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«НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ
ИТМО»
Факультет инфокоммуникационных технологий

Отчет

по лабораторной работе №5 «Работа с БД в СУБД MongoDB»

по дисциплине **«Базы данных»**

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Цель лабораторной работы:
Овладеть практическими навыками работы с CRUD-операциями, с вложенными объектами в коллекции базы данных MongoDB, агрегации иизменения данных, со ссылками и индексами в базе данных MongoDB.
Оборудование: компьютерный класс.
Программное обеспечение: СУБД MongoDB 5.0.8.

Выполнение

Задание 8.1.1

1. Создайте базу данных learn
2. Заполните коллекцию единорогов unicorns
3. Используя второй способ, вставьте в коллекцию единорогов документ

```
> use learn
switched to db learn
> db.createCollection("unicorns")
{ "ok" : 1 }
> db.unicorns.insert({name: 'Horny', loves: ['carrot','papaya'], weight: 600, gender: 'm', vampires: 63});
WriteResult({ "nInserted" : 1 })
> db.unicorns.insert({name: 'Aurora', loves: ['carrot', 'grape'], weight: 450, gender: 'f', vampires: 43});
WriteResult({ "nInserted" : 1 })
> db.unicorns.insert({name: 'Unicrom', loves: ['energon', 'redbull'], weight: 984, gender: 'm', vampires: 182});
WriteResult({ "nInserted" : 1 })
> db.unicorns.insert({name: 'Roooooodles', loves: ['apple'], weight: 575, gender: 'm', vampires: 99});
WriteResult({ "nInserted" : 1 })
> db.unicorns.insert({name: 'Solnara', loves:['apple', 'carrot', 'chocolate'], weight:550, gender:'f', vampires:80});
WriteResult({ "nInserted" : 1 })
> db.unicorns.insert({name:'Ayna', loves: ['strawberry', 'lemon'], weight: 733, gender: 'f', vampires: 40});
WriteResult({ "nInserted" : 1 })
> db.unicorns.insert({name:'Kenny', loves: ['grape', 'lemon'], weight: 690,  gender: 'm', vampires: 39});
WriteResult({ "nInserted" : 1 })
> db.unicorns.insert({name: 'Raleigh', loves: ['apple', 'sugar'], weight: 421, gender: 'm', vampires: 2});
WriteResult({ "nInserted" : 1 })
> db.unicorns.insert({name: 'Leia', loves: ['apple', 'watermelon'], weight: 601, gender: 'f', vampires: 33});
WriteResult({ "nInserted" : 1 })
> db.unicorns.insert({name: 'Pilot', loves: ['apple', 'watermelon'], weight: 650, gender: 'm', vampires: 54});
WriteResult({ "nInserted" : 1 })
> db.unicorns.insert({name: 'Nimue', loves: ['grape', 'carrot'], weight: 540, gender: 'f'});
WriteResult({ "nInserted" : 1 })
> document = {name: 'Dunx', loves: ['grape', 'watermelon'], weight: 704, gender: 'm', vampires: 165}
{
        "name" : "Dunx",
        "loves" : [
                "grape",
                "watermelon"
        ],
        "weight" : 704,
        "gender" : "m",
        "vampires" : 165
}
> db.unicorns.insert(document)
WriteResult({ "nInserted" : 1 })
```

4. Проверьте содержимое коллекции с помощью метода find

```
> db.unicorns.find()
{ "_id" : ObjectId("62b389f7393192bbc163ad2b"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2c"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2d"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2e"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2f"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("62b389f7393192bbc163ad30"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("62b389f7393192bbc163ad31"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("62b389f7393192bbc163ad32"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("62b389f7393192bbc163ad33"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("62b389f7393192bbc163ad34"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("62b389f7393192bbc163ad35"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("62b38a3393192bbc163ad36"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
>
```

