电子科技大学计算机科学与工程学院

标 准 实 验 报 告

（实验）课程名称 数据库原理及应用

电子科技大学教务处制表

电 子 科 技 大 学

实　验　报　告

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实验地点：　　立人楼 B106　　实验时间：2022 年 12 月 16 日

一、实验项目名称：SQL 实验

二、实验学时：4 学时

三、实验内容：基于 openGauss 的设计性实验

四、实验环境：openGauss (2.0.0)

五、实验数据及结果分析：

六、实验结论：

报告评分：

指导教师签字：

基于openGauss的数据库设计实验

一、实验项目名称

基于openGauss的设计实验

二、实验学时

4个学时

三、实验内容

本实验是数据库综合实验，包括**概念设计，逻辑设计，数据库实施，操作和维护的关系数据库和相关的应用程序的设计**。

3.1 应用说明

该数据库是关于一家国产汽车公司（这里选取**比亚迪**）的相关信息。在该汽车公司中， 公司需要保留相当多的数据，重点关注公司运营的以下几个方面

- 车辆。每辆车有一个唯一的车辆识别号（VIN）。
- 品牌：每个公司可能有几个品牌(例如比亚迪有 '汉'，'唐'等)
- 车型：每个品牌提供几种车型
- 配置：车的颜色，发动机排量、变速器等(由于比亚迪大部分车辆为电车，电池功率更有代表性)
- 经销商：经销商有公司名，地址，级别等属性。
- 销售情况：经销商从制造商处购买车辆并将其出售给客户。可以按日期、品牌、型号和颜色跟踪销售情况
- 供应商：供应商有公司名，地址等属性，供应商为制造商某些型号汽车提供某些零件
- 客户：购买汽车的客户，包括姓名、地址、电话、性别和年收入等

3.2 数据生成

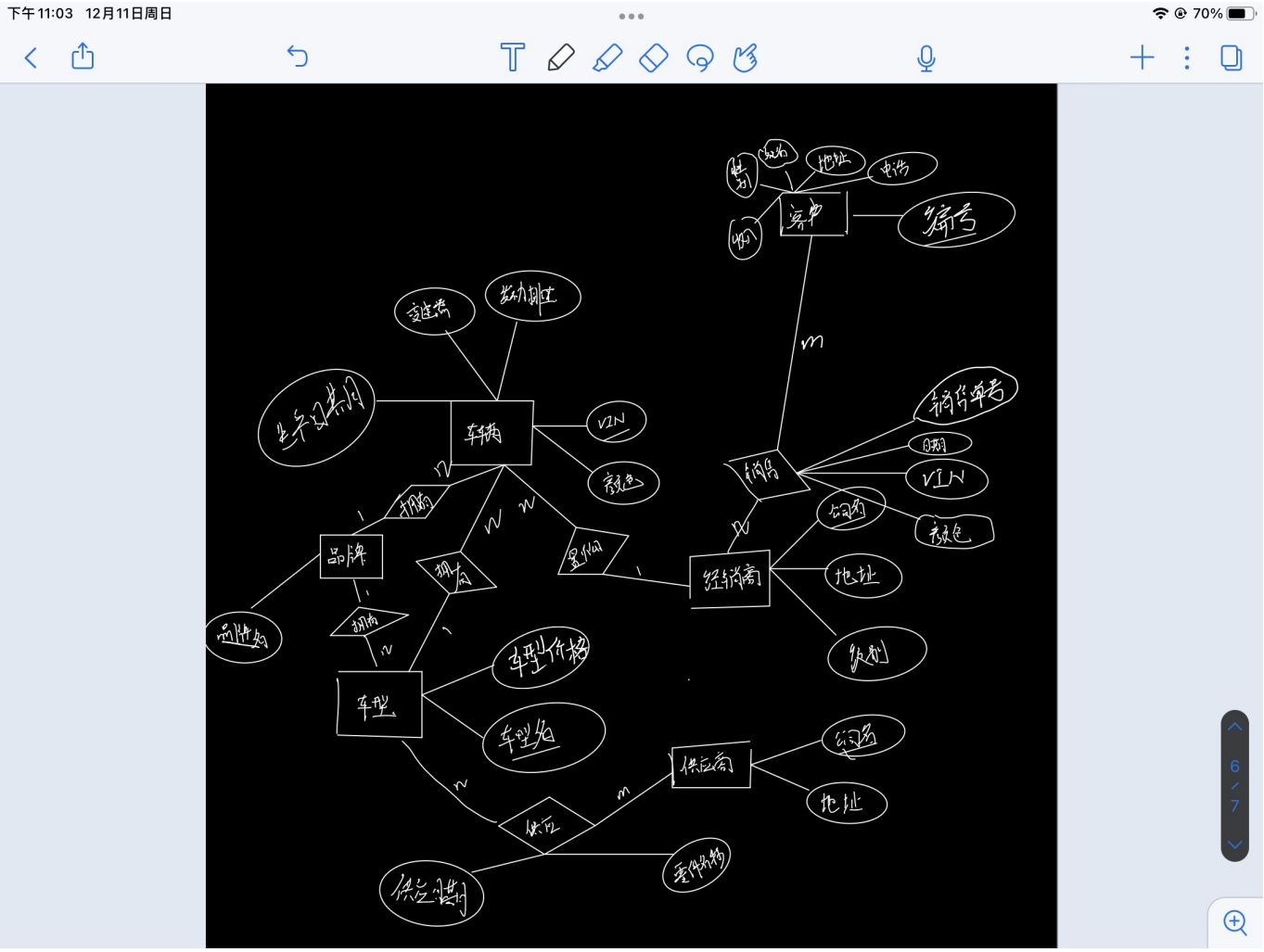
- 车辆数据中车辆标识符(VIN), 根据标识符的规则通过程序构造出比亚迪的车辆标识符
- 车的颜色，品牌，车型，配置信息均通过官网收集数据得到
- 经销商数据从官网收集了几个有特点的数据
- 供应商通过查询官网得到名字，通过程序得到其地址
- 客户和销售数据由于信息不公开，采用自己构造的数据

