Московский государственный технический университет им.Н.Э.Баумана
кафедра "Системы обработки информации и управления"

Постреляционные базы данных

к лабораторной работе №5

Лабораторная работа «Работа с документной NOSQL БД на примере MongoDb»

по дисциплине «Постреляционные базы данных»

Инструктор：Мария Валерьевна

Email:2623859464@qq.com

Студент: Ван Чаочао

группа ИУ5И-22М

2022/05/01

Цель работы:

1. Изучить модель представления данных способы работы с документными БД NoSql.
2. Освоить методы создания документной БД и языки запросов к ним.
3. Получить навыки работы с документной БД MongoDb.

Пункты задания для выполнения:

Задание 1. Создание БД (базовое)

Создание БД《carsystem》

```
> use carsystem
switched to db carsystem
> db
carsystem
>
```

Добавление коллекци в БД:

```
> db.createCollection("car")
{ "ok" : 1 }
> db.createCollection("users")
{ "ok" : 1 }
> show collections
car
users
>
```

Добавление данных:

В коллекцию «car»:

```
> db.car.insert({"carsid":"1","cardescription":"red","carname":"BMW","price":"2000000","sold"
:"20","stock":"100"})
```

```
> db.car.insert({"carsid":"2","cardescription":"black","carname":"Geely","price":"1800000","s
old":"10","stock":"80"})
WriteResult({ "nInserted" : 1 })
> db.car.insert({"carsid":"3","cardescription":"wrangler","carname":"Jeep","price":"42900000"
,"sold":"9","strock":60})
WriteResult({ "nInserted" : 1 })
> db.car.insert({"carsid":"4","cardescription":"silver","carname":"Bently","price":"10000000"
,"sold":"8","stock":"50"})
```

```
> db.car.find().pretty()
{
        "_id" : ObjectId("626a8134a2beb7e64ef1b68a"),
        "carsid" : "1",
        "cardescription" : "red",
        "carname" : "BMW",
        "price" : "2000000",
        "sold" : "20",
        "stock" : "100"
}
{
        "_id" : ObjectId("626a875ca2beb7e64ef1b68b"),
        "carsid" : "2",
        "cardescription" : "black",
        "carname" : "Geely",
        "price" : "1800000",
        "sold" : "10",
        "stock" : "80"
}
{
        "_id" : ObjectId("626a8fd5a2beb7e64ef1b68c"),
        "carsid" : "3",
        "cardescription" : "wrangler",
        "carname" : "Jeep",
        "price" : "42900000",
        "sold" : "9",
        "strock" : 60
}
{
        "_id" : ObjectId("626a987ba2beb7e64ef1b68d"),
        "carsid" : "4",
        "cardescription" : "silver",
        "carname" : "Bently",
        "price" : "10000000",
        "sold" : "8",
        "stock" : "50"
}
>
```

В коллекцию «users»:

```
> db.users.insert({"userid":"1","address":"bmstu","gender":"1","password":"123456789","username":"wcc"})
WriteResult({ "nInserted" : 1 })
> db.users.insert({"userid":"2","address":"bmstu","gender":"1","password":"265438946","username":"zw"})
WriteResult({ "nInserted" : 1 })
> db.users.insert({"userid":"3","address":"bmstu","gender":"0","password":"321654897","username":"hh"})
WriteResult({ "nInserted" : 1 })
> db.users.find().pretty()
{
        "_id" : ObjectId("626a9c47a2beb7e64ef1b68e"),
        "userid" : "1",
        "address" : "bmstu",
        "gender" : "1",
        "password" : "123456789",
        "username" : "wcc"
}
{
        "_id" : ObjectId("626a9ca1a2beb7e64ef1b68f"),
        "userid" : "2",
        "address" : "bmstu",
        "gender" : "1",
        "password" : "265438946",
        "username" : "zw"
}
{
        "_id" : ObjectId("626a9de3a2beb7e64ef1b690"),
        "userid" : "3",
        "address" : "bmstu",
        "gender" : "0",
        "password" : "321654897",
        "username" : "hh"
}
>
```

Задание 2. Изменение данных (**базовое**)

