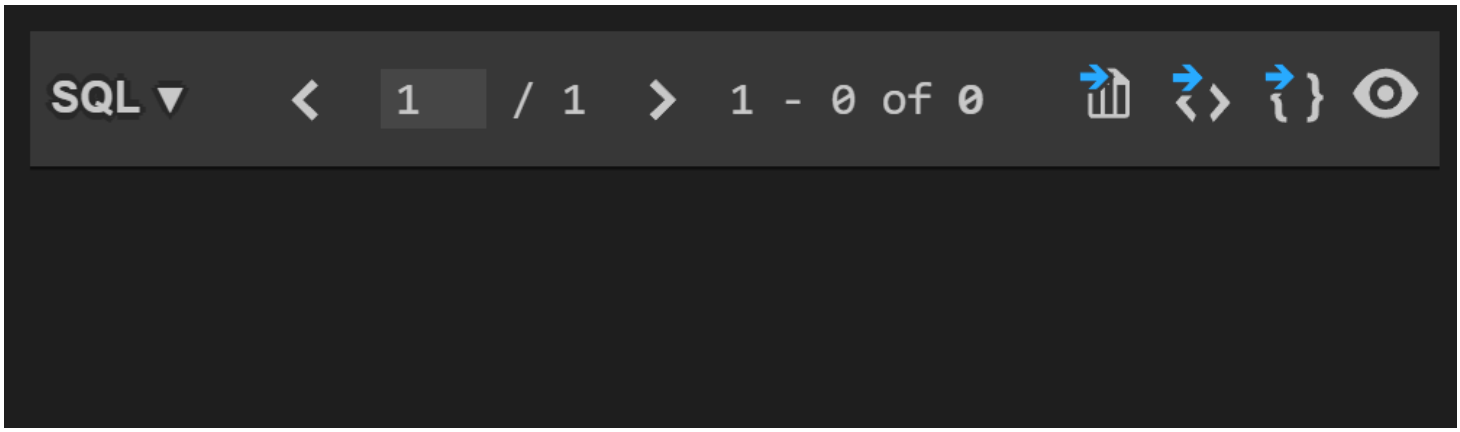
q8-m3

```sql
-- Method 3
SELECT
    a.aid,
    a.aname,
    a.city,
    a.perc
FROM
    Agents a
WHERE
    NOT EXISTS (
        SELECT
            *
        FROM
            Agents t
        WHERE
            t.aid <> a.aid
            AND t.perc > a.perc
    );
```

aid	aname	city	perc
a03	Brown	Tokyo	7

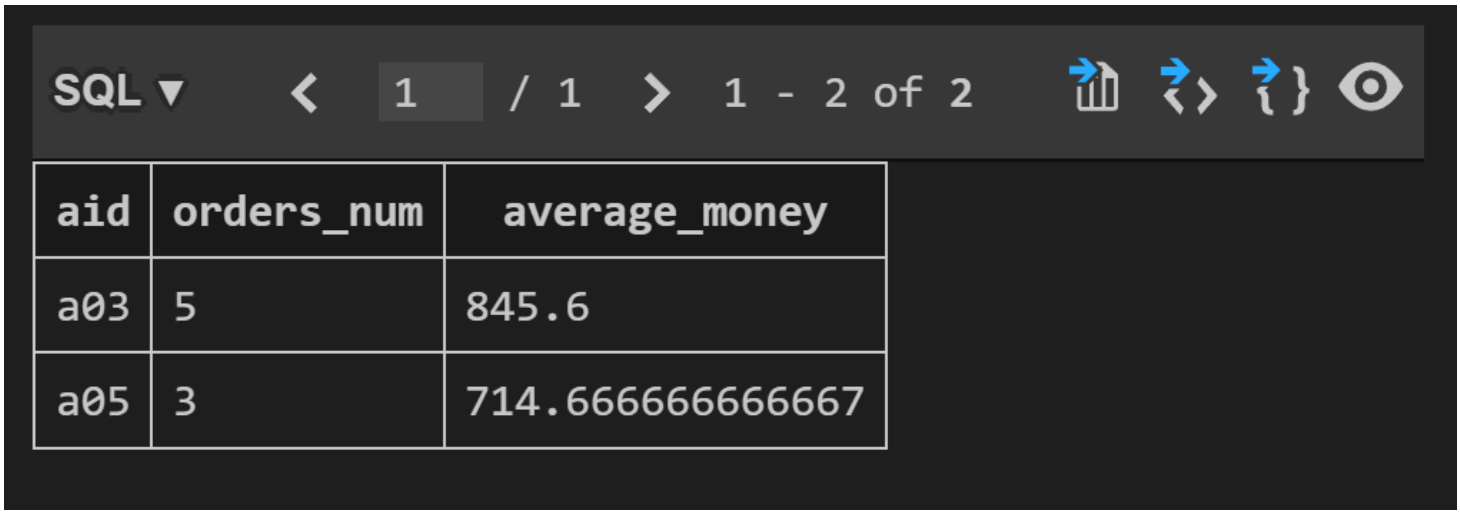
q9 查询仅仅通过 a04 号经销商订购过商品的顾客编号，并给出每个顾客的购买总金额

```
SELECT
    cid,
    SUM(dols) AS total_money
FROM
    Orders
GROUP BY
    (cid)
HAVING
    MAX(aid) = 'a04'
    AND MIN(aid) = 'a04';
```