Задание 8.1.2

1. Сформируйте запросы для вывода списков самцов и самок единорогов. Ограничьте список самок первыми тремя особями. Отсортируйте списки по имени.

```
> db.unicorns.find({gender: "m"}).sort({name:1})
{ "_id" : ObjectId("62b38a34393192bbc163ad36"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2b"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("62b389f7393192bbc163ad31"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("62b389f7393192bbc163ad34"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("62b389f7393192bbc163ad32"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2e"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2d"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
> db.unicorns.find({gender: "f"}).sort({name:1}).limit(3)
{ "_id" : ObjectId("62b389f7393192bbc163ad2c"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("62b389f7393192bbc163ad30"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("62b389f7393192bbc163ad33"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
>
```

2. Найдите всех самок, которые любят carrot. Ограничьте этот список первой особью с помощью функций findOne и limit.

```
> db.unicorns.findOne({gender : "f" , loves:"carrot"})
{
        "_id" : ObjectId("62b389f7393192bbc163ad2c"),
        "name" : "Aurora",
        "loves" : [
                "carrot",
                "grape"
        ],
        "weight" : 450,
        "gender" : "f",
        "vampires" : 43
}
> db.unicorns.find({gender : "f" , loves:"carrot"}).limit(1)
{ "_id" : ObjectId("62b389f7393192bbc163ad2c"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
>
```

Задание 8.1.3

Модифицируйте запрос для вывода списков самцов единорогов, исключив из результата информацию о предпочтениях и поле.

```
> db.unicorns.find({gender: "m"}, {gender:0, loves:0}).sort({name:1})
{ "_id" : ObjectId("62b38a34393192bbc163ad36"), "name" : "Dunx", "weight" : 704, "vampires" : 165 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2b"), "name" : "Horny", "weight" : 600, "vampires" : 63 }
{ "_id" : ObjectId("62b389f7393192bbc163ad31"), "name" : "Kenny", "weight" : 690, "vampires" : 39 }
{ "_id" : ObjectId("62b389f7393192bbc163ad34"), "name" : "Pilot", "weight" : 650, "vampires" : 54 }
{ "_id" : ObjectId("62b389f7393192bbc163ad32"), "name" : "Raleigh", "weight" : 421, "vampires" : 2 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2e"), "name" : "Roooooodles", "weight" : 575, "vampires" : 99 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2d"), "name" : "Unicrom", "weight" : 984, "vampires" : 182 }
>
```

Задание 8.1.4

Вывести список единорогов в обратном порядке добавления.

```
> db.unicorns.find().sort({$natural:-1})
{ "_id" : ObjectId("62b38a34393192bbc163ad36"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("62b389f7393192bbc163ad35"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("62b389f7393192bbc163ad34"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("62b389f7393192bbc163ad33"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("62b389f7393192bbc163ad32"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("62b389f7393192bbc163ad31"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("62b389f7393192bbc163ad30"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2f"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }

{ "_id" : ObjectId("62b389f7393192bbc163ad2e"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2d"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2c"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2b"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
>
```

Задание 8.1.5

Вывести список единорогов с названием первого любимого предпочтения, исключив идентификатор.

```
> db.unicorns.find({}, {loves:{$slice:1},_id:0})
{ "name" : "Horny", "loves" : [ "carrot" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "name" : "Aurora", "loves" : [ "carrot" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "name" : "Unicrom", "loves" : [ "energon" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "name" : "Solnara", "loves" : [ "apple" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "name" : "Ayna", "loves" : [ "strawberry" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "name" : "Kenny", "loves" : [ "grape" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "name" : "Raleigh", "loves" : [ "apple" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "name" : "Leia", "loves" : [ "apple" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "name" : "Pilot", "loves" : [ "apple" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "name" : "Nimue", "loves" : [ "grape" ], "weight" : 540, "gender" : "f" }
{ "name" : "Dunx", "loves" : [ "grape" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
>
```

