Министерство науки и высшего образования Российской ФедерацииФедеральное государственное автономное образовательное учреждение высшего образования
«НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ ИТМО»
Факультет инфокоммуникационных технологий

ОТЧЕТ
О ЛАБОРАТОРНОЙ РАБОТЕ № 8

по теме: Работа с БД в СУБД MongoDB
по дисциплине: Проектирование и реализация баз данных

Специальность:
45.03.04 Интеллектуальные системы в гуманитарной сфере

Проверила:

Говорова М. М. _____

Дата: _____

Оценка _____

Выполнил:

Студентка
группы К3243

Абрамова А. М.

Санкт-Петербург 2021 г.

Цель: овладеть практическими навыками работы с CRUD-операциями, с вложенными объектами в коллекции базы данных MongoDB, агрегации и изменения данных, со ссылками и индексами в базе данных MongoDB.

Оборудование: компьютерный класс.

Программное обеспечение: СУБД MongoDB 4.4.

ПРАКТИЧЕСКАЯ ЧАСТЬ

8.1 CRUD-ОПЕРАЦИИ В СУБД MONGODB. ВСТАВКА ДАННЫХ. ВЫБОРКА ДАННЫХ

8.1.1 ВСТАВКА ДОКУМЕНТОВ В КОЛЛЕКЦИЮ

1. Создайте базу данных learn.
2. Заполните коллекцию единорогов `users`:
3. Используя второй способ, вставьте в коллекцию единорогов документ:
4. Проверьте содержимое коллекции с помощью метода find.

```
> 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.users.insert(document)
WriteResult({ "nInserted" : 1 })
```

```
> db.users.find()
{ "_id" : ObjectId("60b69bff62e607a3e9f4b81e"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("60b69cba62e607a3e9f4b81f"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60b69cc562e607a3e9f4b820"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("60b69cd562e607a3e9f4b821"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("60b69cee62e607a3e9f4b822"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60b69cf862e607a3e9f4b823"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("60b69d0662e607a3e9f4b824"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60b69d1162e607a3e9f4b825"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60b69d1a62e607a3e9f4b826"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("60b69d3a62e607a3e9f4b827"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60b69d4562e607a3e9f4b828"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("60b69d5162e607a3e9f4b829"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
```

8.2.2. ВЫБОРКА ДАННЫХ ИЗ БД

Практическое 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.users.find({gender:'m'}).sort({name: 1});
{ "_id" : ObjectId("60b69d5162e607a3e9f4b829"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("60b69bff62e607a3e9f4b81e"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("60b69d0662e607a3e9f4b824"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60b69d3a62e607a3e9f4b827"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60b69d1162e607a3e9f4b825"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60b69cd562e607a3e9f4b821"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("60b69cc562e607a3e9f4b820"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
```

```
> db.users.find({gender:'f'}).limit(3).sort({name: 1});
{ "_id" : ObjectId("60b69cba62e607a3e9f4b81f"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60b69cf862e607a3e9f4b823"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("60b69d1a62e607a3e9f4b826"), "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.users.find({gender:'f', loves: "carrot"}).limit(1);
{ "_id" : ObjectId("60b69cba62e607a3e9f4b81f"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
```

```
> db.users.findOne({gender:'f', loves: "carrot"});
{
        "_id" : ObjectId("60b69cba62e607a3e9f4b81f"),
        "name" : "Aurora",
        "loves" : [
                "carrot",
                "grape"
        ],
        "weight" : 450,
        "gender" : "f",
        "vampires" : 43
}
```

Практическое задание 8.1.3:

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

```
> db.users.find({gender:'m'}, {gender: 0, loves: 0});
{ "_id" : ObjectId("60b69bff62e607a3e9f4b81e"), "name" : "Horny", "weight" : 600, "vampires" : 63 }
{ "_id" : ObjectId("60b69cc562e607a3e9f4b820"), "name" : "Unicrom", "weight" : 984, "vampires" : 182 }
{ "_id" : ObjectId("60b69cd562e607a3e9f4b821"), "name" : "Roooooodles", "weight" : 575, "vampires" : 99 }
{ "_id" : ObjectId("60b69d0662e607a3e9f4b824"), "name" : "Kenny", "weight" : 690, "vampires" : 39 }
{ "_id" : ObjectId("60b69d1162e607a3e9f4b825"), "name" : "Raleigh", "weight" : 421, "vampires" : 2 }
{ "_id" : ObjectId("60b69d3a62e607a3e9f4b827"), "name" : "Pilot", "weight" : 650, "vampires" : 54 }
{ "_id" : ObjectId("60b69d5162e607a3e9f4b829"), "name" : "Dunx", "weight" : 704, "vampires" : 165 }
>
```

Практическое задание 8.1.4:

Вывести список единорогов в обратном порядке добавления.