Продемонстрировать изменение объектов БД:

- добавление элемента объекта,(添加)

```
> db.users.insert({"userid":"4","address":"bmstu","gender":"0","password":"987654321","userna
me":"gh"}
... )
WriteResult({ "nInserted" : 1 })
```

- изменение элемента объекта, (更改)

```
> db.users.update({"userid":"4"},{$set:{"address":"tiananmen"}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.users.find({"userid":"4"}).pretty()
{
        "_id" : ObjectId("626ba77ca2beb7e64ef1b691"),
        "userid" : "4",
        "address" : "tiananmen",
        "gender" : "0",
        "password" : "987654321",
        "username" : "gh"
}
```

- удаление элемента объекта, (删除对象元素)

```
> db.users.remove({address:"tiananmen"})
WriteResult({ "nRemoved" : 1 })
> db.users.find()
{ "_id" : ObjectId("626a9c47a2beb7e64ef1b68e"), "userid" : "1", "address" : "bmstu", "gender"
 : "1", "password" : "123456789", "username" : "wcc" }
{ "_id" : ObjectId("626a9cala2beb7e64ef1b68f"), "userid" : "2", "address" : "bmstu", "gender"
 : "1", "password" : "265438946", "username" : "zw" }
{ "_id" : ObjectId("626a9de3a2beb7e64ef1b690"), "userid" : "3", "address" : "bmstu", "gender"
 : "0", "password" : "321654897", "username" : "hh" }
>
```

- замена всего объекта, (更换整个对象)

```
> db.users.update({},{$set:{gender:1}},{multi:true})
WriteResult({ "nMatched" : 3, "nUpserted" : 0, "nModified" : 3 })
> db.users.find()
{ "_id" : ObjectId("626a9c47a2beb7e64ef1b68e"), "userid" : "1", "address" : "bmstu", "gender" : 1,
"password" : "123456789", "username" : "wcc" }
{ "_id" : ObjectId("626a9cala2beb7e64ef1b68f"), "userid" : "2", "address" : "bmstu", "gender" : 1,
"password" : "265438946", "username" : "zw" }
{ "_id" : ObjectId("626a9de3a2beb7e64ef1b690"), "userid" : "3", "address" : "bmstu", "gender" : 1,
"password" : "321654897", "username" : "hh" }
>
```

- удаление объекта. (删除一个对象)

```
> db.createCollection("orders")
{ "ok" : 1 }
> db.orders.drop()
true
>
```

Задание 3. Запросы к БД (**базовое**).

Выполнить запросы к базе данных:

- вывод всех элементов коллекции, (显示集合的所有元素)

```
> db.users.find()
{ "_id" : ObjectId("626a9c47a2beb7e64ef1b68e"), "userid" : "1", "address" : "bmstu", "gender" : 1, "passwor
d" : "123456789", "username" : "wcc" }
{ "_id" : ObjectId("626a9ca1a2beb7e64ef1b68f"), "userid" : "2", "address" : "bmstu", "gender" : 1, "passwor
d" : "265438946", "username" : "zw" }
{ "_id" : ObjectId("626a9de3a2beb7e64ef1b690"), "userid" : "3", "address" : "bmstu", "gender" : 1, "passwor
d" : "321654897", "username" : "hh" }
> db.car.find()
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "carsid" : "1", "cardescription" : "red", "carname" : "BMW"
, "price" : "2000000", "sold" : "20", "stock" : "100" }
{ "_id" : ObjectId("626a875ca2beb7e64ef1b68b"), "carsid" : "2", "cardescription" : "black", "carname" : "Ge
ely", "price" : "1800000", "sold" : "10", "stock" : "80" }
{ "_id" : ObjectId("626a8fd5a2beb7e64ef1b68c"), "carsid" : "3", "cardescription" : "wrangler", "carname" :
"Jeep", "price" : "42900000", "sold" : "9", "strock" : 60 }
{ "_id" : ObjectId("626a987ba2beb7e64ef1b68d"), "carsid" : "4", "cardescription" : "silver", "carname" : "B
ently", "price" : "10000000", "sold" : "8", "stock" : "50" }
>
```