Задание 8.1.6

Вывести список самок единорогов весом от полутонны до 700 кг, исключив вывод идентификатора.

```
> db.unicorns.find({gender : "f" , weight:{$gt:500, $lt:700}}, {_id:0})
{ "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires"
 : 80 }
{ "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
>
```

Задание 8.1.7

Вывести список самцов единорогов весом от полутонны и предпочитающих grape и lemon, исключив вывод идентификатора.

```
> db.unicorns.find({gender : "m" , weight:{$gt:500}, loves: {$in:["grape", "lemon"]}}, {_id:0})
{ "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
>
```

Задание 8.1.8

Найти всех единорогов, не имеющих ключ vampires.

```
> db.unicorns.find({vampires:{$exists:false}}, {_id:0})
{ "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
>
```

Задание 8.1.9

Вывести упорядоченный список имен самцов единорогов с информацией об их первом предпочтении.

```
> db.unicorns.find({gender: "m"}, {loves:{$slice:1}}).sort({name:1})
{ "_id" : ObjectId("62b38a34393192bbc163ad36"), "name" : "Dunx", "loves" : [ "grape" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2b"), "name" : "Horny", "loves" : [ "carrot" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("62b389f7393192bbc163ad31"), "name" : "Kenny", "loves" : [ "grape" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("62b389f7393192bbc163ad34"), "name" : "Pilot", "loves" : [ "apple" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("62b389f7393192bbc163ad32"), "name" : "Raleigh", "loves" : [ "apple" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2e"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2d"), "name" : "Unicrom", "loves" : [ "energon" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
>
```

Задание 8.2.1

1. Создайте коллекцию towns, включающую следующие документы

```
> db.towns.find()
{ "_id" : ObjectId("62b5c197393192bbc163ad37"), "name" : "Punxsutawney ", "populatiuon" : 6200, "last_sen
sus" : ISODate("2008-01-31T00:00:00Z"), "famous_for" : [ "" ], "mayor" : { "name" : "Jim Wehrle" } }
{ "_id" : ObjectId("62b5c1dc393192bbc163ad38"), "name" : "New York", "populatiuon" : 22200000, "last_sens
us" : ISODate("2009-07-31T00:00:00Z"), "famous_for" : [ "status of liberty", "food" ], "mayor" : { "name"
 : "Michael Bloomberg", "party" : "I" } }
{ "_id" : ObjectId("62b5c1ef393192bbc163ad39"), "name" : "Portland", "populatiuon" : 528000, "last_sensus
" : ISODate("2009-07-20T00:00:00Z"), "famous_for" : [ "beer", "food" ], "mayor" : { "name" : "Sam Adams",
 "party" : "D" } }
>
```

2. Сформировать запрос, который возвращает список городов с независимыми мэрами (party="I"). Вывести только название города и информацию о мэре.

3. Сформировать запрос, который возвращает список беспартийных мэров (party отсутствует). Вывести только название города и информацию о мэре

```
> db.towns.find({"mayor.party":"I"}, {name:1, mayor:1, _id:0})
{ "name" : "New York", "mayor" : { "name" : "Michael Bloomberg", "party" : "I" } }
> db.towns.find({"mayor.party": {$exists:false}}, {name:1, mayor:1, _id:0})
{ "name" : "Punxsutawney ", "mayor" : { "name" : "Jim Wehrle" } }
```

Задание 8.2.2

1. Сформировать функцию для вывода списка самцов единорогов.

2. Создать курсор для этого списка из первых двух особей с сортировкой в лексикографическом порядке.