q10 查询符合下述要求的经销商的销售统计结果（经销商编号，订单条数，订单的平均销售金额）：订单的平均销售金额达到或超过 500，结果按照订单平均销售金额的降序输出查询结果

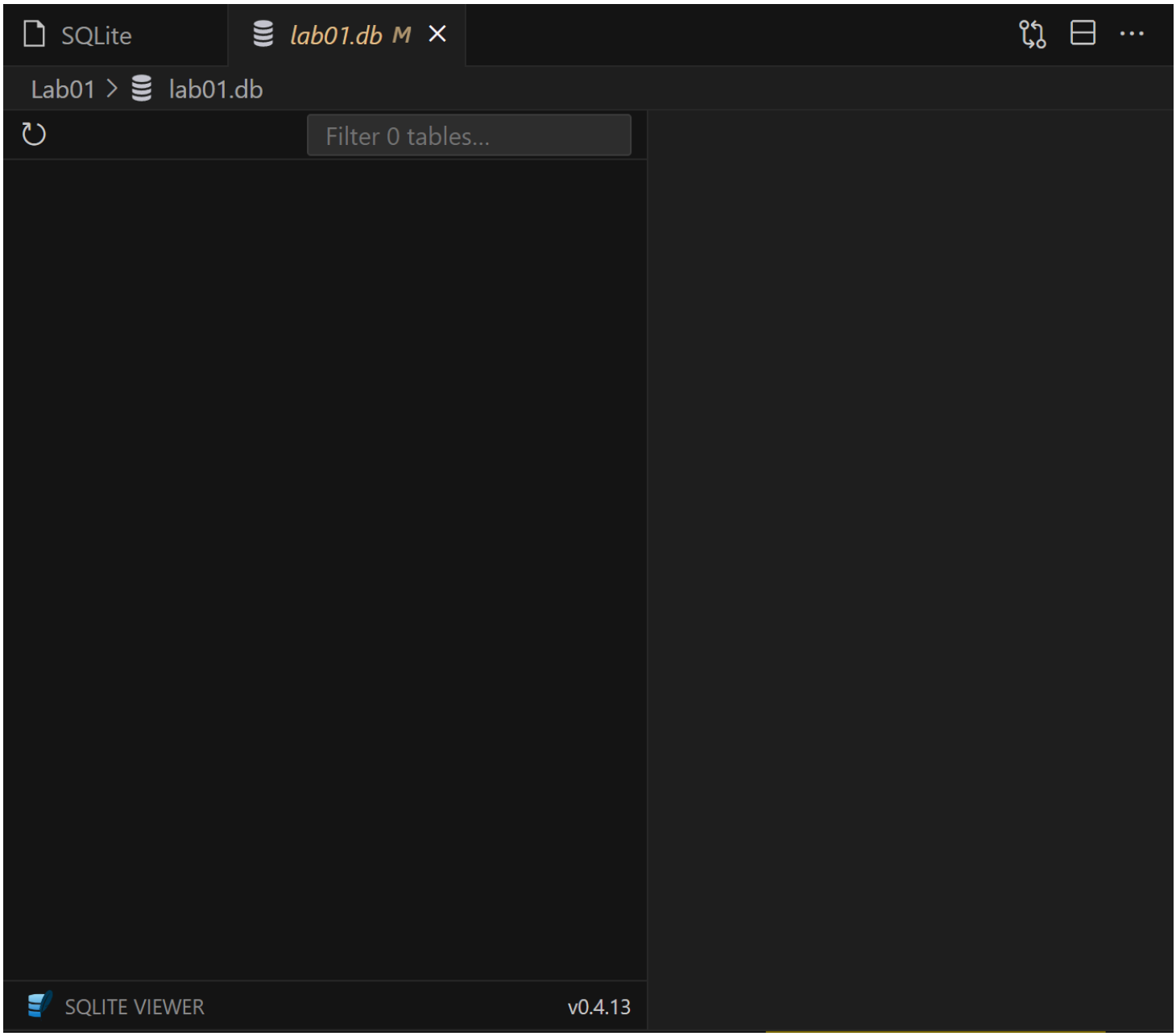
```
SELECT
    aid,
    COUNT(ordno) AS orders_num,
    (SUM(dols) / COUNT(ordno)) AS average_money
FROM
    Orders
GROUP BY
    aid
HAVING
    (SUM(dols) / COUNT(ordno)) >= 500
ORDER BY
    (SUM(dols) / COUNT(ordno)) DESC;
```