- вывод с фильтрацией (условия с И), (过滤输出 (AND 条件))

$lte:<=

```
> db.car.find({price:{$lte:"1800000"}})
{ "_id" : ObjectId("626a875ca2beb7e64ef1b68b"), "carsid" : "2", "cardescription" : "black", "
carname" : "Geely", "price" : "1800000", "sold" : "10", "stock" : "80" }
{ "_id" : ObjectId("626a987ba2beb7e64ef1b68d"), "carsid" : "4", "cardescription" : "silver",
"carname" : "Bently", "price" : "10000000", "sold" : "8", "stock" : "50" }
>
```

условия с И

```
> db.car.find({price:{$lte:"1800000"},cardescription:"black"},{carname:1,stock:1}).limit(1)
{ "_id" : ObjectId("626a875ca2beb7e64ef1b68b"), "carname" : "Geely", "stock" : "80" }
>
```

- проекция вывода (вывод части полей), (输出投影 (部分字段的输出))

```
> db.car.find({carname:"BMW"},{sold:1,stock:1})
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "sold" : "20", "stock" : "100" }
>
```

- сортировка, (排序)

```
> db.car.find().sort({sold:1})
{ "_id" : ObjectId("626a987ba2beb7e64ef1b68d"), "carsid" : "4", "cardescription" : "silver",
"carname" : "Bently", "price" : "10000000", "sold" : 8, "stock" : "50" }
{ "_id" : ObjectId("626a8fd5a2beb7e64ef1b68c"), "carsid" : "3", "cardescription" : "wrangler"
, "carname" : "Jeep", "price" : "42900000", "sold" : 9, "strock" : 60 }
{ "_id" : ObjectId("626a875ca2beb7e64ef1b68b"), "carsid" : "2", "cardescription" : "black", "
carname" : "Geely", "price" : "1800000", "sold" : 10, "stock" : "80" }
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "carsid" : "1", "cardescription" : "red", "ca
rname" : "BMW", "price" : "2000000", "sold" : 20, "stock" : "100" }
>
```

-условия на поля вложенных структур, (嵌套结构字段的条件)

```
> db.car.find({"carname":"BMW"},{price:1,sold:1,stock:1})
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "price" : "2000000", "sold" : 20, "stock" : "100" }
>
```

- поиск по элементам массива объекта.（按对象数组的元素搜索）

```
> db.car.update({"carsid":"2"},{$set:{"cardescription":["black","1.8L"]}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.car.update({"carsid":"3"},{$set:{"cardescription":["wrangler","1.8L"]}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.car.update({"carsid":"4"},{$set:{"cardescription":["silver","1.5L"]}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.car.find({cardescription:"1.5L"})
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "carsid" : "1", "cardescription" : [ "red", "1.5L" ], "
carname" : "BMW", "price" : "2000000", "sold" : 20, "stock" : "100" }
{ "_id" : ObjectId("626a987ba2beb7e64ef1b68d"), "carsid" : "4", "cardescription" : [ "silver", "1.5L" ]
, "carname" : "Bently", "price" : "10000000", "sold" : 8, "stock" : "50" }
>
```

Задание 4. Расширенные возможности (**хорошо**)

Выполнить запросы к базе данных:

- вывод с фильтрацией (условия И, ИЛИ, операции сравнения),

условия И

```
> db.car.find({carname:"BMW",sold:20})
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "carsid" : "1", "cardescription" : [ "red",
"1.5L" ], "carname" : "BMW", "price" : "2000000", "sold" : 20, "stock" : "100" }
>
```

Условия ИЛИ

```
> db.car.find({$or:[{sold:8},{carname:"Jeep"}]})
{ "_id" : ObjectId("626a8fd5a2beb7e64ef1b68c"), "carsid" : "3", "cardescription" : [ "wrangler", "1.8L"
], "carname" : "Jeep", "price" : "42900000", "sold" : 9, "strock" : 60 }
{ "_id" : ObjectId("626a987ba2beb7e64ef1b68d"), "carsid" : "4", "cardescription" : [ "silver", "1.5L" ]
, "carname" : "Bently", "price" : "10000000", "sold" : 8, "stock" : "50" }
>
```