```
> db.users.find().sort({$natural: -1});
{ "_id" : ObjectId("60b69d5162e607a3e9f4b829"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("60b69d4562e607a3e9f4b828"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("60b69d3a62e607a3e9f4b827"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60b69d1a62e607a3e9f4b826"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("60b69d1162e607a3e9f4b825"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60b69d0662e607a3e9f4b824"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60b69cf862e607a3e9f4b823"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("60b69cee62e607a3e9f4b822"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60b69cd562e607a3e9f4b821"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("60b69cc562e607a3e9f4b820"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("60b69cba62e607a3e9f4b81f"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60b69bff62e607a3e9f4b81e"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
```

Практическое задание 8.1.5:

Вывести список единорогов с названием первого любимого предпочтения, исключив идентификатор

```
> db.users.find({}, {_id: 0, loves:{$slice: 1}})
{ "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 }
```

8.2.3. ЛОГИЧЕСКИЕ ОПЕРАТОРЫ

Практическое задание 8.1.6:

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

```
> db.users.find({gender:'f', weight: {$gte: 500, $lte: 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" }
```

Практическое задание 8.1.7:

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

```
> db.users.find({gender:'m', weight: {$gte: 500}, loves: {$all: ["grape", "lemon"]}}, {_id: 0});
{ "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
```

Практическое задание 8.1.8:

Найти всех единорогов, не имеющих ключ `vampires`.

```
> db.users.find({vampires: {$exists:true}});
{ "_id" : ObjectId("60b69bff62e607a3e9f4b81e"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("60b69cba62e607a3e9f4b81f"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60b69cc562e607a3e9f4b820"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("60b69cd562e607a3e9f4b821"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("60b69cee62e607a3e9f4b822"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60b69cf862e607a3e9f4b823"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("60b69d0662e607a3e9f4b824"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60b69d1162e607a3e9f4b825"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60b69d1a62e607a3e9f4b826"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("60b69d3a62e607a3e9f4b827"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60b69d5162e607a3e9f4b829"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
```

Практическое задание 8.1.9:

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

```
> db.users.find({gender:'m'}, {name: 1, _id: 0, loves: {$slice: 1}}).sort({name: 1})
{ "name" : "Dunx", "loves" : [ "grape" ] }
{ "name" : "Horny", "loves" : [ "carrot" ] }
{ "name" : "Kenny", "loves" : [ "grape" ] }
{ "name" : "Pilot", "loves" : [ "apple" ] }
{ "name" : "Raleigh", "loves" : [ "apple" ] }
{ "name" : "Roooooodles", "loves" : [ "apple" ] }
{ "name" : "Unicrom", "loves" : [ "energon" ] }
```

8.2 ЗАПРОСЫ К БАЗЕ ДАННЫХ MONGODB. ВЫБОРКА ДАННЫХ. ВЛОЖЕННЫЕ ОБЪЕКТЫ. ИСПОЛЬЗОВАНИЕ КУРСОРОВ. АГРЕГИРОВАННЫЕ ЗАПРОСЫ. ИЗМЕНЕНИЕ ДАННЫХ

8.2.1 ЗАПРОС К ВЛОЖЕННЫМ ОБЪЕКТАМ

Практическое задание 8.2.1:

1. Создайте коллекцию towns, включающую следующие документы:

```
> db.towns.find()
{ "_id" : ObjectId("60b797e85dc408ebab6796d6"), "name" : "Punxsutawney ", "populatiuon" : 6200, "last_sensus" : ISODate("2008-01-31T00:00:00Z"), "famous_for" : [ "" ], "mayor" : { "name" : "Jim Wehrle" } }
{ "_id" : ObjectId("60b798ec5dc408ebab6796d7"), "name" : "New York", "populatiuon" : 22200000, "last_sensus" : ISODate("2009-07-31T00:00:00Z"), "famous_for" : [ "status of liberty", "food" ], "mayor" : { "name"
: "Michael Bloomberg", "party" : "I" } }
{ "_id" : ObjectId("60b799215dc408ebab6796d8"), "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.