3. Вывести результат, используя forEach.

```
> var cursor = db.unicorns.find(func);null;
null
> cursor.limit(2);null;
null
> cursor.sort({name:1});null;
null
> cursor.forEach(function(obj) {print(obj.name);})
Dunx
Horny
```

Задание 8.2.3

Вывести количество самок единорогов весом от полутонны до 600 кг.

```
> db.unicorns.find({gender:"f", weight:{$gt:500, $lt:600}}).count()
2
```

Задание 8.2.4

Вывести список предпочтений.

```
> db.unicorns.distinct("loves")
[
        "apple",
        "carrot",
        "chocolate",
        "energon",
        "grape",
        "lemon",
        "papaya",
        "redbull",
        "strawberry",
        "sugar",
        "watermelon"
]
```

Задание 8.2.5

Посчитать количество особей единорогов обоих полов.

```
> db.unicorns.aggregate({"$group":{_id:"$gender",count:{$sum:1}}})
{ "_id" : "m", "count" : 7 }
{ "_id" : "f", "count" : 5 }
>
```

Задание 8.2.6

1. Выполнить команду:

> db.unicorns.save({name: 'Barny', loves: ['grape'], weight: 340, gender: 'm'})

2. Проверить содержимое коллекции unicorns.

```
> db.unicorns.save({name:"Barny",loves:["grape"],weight:340,gender:"m"})
WriteResult({ "nInserted" : 1 })
> db.unicorns.find()
{ "_id" : ObjectId("62b389f7393192bbc163ad2b"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2c"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2d"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2e"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2f"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("62b389f7393192bbc163ad30"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("62b389f7393192bbc163ad31"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("62b389f7393192bbc163ad32"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("62b389f7393192bbc163ad33"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("62b389f7393192bbc163ad34"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("62b389f7393192bbc163ad35"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("62b38a34393192bbc163ad36"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("62b5dab0393192bbc163ad3a"), "name" : "Barny", "loves" : [ "grape" ], "weight" : 340, "gender" : "m" }
>
```

Задание 8.2.7

1. Для самки единорога Ayna внести изменения в БД: теперь ее вес 800, она убила 51 вапмира.

2. Проверить содержимое коллекции unicorns.

```
> db.unicorns.update({name:"Ayna"}, {name:"Ayna", weight:800, gender:"f", vampires:51})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.find()
{ "_id" : ObjectId("62b389f7393192bbc163ad2b"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2c"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2d"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2e"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2f"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("62b389f7393192bbc163ad30"), "name" : "Ayna", "weight" : 800, "gender" : "f", "vampires" : 51 }
{ "_id" : ObjectId("62b389f7393192bbc163ad31"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("62b389f7393192bbc163ad32"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("62b389f7393192bbc163ad33"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("62b389f7393192bbc163ad34"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("62b389f7393192bbc163ad35"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("62b38a34393192bbc163ad36"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("62b5dab0393192bbc163ad3a"), "name" : "Barny", "loves" : [ "grape" ], "weight" : 340, "gender" : "m" }
>
```

Задание 8.2.8

1. Для самца единорога Raleigh внести изменения в БД: теперь он любит рэдбул.

2. Проверить содержимое коллекции unicorns

```
> db.unicorns.update({name:"Raleigh"}, {$set:{loves:["redbull"]}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.find()
{ "_id" : ObjectId("62b389f7393192bbc163ad2b"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2c"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2d"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2e"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2f"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("62b389f7393192bbc163ad30"), "name" : "Ayna", "weight" : 800, "gender" : "f", "vampires" : 51 }
{ "_id" : ObjectId("62b389f7393192bbc163ad31"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("62b389f7393192bbc163ad32"), "name" : "Raleigh", "loves" : [ "redbull" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("62b389f7393192bbc163ad33"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("62b389f7393192bbc163ad34"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("62b389f7393192bbc163ad35"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("62b38a34393192bbc163ad36"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("62b5dab0393192bbc163ad3a"), "name" : "Barny", "loves" : [ "grape" ], "weight" : 340, "gender" : "m" }
>
```

Задание 8.2.9

1. Всем самцам единорогов увеличить количество убитых вапмиров на 5.