операции сравнения

```
> db.car.find({sold:{$lte:10}})
{ "_id" : ObjectId("626a875ca2beb7e64ef1b68b"), "carsid" : "2", "cardescription" : [ "black", "1.8L" ],
"carname" : "Geely", "price" : "1800000", "sold" : 10, "stock" : "80" }
{ "_id" : ObjectId("626a8fd5a2beb7e64ef1b68c"), "carsid" : "3", "cardescription" : [ "wrangler", "1.8L"
], "carname" : "Jeep", "price" : "42900000", "sold" : 9, "strock" : 60 }
{ "_id" : ObjectId("626a987ba2beb7e64ef1b68d"), "carsid" : "4", "cardescription" : [ "silver", "1.5L" ]
, "carname" : "Bently", "price" : "10000000", "sold" : 8, "stock" : "50" }
>
```

- проекция вывода

вывод конкретных полей特定字段的输出

```
> db.car.find({carname:"BMW"},{price:1,sold:1,stock:1})
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "price" : "2000000", "sold" : 20, "stock" : "100" }
>
```

вывод без идентификатора不带标识符的输出

```
> db.car.find({},{carname:1,sold:1,stock:1}).pretty()
{
        "_id" : ObjectId("626a8134a2beb7e64ef1b68a"),
        "carname" : "BMW",
        "sold" : 20,
        "stock" : "100"
}
{
        "_id" : ObjectId("626a875ca2beb7e64ef1b68b"),
        "carname" : "Geely",
        "sold" : 10,
        "stock" : "80"
}
{
        "_id" : ObjectId("626a8fd5a2beb7e64ef1b68c"),
        "carname" : "Jeep",
        "sold" : 9
}
{
        "_id" : ObjectId("626a987ba2beb7e64ef1b68d"),
        "carname" : "Bently",
        "sold" : 8,
        "stock" : "50"
}
>
```

- с условием на наличие поля，以场的存在为条件，

```
> db.car.find({carname:{$exists:true}})
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "carsid" : "1", "cardescription" : [ "red", "1.5L" ], "carname" : "BMW", "price" : "2000000", "sold" : 20, "stock" : "100" }
{ "_id" : ObjectId("626a875ca2beb7e64ef1b68b"), "carsid" : "2", "cardescription" : [ "black", "1.8L" ], "carname" : "Geely", "price" : "1800000", "sold" : 10, "stock" : "80" }
{ "_id" : ObjectId("626a8fd5a2beb7e64ef1b68c"), "carsid" : "3", "cardescription" : [ "wrangler", "1.8L" ], "carname" : "Jeep", "price" : "42900000", "sold" : 9, "strock" : 60 }
{ "_id" : ObjectId("626a987ba2beb7e64ef1b68d"), "carsid" : "4", "cardescription" : [ "silver", "1.5L" ], "carname" : "Bently", "price" : "10000000", "sold" : 8, "stock" : "50" }
>
```

- вывести один элемент коллекции,- 显示集合的一个元素，

```
> db.car.findOne()
{
        "_id" : ObjectId("626a8134a2beb7e64ef1b68a"),
        "carsid" : "1",
        "cardescription" : [
                "red",
                "1.5L"
        ],
        "carname" : "BMW",
        "price" : "2000000",
        "sold" : 20,
        "stock" : "100"
}
>
```

- продемонстрировать выполнение операторов count, distinct, limit,

Count

```
> db.car.find({carname:"BMW"}).count()
1
>
```

Distinct

```
> db.car.distinct("carname")
[ "BMW", "Bently", "Geely", "Jeep" ]
>
```

limit

```
> db.car.find().limit(2)
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "carsid" : "1", "cardescription" : [ "red", "1.5L" ], "carname" : "BMW", "price" : "2000000", "sold" : 20, "stock" : "100" }
{ "_id" : ObjectId("626a875ca2beb7e64ef1b68b"), "carsid" : "2", "cardescription" : [ "black", "1.8L" ], "carname" : "Geely", "price" : "1800000", "sold" : 10, "stock" : "80" }
>
```