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

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

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

8.2.2 ИСПОЛЬЗОВАНИЕ JAVASCRIPT

8.2.3 КУРСОРЫ

Практическое задание 8.2.2:

1. Сформировать функцию для вывода списка самцов единорогов.

```
> fn = function() {return this.gender=="m";}
function() {return this.gender=="m";}
```

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

```
> var cursor = db.users.find(fn);null;
null
> cursor.limit(2).sort({name: 1})
{ "_id" : ObjectId("60b69d5162e607a3e9f4b829"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("60b69bff62e607a3e9f4b81e"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
```

3. Вывести результат, используя forEach.

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

8.2.4 АГРЕГИРОВАННЫЕ ЗАПРОСЫ

Практическое задание 8.2.3:

Вывести количество самок единорогов весом от полутонны до 600 кг.

```
> db.users.find({gender: 'f', weight: {$gte:500, $lte:600}}).count()
2
```

Практическое задание 8.2.4:

Вывести список предпочтений.

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

Практическое задание 8.2.5:

Посчитать количество особей единорогов обоих полов.

```
> db.users.aggregate([{$group:{_id:"gender", count:{$sum:1}}}])
{ "_id" : "gender", "count" : 12 }
```

8.2.5 РЕДАКТИРОВАНИЕ ДАННЫХ

Практическое задание 8.2.6:

1. Выполнить команду:

2. Проверить содержимое коллекции `users`.

```
> db.users.save({name: 'Barny', loves: ['grape'], weight: 340, gender: 'm'})
WriteResult({ "nInserted" : 1 })
> db.users.find()
{ "_id" : ObjectId("60b69bff62e607a3e9f4b81e"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("60b69cba62e607a3e9f4b81f"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60b69cc562e607a3e9f4b820"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("60b69cd562e607a3e9f4b821"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("60b69cee62e607a3e9f4b822"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60b69cf862e607a3e9f4b823"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("60b69d0662e607a3e9f4b824"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60b69d1162e607a3e9f4b825"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60b69d1a62e607a3e9f4b826"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("60b69d3a62e607a3e9f4b827"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60b69d4562e607a3e9f4b828"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("60b69d5162e607a3e9f4b829"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("60b7a7375dc408ebab6796da"), "name" : "Barny", "loves" : [ "grape" ], "weight" : 340, "gender" : "m" }
```

Практическое 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 `users`.

```
> db.users.update({name: "Ayna"}, {name: "Ayna", loves:["strawberry", "lemon"], gender:"f", weight:800, vampires:51})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.users.find({name:"Ayna"})
{ "_id" : ObjectId("60b69cf862e607a3e9f4b823"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "gender" : "f", "weight" : 800, "vampires" : 51 }
```

Практическое задание 8.2.8:

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

2. Проверить содержимое коллекции `users`.

```
> db.users.update({name:"Raleigh", gender:'m'}, {$set: {loves:["redbull"]}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.users.find({name:"Raleigh"})
{ "_id" : ObjectId("60b69d1162e607a3e9f4b825"), "name" : "Raleigh", "loves" : [ "redbull" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
```

Практическое задание 8.2.9:

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

2. Проверить содержимое коллекции `users`.

```
> db.users.update({gender:'m'}, {$inc:{vampires:5}},{multi:true})
WriteResult({ "nMatched" : 8, "nUpserted" : 0, "nModified" : 8 })
> db.users.find({gender:'m'})
{ "_id" : ObjectId("60b69bff62e607a3e9f4b81e"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 68 }
{ "_id" : ObjectId("60b69cc562e607a3e9f4b820"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 187 }
{ "_id" : ObjectId("60b69cd562e607a3e9f4b821"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 104 }
{ "_id" : ObjectId("60b69d0662e607a3e9f4b824"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 44 }
{ "_id" : ObjectId("60b69d1162e607a3e9f4b825"), "name" : "Raleigh", "loves" : [ "redbull" ], "weight" : 421, "gender" : "m", "vampires" : 7 }
{ "_id" : ObjectId("60b69d3a62e607a3e9f4b827"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 59 }
{ "_id" : ObjectId("60b69d5162e607a3e9f4b829"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 170 }
{ "_id" : ObjectId("60b7a7375dc408ebab6796da"), "name" : "Barny", "loves" : [ "grape" ], "weight" : 340, "gender" : "m", "vampires" : 5 }
```