aid	orders_num	average_money
a03	5	845.6
a05	3	714.666666666667

(D) 删除表

```
DROP TABLE IF EXISTS Orders;

DROP TABLE IF EXISTS Products;

DROP TABLE IF EXISTS Customers;

DROP TABLE IF EXISTS Agents;
```



（四）实验中遇到的困难及解决办法

1. **困难**：实验 insert 的 data 难以测试写出的查询语句。
2. **办法**：自身再设计一些 data 插入，从而简单的测试一下查询语句书写的正确性与否。

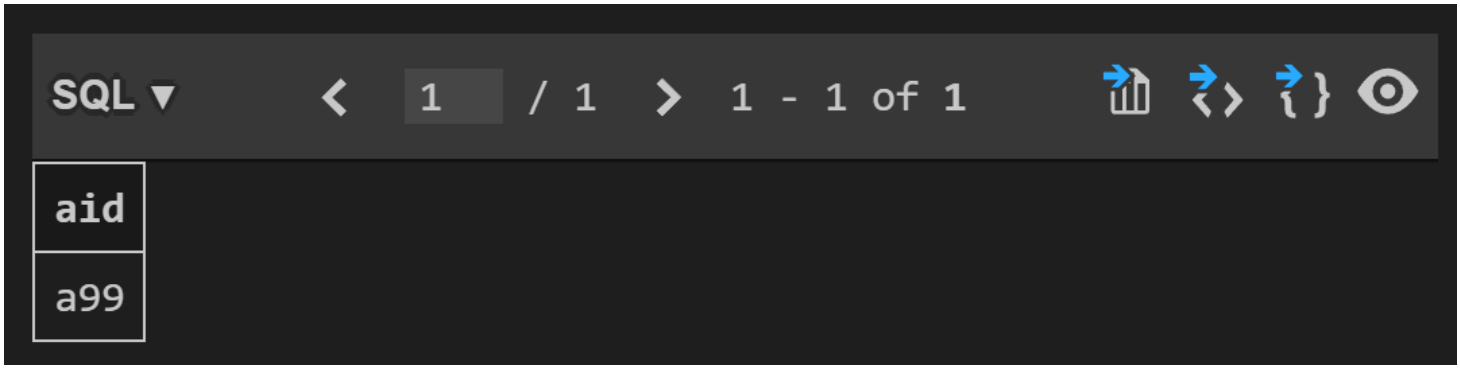
插入简单测试数据

```
-- single test for 3.9
INSERT INTO Customers VALUES ('c100', 'Mojo',   'Suzhou',    0.00);
INSERT INTO Orders VALUES (2001, '2027-01-28', 'c100', 'a04', 'p01', 1000, 460.00);
INSERT INTO Orders VALUES (2002, '2027-02-05', 'c100', 'a04', 'p01', 1000, 500.00);
INSERT INTO Orders VALUES (2003, '2027-02-05', 'c100', 'a04', 'p07', 600,  600.00);
INSERT INTO Orders VALUES (2004, '2027-03-12', 'c100', 'a04', 'p01', 800,  400.00);

-- single test for 3.6 & 3.7
INSERT INTO Products VALUES('p99', 'mama', 'Dallas', 111400, 0.50);
INSERT INTO Orders VALUES (2100, '2036-02-28', 'c002', 'a03', 'p99', 1000, 460.00);
INSERT INTO Orders VALUES (2101, '2036-02-28', 'c003', 'a03', 'p99', 1000, 460.00);
INSERT INTO Orders VALUES (2102, '2036-02-28', 'c001', 'a03', 'p99', 1000, 460.00);
INSERT INTO Orders VALUES (2103, '2036-02-28', 'c004', 'a03', 'p99', 1000, 460.00);
INSERT INTO Orders VALUES (2104, '2036-02-28', 'c006', 'a03', 'p99', 1000, 460.00);
INSERT INTO Orders VALUES (2105, '2036-02-28', 'c100', 'a04', 'p99', 1000, 460.00);

-- single test for 3.1 & 3.8
INSERT INTO Agents VALUES ('a99', 'Mojo',  'York New York', 7);
```