四、实验环境

openGauss(2.0.0)

五、实验数据及结果分析

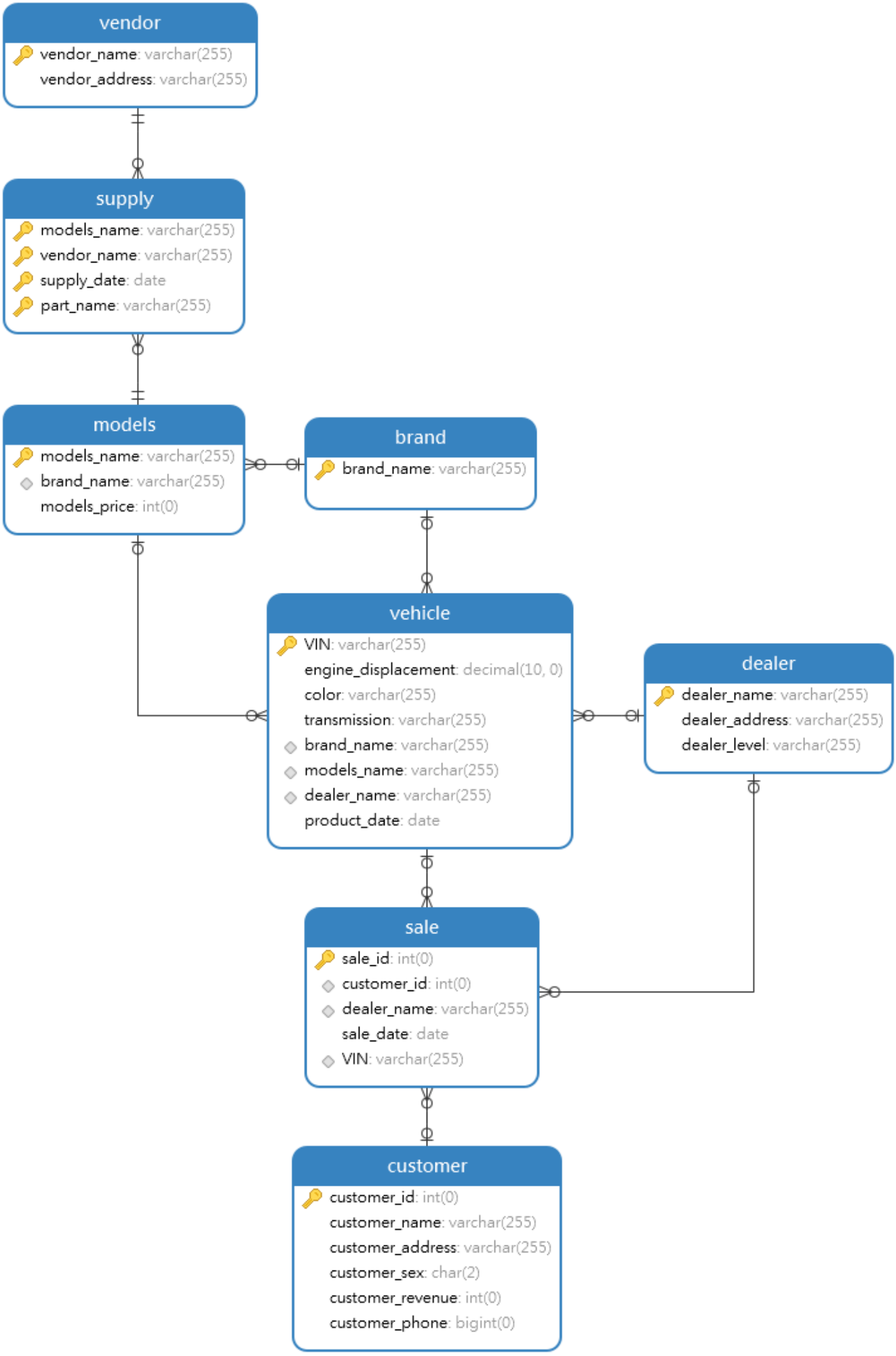
5.1 E-R图及相关解释性说明



5.2 关系模式(逻辑模型)

```
brand (brand_name)
models (models_name, brand_name, models_price)
Vendor (vendor_name, vendor_address)
Dealer (dealer_name, dealer_address, dealer_level)
Customer (customer_id, customer_name, customer_address, customer_sex,
customer_revenue, customer_phone)
vehicle (VIN, engine_displacement, color, transmission, brand_name, models_name,
dealer_name, product_date)
sale (sale_id, customer_id, dealer_name, sale_date, VIN)
Supply (vendor_name, models_name, supply_date, part_name)
```

5.3 表结构(物理结构)


vendor
vendor_name: varchar(255)
vendor_address: varchar(255)
supply
models_name: varchar(255)
vendor_name: varchar(255)
supply_date: date
part_name: varchar(255)
models
models_name: varchar(255)
brand_name: varchar(255)
models_price: int(0)
brand
brand_name: varchar(255)
vehicle
VIN: varchar(255)
engine_displacement: decimal(10, 0)
color: varchar(255)
transmission: varchar(255)
brand_name: varchar(255)
models_name: varchar(255)
dealer_name: varchar(255)
product_date: date
dealer
dealer_name: varchar(255)
dealer_address: varchar(255)
dealer_level: varchar(255)
sale
sale_id: int(0)