- поиск по вложенным коллекциям объекта.- 搜索对象的嵌套集合。

```
> db.car.find({cardescription:["red","1.5L"]})
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "carsid" : "1", "cardescription" : [ "red", "1.5L" ], "carname" : "BMW", "price" : "2000000", "sold" : 20, "stock" : "100" }
>
```

Продемонстрировать изменение объектов БД:

добавление элементов массива,添加数组元素

```
> db.car.update({carsid:"1"},{$push:{cardescription:"5 seats"}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.car.find({carsid:"1"})
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "carsid" : "1", "cardescription" : [ "red", "1.5L", "5 seats" ], "carname" : "BMW", "price" : "2000000", "sold" : 20, "stock" : "100" }
>
```

удаление элементов массива,删除

```
> db.car.update({carsid:"1"},{$pull:{cardescription:"5 seats"}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.car.find({carsid:"1"})
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "carsid" : "1", "cardescription" : [ "red", "1.5L" ], "carname" : "BMW", "price" : "2000000", "sold" : 20, "stock" : "100" }
>
```

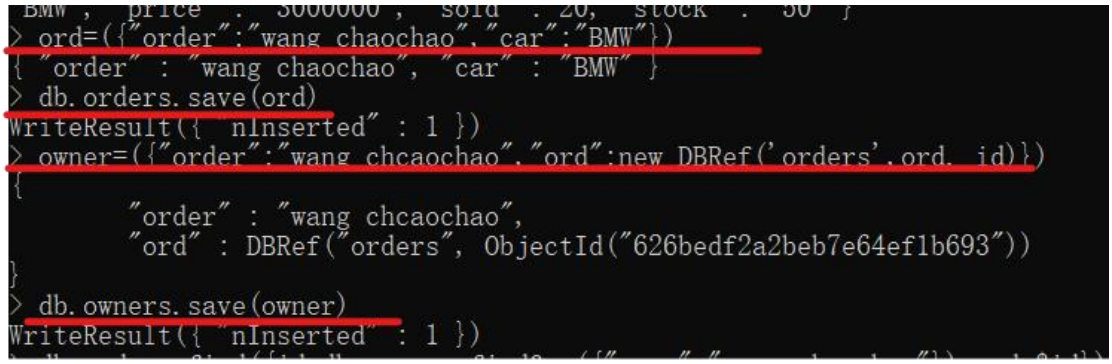
изменение элементов массива,更改

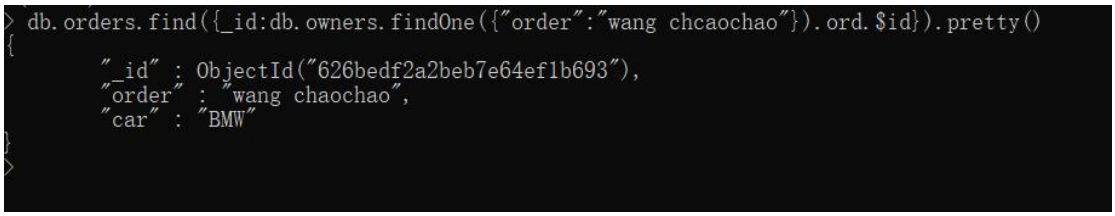
```
> db.car.update({carsid:"1"},{$set:{cardescription:["red","1.8L"]}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.car.find({carsid:"1"})
{ "_id" : ObjectId("626a8134a2beb7e64ef1b68a"), "carsid" : "1", "cardescription" : [ "red", "1.8L" ], "carname" : "BMW", "price" : "2000000", "sold" : 20, "stock" : "100" }
>
```

- изменение нескольких объектов коллекции в одном запросе.在一个请求中更改多个集合对象。

Задание 5. Дополнительные возможности (**отлично**)

5.1. Добавить в коллекцию связанные объекты. Продемонстрировать переход по связи в запросе. 将相关对象添加到集合中。 在查询中演示链接导航。





5.2. Выполнить запрос к базе данных с группировкой и агрегированием.使用分组和聚合运行数据库查询。

5.3. Создать уникальный индекс на одном из полей. Продемонстрировать использование индекса.在其中一个字段上创建唯一索引。 演示索引的使用。