2. Проверить содержимое коллекции unicorns.

```
> db.unicorns.updateMany({gender:"m"},{$inc:{vampires:5}})
{ "acknowledged" : true, "matchedCount" : 8, "modifiedCount" : 8 }
> db.unicorns.find({gender:"m"})
{ "_id" : ObjectId("62b389f7393192bbc163ad2b"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 68 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2d"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 187 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2e"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 104 }
{ "_id" : ObjectId("62b389f7393192bbc163ad31"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 44 }
{ "_id" : ObjectId("62b389f7393192bbc163ad32"), "name" : "Raleigh", "loves" : [ "redbull" ], "weight" : 421, "gender" : "m", "vampires" : 7 }
{ "_id" : ObjectId("62b389f7393192bbc163ad34"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 59 }
{ "_id" : ObjectId("62b38a34393192bbc163ad36"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 170 }
{ "_id" : ObjectId("62b5dab0393192bbc163ad3a"), "name" : "Barny", "loves" : [ "grape" ], "weight" : 340, "gender" : "m", "vampires" : 5 }
>
```

Задание 8.2.10

1. Изменить информацию о городе Портланд: мэр этого города теперь беспартийный.

2. Проверить содержимое коллекции towns.

```
> db.towns.update({name:"Portland"}, {$unset:{"mayor.party":1}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.towns.find()
{ "_id" : ObjectId("62b5c197393192bbc163ad37"), "name" : "Punxsutawney ", "populatiuon" : 6200, "last_sensus
" : ISODate("2008-01-31T00:00:00Z"), "famous_for" : [ "" ], "mayor" : { "name" : "Jim Wehrle" } }
{ "_id" : ObjectId("62b5c1dc393192bbc163ad38"), "name" : "New York", "populatiuon" : 22200000, "last_sensus"
 : ISODate("2009-07-31T00:00:00Z"), "famous_for" : [ "status of liberty", "food" ], "mayor" : { "name" : "Mi
chael Bloomberg", "party" : "I" } }
{ "_id" : ObjectId("62b5c1ef393192bbc163ad39"), "name" : "Portland", "populatiuon" : 528000, "last_sensus" :
 ISODate("2009-07-20T00:00:00Z"), "famous_for" : [ "beer", "food" ], "mayor" : { "name" : "Sam Adams" } }
>
```

Задание 8.2.11

1. Изменить информацию о самце единорога Pilot: теперь он любит и шоколад.

2. Проверить содержимое коллекции unicorns.

```
> db.unicorns.update({name:"Pilot"}, {$push:{loves:"chocolate"}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.find()
{ "_id" : ObjectId("6294cc8724e714bd3307b814"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 68 }
{ "_id" : ObjectId("6294cc8f24e714bd3307b815"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("6294cc9724e714bd3307b816"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 187 }
{ "_id" : ObjectId("6294cce824e714bd3307b817"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 104 }
{ "_id" : ObjectId("6294ccf324e714bd3307b818"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("6294cd0324e714bd3307b819"), "name" : "Ayna", "weight" : 800, "gender" : "f", "vampires" : 51 }
{ "_id" : ObjectId("6294cd0c24e714bd3307b81a"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 44 }
{ "_id" : ObjectId("6294cde324e714bd3307b81c"), "name" : "Raleigh", "loves" : [ "redbull" ], "weight" : 421, "gender" : "m", "vampires" : 7 }
{ "_id" : ObjectId("6294cdea24e714bd3307b81d"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("6294cdf324e714bd3307b81e"), "name" : "Pilot", "loves" : [ "apple", "watermelon", "chocolate" ], "weight" : 650, "gender" : "m", "vampires" : 59 }
{ "_id" : ObjectId("6294cdfc24e714bd3307b81f"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("6294ce0324e714bd3307b820"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 170 }
{ "_id" : ObjectId("6294ceb624e714bd3307b821"), "name" : "Barny", "loves" : [ "grape" ], "weight" : 340, "gender" : "m", "vampires" : 5 }
```

Задание 8.2.12

1. Изменить информацию о самке единорога Aurora: теперь она любит еще и сахар, и лимоны.