插入测试数据后再次进行 3.1-3.10 的 查询

> 结果见 ../queries_result/test/

3.1



3.2

SQL ▾ 1 / 1 1 - 4 of 4

aid	aname	city
a01	Smith	New York
a02	Jones	Newark
a04	Gray	New York
a99	Mojo	York New York

3.3 m1 & m2

SQL ▾ 1 / 1 1 - 2 of 2

cid
c002
c003

SQL ▾ 1 / 1 1 - 2 of 2

cid
c002
c003

3.4

3.5 m1 & m2

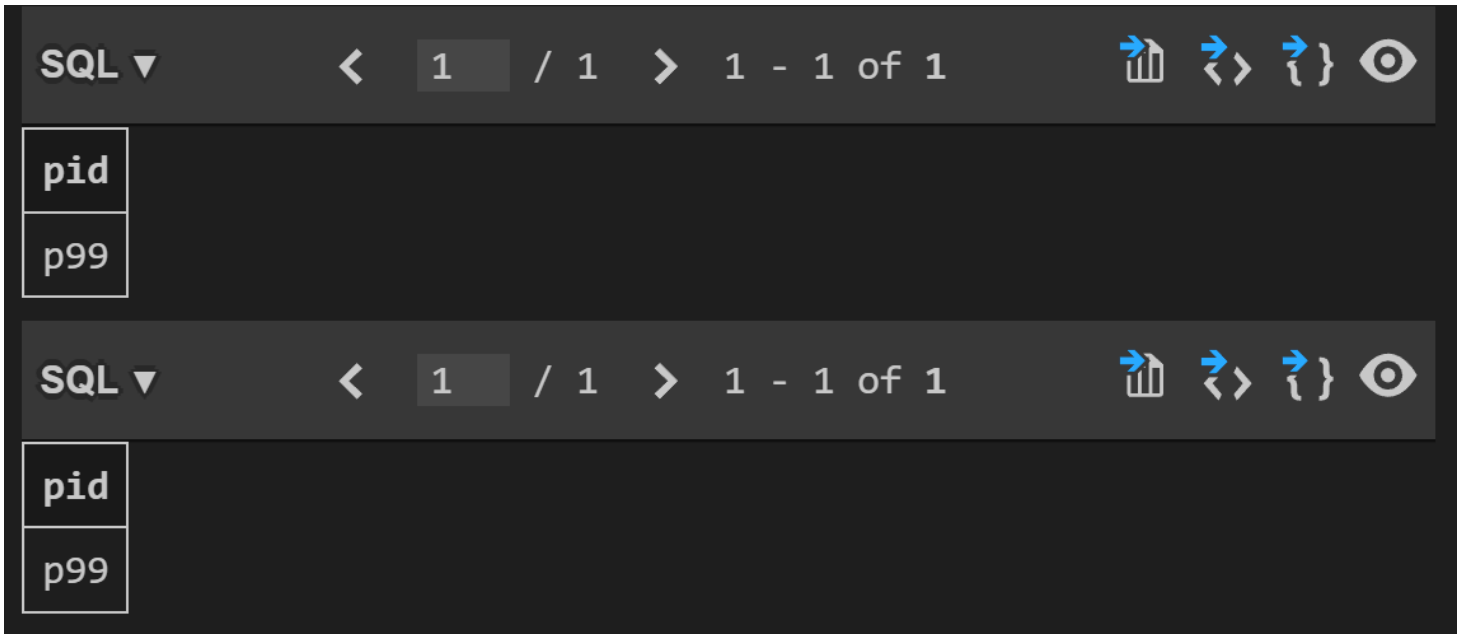
SQL ▾ 1 / 1 1 - 6 of 6

cid	first_ord	first_date	last_ord	last_date
c001	1011	2016-01-08	2102	2036-02-28
c002	1013	2016-01-13	2100	2036-02-28