customer_id: int(0)
dealer_name: varchar(255)
sale_date: date
VIN: varchar(255)
customer
customer_id: int(0)
customer_name: varchar(255)
customer_address: varchar(255)
customer_sex: char(2)
customer_revenue: int(0)
customer_phone: bigint(0)

5.4 示例查询

- 假设发现供应商“佛吉亚”在2021年12月之间生产的排气系统存在缺陷。找到每辆装有这种排气系统的汽车的车辆识别号（VIN）以及向其销售的客户(姓名+电话)

```
select VIN, customer_name, customer_phone from
vehicle natural join sale natural join customer
where VIN in
(select VIN from vendor natural join supply natural join models natural join
vehicle
where vendor_name = '佛吉亚' and supply_date >= '2021-12-01' and supply_date <=
'2022_12_31' and part_name like '%排气系统%');
```

```
zhangliqundb=> select VIN, customer_name, customer_phone from
zhangliqundb-> vehicle natural join sale natural join customer
zhangliqundb-> where VIN in
zhangliqundb-> (select VIN from vendor natural join supply natural join models natural join vehicle
zhangliqundb(> where vendor_name = '佛吉亚' and supply_date >= '2021-12-01' and supply_date <= '2022_12_31' and part_name like '%排气系统%');
        vin        | customer_name | customer_phone
-------------------+---------------+----------------
 LGXC16DF7C0178765 | 叶文博        |    17536099347
(1 row)
```