2. Проверить содержимое коллекции unicorns.

```
> db.unicorns.update({name:"Aurora"}, {$addToSet:{loves:{$each:["sugar","lemon"]}}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.find()
{ "_id" : ObjectId("6294cc8724e714bd3307b814"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 68 }
{ "_id" : ObjectId("6294cc8f24e714bd3307b815"), "name" : "Aurora", "loves" : [ "carrot", "grape", "sugar", "lemon" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("6294cc9724e714bd3307b816"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 187 }
{ "_id" : ObjectId("6294cce824e714bd3307b817"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 104 }
{ "_id" : ObjectId("6294ccf324e714bd3307b818"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("6294cd0324e714bd3307b819"), "name" : "Ayna", "weight" : 800, "gender" : "f", "vampires" : 51 }
{ "_id" : ObjectId("6294cd0c24e714bd3307b81a"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 44 }
{ "_id" : ObjectId("6294cde324e714bd3307b81c"), "name" : "Raleigh", "loves" : [ "redbull" ], "weight" : 421, "gender" : "m", "vampires" : 7 }
{ "_id" : ObjectId("6294cdea24e714bd3307b81d"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("6294cdf324e714bd3307b81e"), "name" : "Pilot", "loves" : [ "apple", "watermelon", "chocolate" ], "weight" : 650, "gender" : "m", "vampires" : 59 }
{ "_id" : ObjectId("6294cdfc24e714bd3307b81f"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("6294ce0324e714bd3307b820"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 170 }
{ "_id" : ObjectId("6294ceb624e714bd3307b821"), "name" : "Barny", "loves" : [ "grape" ], "weight" : 340, "gender" : "m", "vampires" : 5 }
>
```

Задание 8.2.13

1. Создайте коллекцию towns, включающую следующие документы

```
> db.createCollection("towns")
{ "ok" : 1 }
> doc1={name: "Punxsutawney ",
... popujatiuon: 6200,
... last_sensus: ISODate("2008-01-31"),
... famous_for: ["phil the groundhog"],
... mayor: {
...     name: "Jim Wehrle"
... }}
{
        "name" : "Punxsutawney ",
        "popujatiuon" : 6200,
        "last_sensus" : ISODate("2008-01-31T00:00:00Z"),
        "famous_for" : [
                "phil the groundhog"
        ],
        "mayor" : {
                "name" : "Jim Wehrle"
        }
}
> db.towns.insert(doc1)
WriteResult({ "nInserted" : 1 })
```

2. Удалите документы с беспартийными мэрами

3. Проверьте содержание коллекции.

```
> db.towns.remove({"mayor.party":{$exists:false}})
WriteResult({ "nRemoved" : 1 })
> db.towns.find()
{ "_id" : ObjectId("6294da8124e714bd3307b823"), "name" : "New York", "popujatiuon" : 22200000, "last_sensus" : ISODate("2009-07-31T
00:00:00Z"), "famous_for" : [ "status of liberty", "food" ], "mayor" : { "name" : "Michael Bloomberg", "party" : "I" } }
{ "_id" : ObjectId("6294daae24e714bd3307b824"), "name" : "Portland", "popujatiuon" : 528000, "last_sensus" : ISODate("2009-07-20T00
:00:00Z"), "famous_for" : [ "beer", "food" ], "mayor" : { "name" : "Sam Adams", "party" : "D" } }
>
```

4. Очистите коллекцию.