Практическое 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("60b797e85dc408ebab6796d6"), "name" : "Punxsutawney ", "populatiuon" : 6200, "last_sensus" : ISODate("2008-01-31T00:00:00Z"), "famous_for" : [ "" ], "mayor" : { "name" : "Jim Wehrle" } }
{ "_id" : ObjectId("60b798ec5dc408ebab6796d7"), "name" : "New York", "populatiuon" : 22200000, "last_sensus" : ISODate("2009-07-31T00:00:00Z"), "famous_for" : [ "status of liberty", "food" ], "mayor" : { "name" : "Michael Bloomberg", "party" : "I" } }
{ "_id" : ObjectId("60b799215dc408ebab6796d8"), "name" : "Portland", "populatiuon" : 528000, "last_sensus" : ISODate("2009-07-20T00:00:00Z"), "famous_for" : [ "beer", "food" ], "mayor" : { "name" : "Sam Adams" } }
>
```

Практическое задание 8.2.11:

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

2. Проверить содержимое коллекции `users`.

```
> db.users.find({name:"Pilot"})
{ "_id" : ObjectId("60b69d3a62e607a3e9f4b827"), "name" : "Pilot", "loves" : [ "apple", "watermelon", "chocolate" ], "weight" : 650, "gender" : "m", "vampires" : 59 }
```

Практическое задание 8.2.12:

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

2. Проверить содержимое коллекции `users`.

```
> db.users.update({name:"Aurora"}, {$addToSet:{loves:{$each:["sugar", "lemon"]}}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.users.find({name:"Aurora"})
{ "_id" : ObjectId("60b69cba62e607a3e9f4b81f"), "name" : "Aurora", "loves" : [ "carrot", "grape", "sugar", "lemon" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
```

8.2.6 УДАЛЕНИЕ ДАННЫХ ИЗ КОЛЛЕКЦИИ

Практическое задание 8.2.13:

1. Создайте коллекцию towns, включающую следующие документы:

```
> db.towns.insert({name: "Punxsutawney ",
... popujatiuon: 6200,
... last_sensus: ISODate("2008-01-31"),
... famous_for: ["phil the groundhog"],
... mayor: {
...     name: "Jim Wehrle"
... }})
WriteResult({ "nInserted" : 1 })
> db.towns.find()
{ "_id" : ObjectId("60b797e85dc408ebab6796d6"), "name" : "Punxsutawney ", "populatiuon" : 6200, "last_sensus" : ISODate("2008-01-31T00:00:00Z"), "famous_for" : [ "" ], "mayor" : { "name" : "Jim Wehrle" } }
{ "_id" : ObjectId("60b798ec5dc408ebab6796d7"), "name" : "New York", "populatiuon" : 22200000, "last_sensus" : ISODate("2009-07-31T00:00:00Z"), "famous_for" : [ "status of liberty", "food" ], "mayor" : { "name
: "Michael Bloomberg", "party" : "I" } }
{ "_id" : ObjectId("60b799215dc408ebab6796d8"), "name" : "Portland", "populatiuon" : 528000, "last_sensus" : ISODate("2009-07-20T00:00:00Z"), "famous_for" : [ "beer", "food" ], "mayor" : { "name" : "Sam Adams" }
}
{ "_id" : ObjectId("60b7b1a85dc408ebab6796db"), "name" : "Punxsutawney ", "popujatiuon" : 6200, "last_sensus" : ISODate("2008-01-31T00:00:00Z"), "famous_for" : [ "phil the groundhog" ], "mayor" : { "name" : "Jim
 Wehrle" } }
> db.towns.insert({name: "New York",
... popujatiuon: 22200000,
... last_sensus: ISODate("2009-07-31"),
... famous_for: ["status of liberty", "food"],
... mayor: {
...     name: "Michael Bloomberg",
... party: "I"}})
WriteResult({ "nInserted" : 1 })
> db.towns.insert({name: "Portland",
... popujatiuon: 528000,
... last_sensus: ISODate("2009-07-20"),
... famous_for: ["beer", "food"],
... mayor: {
...     name: "Sam Adams",
... party: "D"}})
WriteResult({ "nInserted" : 1 })
> db.towns.find()
{ "_id" : ObjectId("60b797e85dc408ebab6796d6"), "name" : "Punxsutawney ", "populatiuon" : 6200, "last_sensus" : ISODate("2008-01-31T00:00:00Z"), "famous_for" : [ "" ], "mayor" : { "name" : "Jim Wehrle" } }
{ "_id" : ObjectId("60b798ec5dc408ebab6796d7"), "name" : "New York", "populatiuon" : 22200000, "last_sensus" : ISODate("2009-07-31T00:00:00Z"), "famous_for" : [ "status of liberty", "food" ], "mayor" : { "name
: "Michael Bloomberg", "party" : "I" } }
{ "_id" : ObjectId("60b799215dc408ebab6796d8"), "name" : "Portland", "populatiuon" : 528000, "last_sensus" : ISODate("2009-07-20T00:00:00Z"), "famous_for" : [ "beer", "food" ], "mayor" : { "name" : "Sam Adams" }
}
{ "_id" : ObjectId("60b7b1a85dc408ebab6796db"), "name" : "Punxsutawney ", "popujatiuon" : 6200, "last_sensus" : ISODate("2008-01-31T00:00:00Z"), "famous_for" : [ "phil the groundhog" ], "mayor" : { "name" : "Jim
 Wehrle" } }
{ "_id" : ObjectId("60b7b1e55dc408ebab6796dc"), "name" : "New York", "popujatiuon" : 22200000, "last_sensus" : ISODate("2009-07-31T00:00:00Z"), "famous_for" : [ "status of liberty", "food" ], "mayor" : { "name"
: "Michael Bloomberg", "party" : "I" } }
{ "_id" : ObjectId("60b7b1f55dc408ebab6796dd"), "name" : "Portland", "popujatiuon" : 528000, "last_sensus" : ISODate("2009-07-20T00:00:00Z"), "famous_for" : [ "beer", "food" ], "mayor" : { "name" : "Sam Adams",
"party" : "D" } }
>
```

2. Удалите документы с беспартийными мэрами.