- 按销售金额找出销售最好的前两大车型

```
create view total_sales as
select models_name, sum(models_price) models_total_sales
from sale natural join vehicle natural join models
group by models_name
order by models_total_sales desc;

select  * from total_sales limit 2;
```

```
zhangliqundb=> select * from pg_views where viewname = 'total_sales';
-[ RECORD 1 ]-----------------------------------------------------------------------------------------------------------------------------------------------------
schemaname | zhangliqun
viewname   | total_sales
viewowner  | zhangliqun
definition | SELECT vehicle.models_name, sum(models.models_price) AS models_total_sales FROM ((sale NATURAL JOIN vehicle) NATURAL JOIN models) GROUP
BY vehicle.models_name ORDER BY sum(models.models_price) DESC;

zhangliqundb=> select * from total_sales limit 2;
-[ RECORD 1 ]------+---------------
models_name        | 215KM四驱旗舰型
models_total_sales | 329800
-[ RECORD 2 ]------+---------------
models_name        | 千山翠限量版
models_total_sales | 329800

zhangliqundb=>
```

- 按销售数量找出销售最好的前两大品牌

```
create view total_nums as
select brand_name, count(brand_name) brand_total_names
from sale natural join vehicle
group by brand_name
order by brand_total_names desc;

select * from total_nums limit 2;
```

```
zhangliqundb=> select * from pg_views where viewname = 'total_nums';
-[ RECORD 1 ]-----------------------------------------------------------------------------------------------------------------------------------------------------------
schemaname | zhangliqun
viewname   | total_nums
viewowner  | zhangliqun
definition | SELECT vehicle.brand_name, count(vehicle.brand_name) AS brand_total_names FROM (sale NATURAL JOIN vehicle) GROUP BY vehicle.brand_name O
RDER BY count(vehicle.brand_name) DESC;

zhangliqundb=> select * from total_nums limit 2;
-[ RECORD 1 ]-----+---------
brand_name        | 汉
brand_total_names | 2
-[ RECORD 2 ]-----+---------
brand_name        | 驱逐舰05
brand_total_names | 1
```

- 什么颜色的车卖的最好

```
create view total_color_nums as
select color, count(*) color_count from sale natural join vehicle
group by color
order by color_count desc;

select * from total_color_nums limit 2;
```

```
zhangliqundb=> select * from pg_views where viewname = 'total_color_nums';
-[ RECORD 1 ]-----------------------------------------------------------------------------------------------------------------------------------------------------------
schemaname | zhangliqun
viewname   | total_color_nums
viewowner  | zhangliqun
definition | SELECT vehicle.color, count(*) AS color_count FROM (sale NATURAL JOIN vehicle) GROUP BY vehicle.color ORDER BY count(*) DESC;

zhangliqundb=> select * from total_color_nums limit 2;
-[ RECORD 1 ]-----
color       | 白色
color_count | 3
-[ RECORD 2 ]-----
color       | 蓝色
color_count | 2

zhangliqundb=>
```

- 品牌'汉'的车在哪个月卖的最好

```
create view best_sale_month as
select to_char(sale_date, 'YYYY-MM') date1, count(*)
from sale natural join vehicle
where brand_name = '汉'
group by date1
order by count(*);

select * from best_sale_month limit 1;
```

```
zhangliqundb=> create view best_sale_month as
zhangliqundb-> select to_char(sale_date, 'YYYY-MM') date1, count(*)
zhangliqundb-> from sale natural join vehicle
zhangliqundb-> where brand_name = '汉'
zhangliqundb-> group by date1
zhangliqundb-> order by count(*);
CREATE VIEW
zhangliqundb=> select * from best_sale_month limit 1;
  date1   | count
----------+-------
 2020-07 |     1
(1 row)
```

- 实现简单的权限控制

角色名	用户名	权限
customers	yewenbo, liqi	select(vehicle, brand, models, dealer, customer) update(customer)
vendors	fojiya, kedaxunfei	select(models, supply, vendor) update(supply, vendor)
dealers	chengdu, shanghai	select(vehicle, customer, dealer, sale) update(sale, dealer)

```
create role customers identified by 'kunpeng@1234';
create role vendors identified by 'kunpeng@1234';
create role dealers identified by 'kunpeng@1234';
create user yewenbo identified by 'kunpeng@1234';
create user liqi identified by 'kunpeng@1234';
create user fojiya identified by 'kunpeng@1234';
create user kedaxunfei identified by 'kunpeng@1234';
create user chengdu identified by 'kunpeng@1234';
create user shanghai identified by 'kunpeng@1234';

-- 授予角色连接权限
alter role customers login;
alter role vendors login;
alter role dealers login;

-- 授予角色对模式的使用权限
grant usage on schema zhangliqun to customers, vendors, dealers;
grant usage on schema zhangliqun to yewenbo, liqi;
grant usage on schema zhangliqun to fojiya, kedaxunfei;
grant usage on schema zhangliqun to chengdu, shanghai;

-- 授予角色控制权限
grant select on table vehicle, brand, models, dealer, customer to customers;
grant update on table customer to customers;
grant select on table models, supply, vendor to vendors;
grant update on table supply, vendor to customers;
grant select on table vehicle, customer,  dealer, sale to dealers;
grant update on table sale, dealer to dealers;

-- 将用户添加到角色组
grant customers to yewenbo, liqi;
grant vendors to fojiya, kedaxunfei;
grant dealers to chengdu, shanghai;

-- 测试
\c zhangliqundb yewenbo
select * from customer;
select * from sale;
update customer set customer_phone = 19135008746 where customer_name = '叶文博';
update sale set customer_id = 1009;
```