5. Просмотрите список доступных коллекций.

```
> db.towns.remove({})
WriteResult({ "nRemoved" : 2 })
> show collections
towns
unicorns
```

Задание 8.3.1

1. Создайте коллекцию зон обитания единорогов, указав в качестве идентификатора кратко название зоны, далее включив полное название и описание

```
> db.zones.insertMany([{ id: "mountain", name: "big rock", description: "Very big rock with cucumbers"},
 {id: "cave", name: "scary cave", description: "very scary cave with bats"}])
{
        "acknowledged" : true,
        "insertedIds" : [
                ObjectId("62b84b878bbbb15dc886a588"),
                ObjectId("62b84b878bbbb15dc886a589")
        ]
}
> db.zones.find()
{ "_id" : ObjectId("62b84b878bbbb15dc886a588"), "id" : "mountain", "name" : "big rock", "description" :
"Very big rock with cucumbers" }
{ "_id" : ObjectId("62b84b878bbbb15dc886a589"), "id" : "cave", "name" : "scary cave", "description" : "v
ery scary cave with bats" }
>
```

2. Включите для нескольких единорогов в документы ссылку на зону обитания, использую второй способ автоматического связывания.

3. Проверьте содержание коллекции единорогов

```
> db.unicorns.update({name: "Ayna"}, {$set: {zone: {$ref: "zones", $id: "cave"}}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.update({name: "Kenny"}, {$set: {zone: {$ref: "zones", $id: "mountain"}}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.find()
{ "_id" : ObjectId("62b389f7393192bbc163ad2b"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "wei
ght" : 600, "gender" : "m", "vampires" : 68 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2c"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "wei
ght" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2d"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ],
"weight" : 984, "gender" : "m", "vampires" : 187 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2e"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight"
: 575, "gender" : "m", "vampires" : 104 }
{ "_id" : ObjectId("62b389f7393192bbc163ad2f"), "name" : "Solnara", "loves" : [ "apple", "carrot", "choc
olate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("62b389f7393192bbc163ad30"), "name" : "Ayna", "weight" : 800, "gender" : "f", "vampir
es" : 51, "zone" : DBRef("zones", "cave") }
{ "_id" : ObjectId("62b389f7393192bbc163ad31"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weigh
t" : 690, "gender" : "m", "vampires" : 44, "zone" : DBRef("zones", "mountain") }
{ "_id" : ObjectId("62b389f7393192bbc163ad32"), "name" : "Raleigh", "loves" : [ "redbull" ], "weight" :
421, "gender" : "m", "vampires" : 7 }
{ "_id" : ObjectId("62b389f7393192bbc163ad33"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "w
eight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("62b389f7393192bbc163ad34"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "
weight" : 650, "gender" : "m", "vampires" : 59 }
{ "_id" : ObjectId("62b389f7393192bbc163ad35"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weig
ht" : 540, "gender" : "f" }
{ "_id" : ObjectId("62b38a34393192bbc163ad36"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "w
eight" : 704, "gender" : "m", "vampires" : 170 }
{ "_id" : ObjectId("62b5dab0393192bbc163ad3a"), "name" : "Barny", "loves" : [ "grape" ], "weight" : 340,
 "gender" : "m", "vampires" : 5 }
```

Задание 8.3.2

1. Проверьте, можно ли задать для коллекции unicorns индекс для ключа name с флагом unique.

```
> db.unicorns.createIndex({"name": 1}, {"unique": true})
{
        "numIndexesBefore" : 1,
        "numIndexesAfter" : 2,
        "createdCollectionAutomatically" : false,
        "ok" : 1
}
> db.unicorns.insert({name: "Pilot"})
WriteResult({
        "nInserted" : 0,
        "writeError" : {
                "code" : 11000,
                "errmsg" : "E11000 duplicate key error collection: learn.unicorns index: name_1 dup key:
 { name: \"Pilot\" }"
        }
})
```

Задание 8.3.3

1. Получите информацию обо всех индексах коллекции unicorns.