c003	1014	2016-01-18	2101	2036-02-28
c004	1021	2016-02-28	2103	2036-02-28
c006	1016	2016-01-25	2104	2036-02-28
c100	2001	2027-01-28	2105	2036-02-28

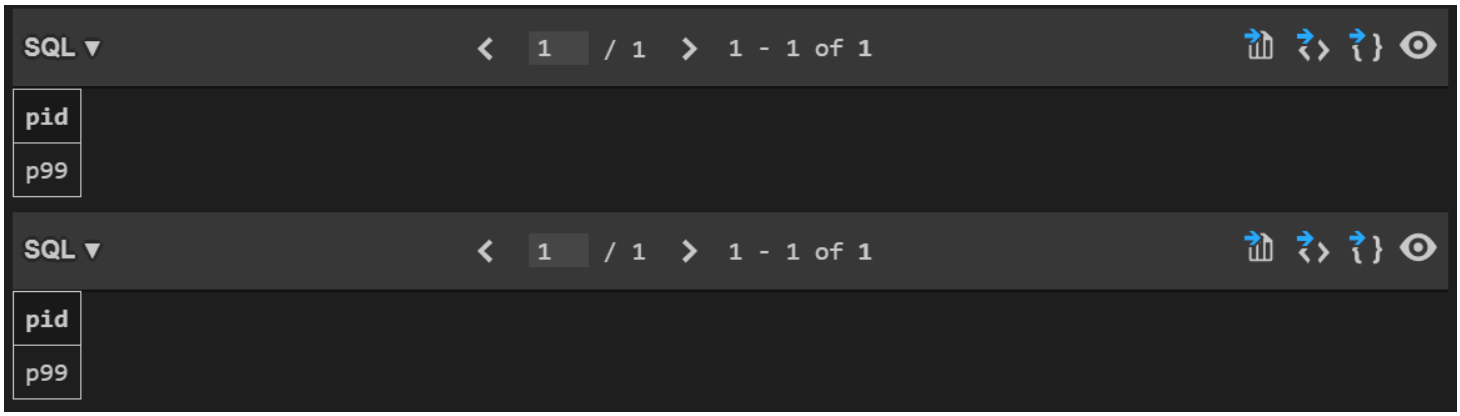
SQL ▾ 1 / 1 1 - 6 of 6

cid	first_ord	first_date	last_ord	last_date
c001	1011	2016-01-08	2102	2036-02-28
c002	1013	2016-01-13	2100	2036-02-28
c003	1014	2016-01-18	2101	2036-02-28
c004	1021	2016-02-28	2103	2036-02-28
c006	1016	2016-01-25	2104	2036-02-28
c100	2001	2027-01-28	2105	2036-02-28