创建的用户组

```
zhangliqundb=> \du
                                                    List of roles
 Role name  |                                                 Attributes                                                 |  Member of
------------+------------------------------------------------------------------------------------------------------------+-------------
 carton     |                                                                                                            | {}
 chengdu    |                                                                                                            | {dealers}
 customers  |                                                                                                            | {}
 dealers    |                                                                                                            | {}
 fojiya     |                                                                                                            | {vendors}
 kedaxunfei |                                                                                                            | {vendors}
 liqi       |                                                                                                            | {customers}
 omm        | Sysadmin, Create role, Create DB, Replication, Administer audit, Monitoradmin, Operatoradmin, Policyadmin, UseFT | {}
 shanghai   |                                                                                                            | {dealers}
 vendors    |                                                                                                            | {}
 yewenbo    |                                                                                                            | {customers}
 zhangliqun | Sysadmin                                                                                                   | {}
```

测试

```
zhangliqundb=> \c zhangliqundb yewenbo
Password for user yewenbo:
Non-SSL connection (SSL connection is recommended when requiring high-security)
You are now connected to database "zhangliqundb" as user "yewenbo".
zhangliqundb=> \dt
                        List of relations
   Schema   |   Name   | Type  | Owner |             Storage
------------+----------+-------+-------+---------------------------------
 zhangliqun | brand    | table |       | {orientation=row,compression=no}
 zhangliqun | customer | table |       | {orientation=row,compression=no}
 zhangliqun | dealer   | table |       | {orientation=row,compression=no}
 zhangliqun | models   | table |       | {orientation=row,compression=no}
 zhangliqun | sale     | table |       | {orientation=row,compression=no}
 zhangliqun | supply   | table |       | {orientation=row,compression=no}
 zhangliqun | vehicle  | table |       | {orientation=row,compression=no}
 zhangliqun | vendor   | table |       | {orientation=row,compression=no}
(8 rows)

zhangliqundb=> select * from customer;
 customer_id | customer_name | customer_address | customer_sex | customer_revenue | customer_phone
-------------+---------------+------------------+--------------+------------------+----------------
      201902 | 李鸿柯        | 重庆             | M            |             5500 |    17227455232
      201903 | 梅野石        | 广州             | F            |             8800 |    16551914771
      201904 | 李琦          | 太原             | F            |             7800 |    18694627441
      201905 | 徐胜治        | 上海             | M            |             6600 |    15550271435
      201906 | 齐守正        | 北京             | M            |             9999 |    18615306331
      201907 | 李佳奇        | 成都             | M            |             5600 |    17157062326
      201908 | 乔振华        | 上海             | M            |             8888 |    14732413907
      201909 | 江浩然        | 重庆             | M            |             5500 |    15382571635
     2019010 | 赵伟          | 北京             | M            |             6777 |    18526016824
     2019011 | 徐达          | 广州             | M            |             8800 |    17859904541
      201901 | 叶文博        | 成都             | M            |             6000 |    19135008746
(11 rows)

zhangliqundb=> select * from sale;
ERROR:  permission denied for relation sale
zhangliqundb=> update customer set customer_phone = 19135008746 where customer_name = '叶文博';
UPDATE 1
```

六、实验结论

- 通过课堂上的限时测试与课下的思考，对openGauss中的触发器，函数，索引，存储过程都有了更深的理解，了解了用sql语句处理**更复杂的业务流程**
- 不同数据库间sql语句有一定的区别，高级数据的管理结构也有较大差异，需要根据不同的数据库做不同的操作

七、附录（代码地址）

初始化数据库

实例查询