2. Удалите все индексы, кроме индекса для идентификатора.

```
> db.unicorns.getIndexes()
[
        {
                "v" : 2,
                "key" : {
                        "_id" : 1
                },
                "name" : "_id_"
        },
        {
                "v" : 2,
                "key" : {
                        "name" : 1
                },
                "name" : "name_1",
                "unique" : true
        }
]
> db.unicorns.dropIndexes("name")
{
        "ok" : 0,
        "errmsg" : "index not found with name [name]",
        "code" : 27,
        "codeName" : "IndexNotFound"
}
```

3. Попытайтесь удалить индекс для идентификатора

```
> db.unicorns.dropIndexes("_id_")
uncaught exception: Error: error dropping indexes : {
        "ok" : 0,
        "errmsg" : "cannot drop _id index",
        "code" : 72,
        "codeName" : "InvalidOptions"
} :
_getErrorWithCode@src/mongo/shell/utils.js:25:13
DBCollection.prototype.dropIndexes@src/mongo/shell/collection.js:704:11
@(shell):1:1
```

Задание 8.3.4

1. Создайте объемную коллекцию numbers, задействовав курсор:

for(i = 0; i < 100000; i++){db.numbers.insert({value: i})}

2. Выберите последних четыре документа.

```
> db.numbers.find().sort({$natural: -1}).limit(4)
{ "_id" : ObjectId("62b85068b7dd48e87dd2b81f"), "value" : 99999 }
{ "_id" : ObjectId("62b85068b7dd48e87dd2b81e"), "value" : 99998 }
{ "_id" : ObjectId("62b85068b7dd48e87dd2b81d"), "value" : 99997 }
{ "_id" : ObjectId("62b85068b7dd48e87dd2b81c"), "value" : 99996 }
```

3. Проанализируйте план выполнения запроса 2. Сколько потребовалось времени на выполнение запроса? (по значению параметра executionTimeMillis)

```
> db.numbers.explain("executionStats").find().sort({value: -1}).limit(4)
{
        "explainVersion" : "1",
        "queryPlanner" : {
                "namespace" : "learn.numbers",
                "indexFilterSet" : false,
                "parsedQuery" : {

                },
                "maxIndexedOrSolutionsReached" : false,
                "maxIndexedAndSolutionsReached" : false,
                "maxScansToExplodeReached" : false,
                "winningPlan" : {
                        "stage" : "SORT",
                        "sortPattern" : {
                                "value" : -1
                        },
                        "memLimit" : 104857600,
                        "limitAmount" : 4,
                        "type" : "simple",
                        "inputStage" : {
                                "stage" : "COLLSCAN",
                                "direction" : "forward"
                        }
                },
                "rejectedPlans" : [ ]
        },
        "executionStats" : {
                "executionSuccess" : true,
                "nReturned" : 4,
                "executionTimeMillis" : 330,
```

Потребовалось 330мс

4. Создайте индекс для ключа value.
5. Получите информацию обо всех индексах коллекции numbres.

```
> db.numbers.createIndex({"value": 1})
{
        "numIndexesBefore" : 1,
        "numIndexesAfter" : 2,
        "createdCollectionAutomatically" : false,
        "ok" : 1
}
> db.numbers.getIndexes()
[
        {
                "v" : 2,
                "key" : {
                        "_id" : 1
                },
                "name" : "_id_"
        },
        {
                "v" : 2,
                "key" : {
                        "value" : 1
                },
                "name" : "value_1"
        }
]
```

6. Выполните запрос 2. Проанализируйте план выполнения запроса с установленным индексом.Сколько потребовалось времени на выполнение запроса?

```
> db.numbers.explain("executionStats").find().sort({value:-1}).limit(4)
```

Потребовалось 2мс

7. Сравните время выполнения запросов с индексом и без. Дайте ответ на вопрос: какой запрос более эффективен?

Вывод:

Запрос с индексом выполнился быстрее на 328мс. Соответственно, запрос с использованием индексов более эффективен. В результате выполнения лабораторной работы я познакомилась с СУБД MongoDB и получила навыки работы с CRUD – операциями, с вложенными объектами в коллекции базы данных MongoDB, изменения данных и индексами вбазе данных MongoDB.