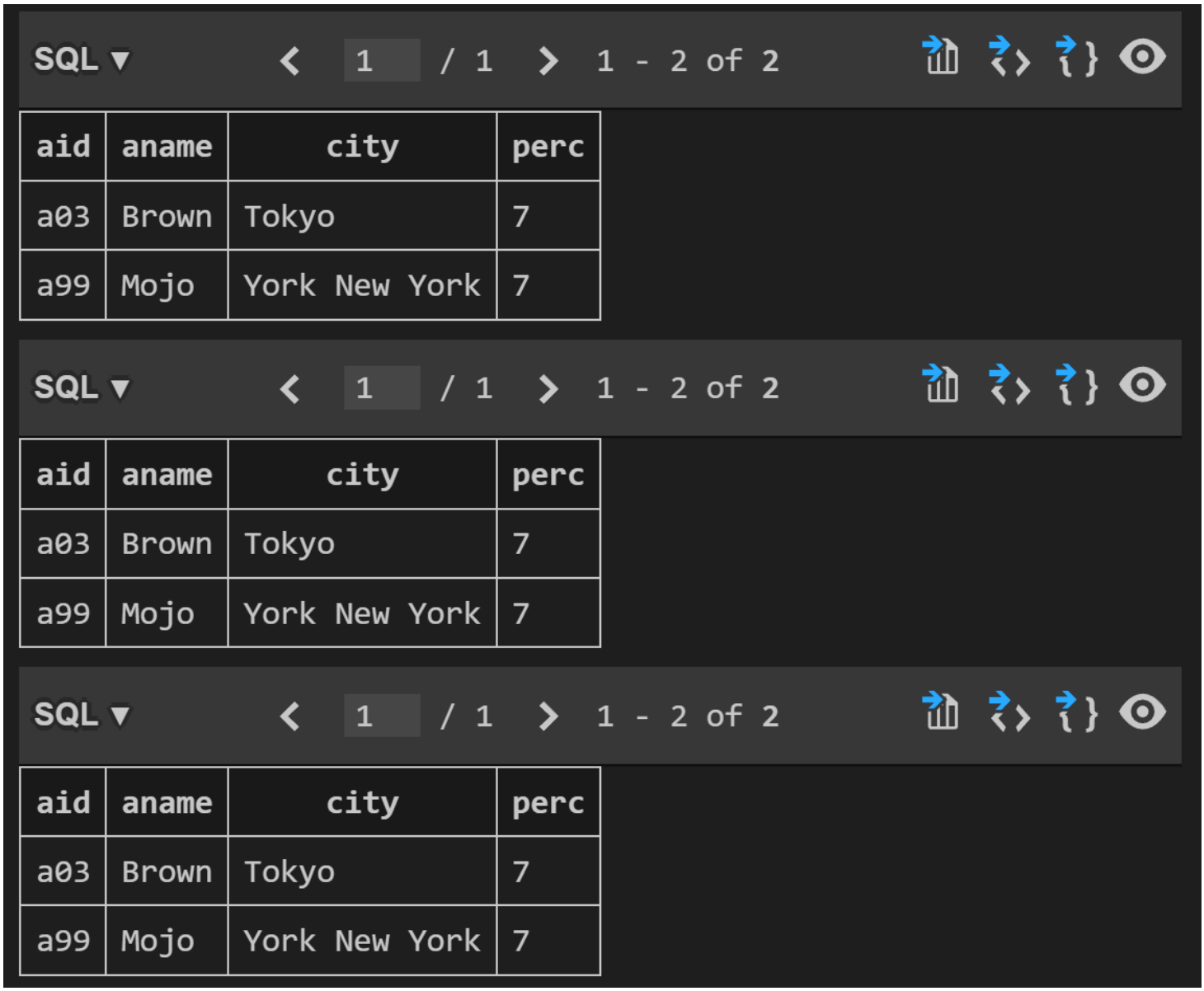
3.6 m1 & m2



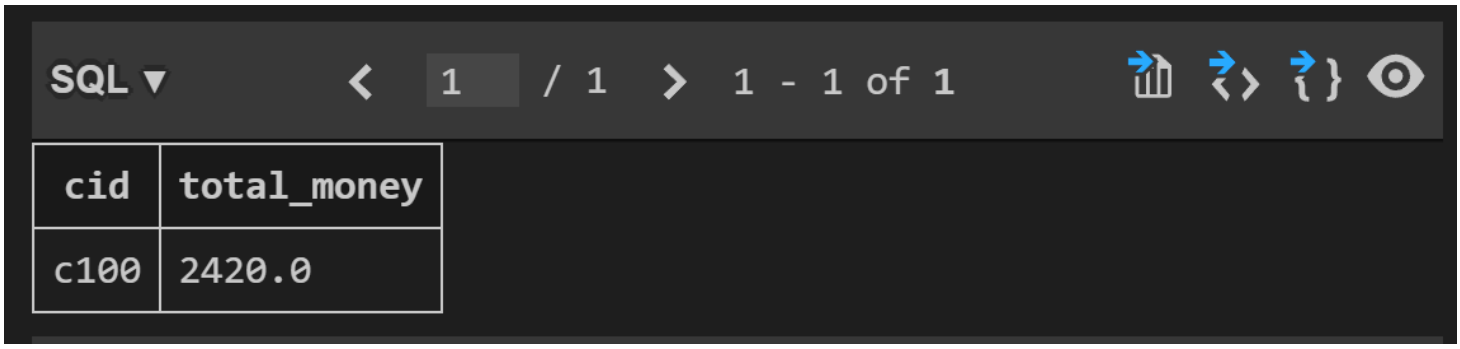
3.7 m1 & m2



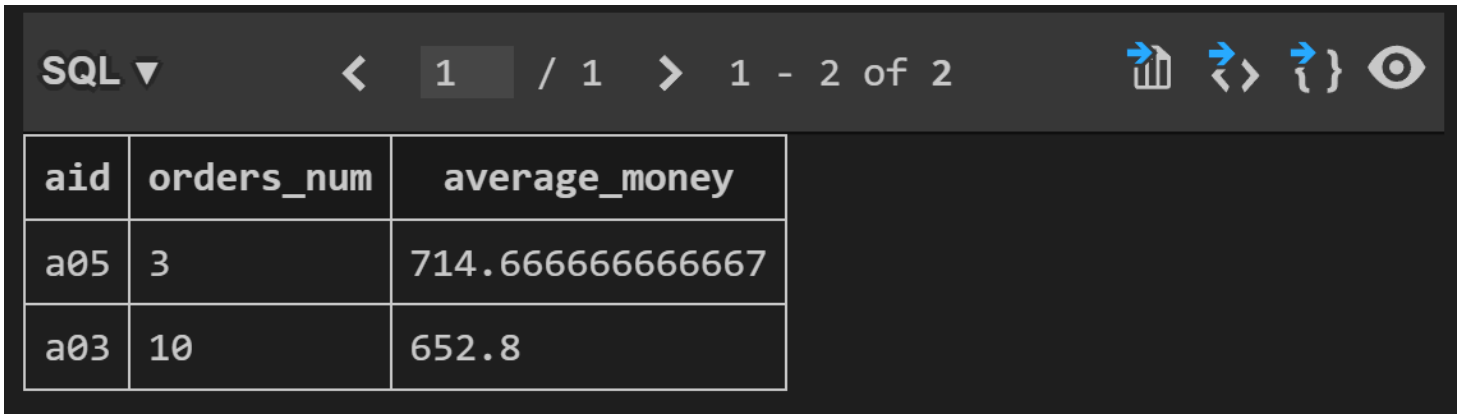
3.8 m1 - m3


SQL ▾ 1 / 1 1 - 2 of 2
aid aname city perc
a03 Brown Tokyo 7
a99 Mojo York New York 7
SQL ▾ 1 / 1 1 - 2 of 2
aid aname city perc
a03 Brown Tokyo 7
a99 Mojo York New York 7
SQL ▾ 1 / 1 1 - 2 of 2
aid aname city perc
a03 Brown Tokyo 7
a99 Mojo York New York 7

3.9


SQL ▾ 1 / 1 1 - 1 of 1
cid total_money
c100 2420.0

3.10



aid	orders_num	average_money
a05	3	714.666666666667
a03	10	652.8

（五）参考文献及致谢

> 查询语句 的 3.5 - method 1 参考了 本次 课程 第二次作业的参考答案.