```
> db.towns.remove({"mayor.party":{$exists:false}})
WriteResult({ "nRemoved" : 3 })
```

3. Проверьте содержание коллекции.

```
> db.towns.find()
{ "_id" : ObjectId("60b798ec5dc408ebab6796d7"), "name" : "New York", "populatiuon" : 22200000, "last_sensus" : ISODate("2009-07-31T00:00:00Z"), "famous_for" : [ "status of liberty", "food" ], "mayor"
: { "name" : "Michael Bloomberg", "party" : "I" } }
{ "_id" : ObjectId("60b7b1e55dc408ebab6796dc"), "name" : "New York", "popujatiuon" : 22200000, "last_sensus" : ISODate("2009-07-31T00:00:00Z"), "famous_for" : [ "status of liberty", "food" ], "mayor"
: { "name" : "Michael Bloomberg", "party" : "I" } }
{ "_id" : ObjectId("60b7b1f55dc408ebab6796dd"), "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.

```
> db.towns.remove({})
WriteResult({ "nRemoved" : 3 })
```

5. Просмотрите список доступных коллекций.

```
> show collections
towns
unicorns
users
```

8.3 ССЫЛКИ И РАБОТА С ИНДЕКСАМИ В БАЗЕ ДАННЫХ MONGODB

8.3.1 ССЫЛКИ В БД

Практическое задание 8.3.1:

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

```
> db.areas.insert({_id:"fromds", name: "Treg fromds", desc:"In the world"})
WriteResult({ "nInserted" : 1 })
> db.areas.insert({_id:"qwerty", name: "Qwerty uhi", desc:"In the world"})
WriteResult({ "nInserted" : 1 })
```

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

```
> db.users.update({name:"Horny"},{$set:{area:{$ref:"areas", $id:"fromds"}}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.users.update({name:"Aurora"},{$set:{area:{$ref:"areas", $id:"qwerty"}}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.users.update({name:"Pilot"},{$set:{area:{$ref:"areas", $id:"qwerty"}}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
```

3. Проверьте содержание коллекции единорогов.

```
> db.users.find()
{ "_id" : ObjectId("60b69bff62e607a3e9f4b81e"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 68, "area" : DBRef("areas", "fromds") }
{ "_id" : ObjectId("60b69cba62e607a3e9f4b81f"), "name" : "Aurora", "loves" : [ "carrot", "grape", "sugar", "lemon" ], "weight" : 450, "gender" : "f", "vampires" : 43, "area" : DBRef("areas", "qwerty"
) }
{ "_id" : ObjectId("60b69cc562e607a3e9f4b820"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 187 }
{ "_id" : ObjectId("60b69cd562e607a3e9f4b821"), "name" : "Roooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 104 }
{ "_id" : ObjectId("60b69cee62e607a3e9f4b822"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60b69cf862e607a3e9f4b823"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "gender" : "f", "weight" : 800, "vampires" : 51 }
{ "_id" : ObjectId("60b69d0662e607a3e9f4b824"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 44 }
{ "_id" : ObjectId("60b69d1162e607a3e9f4b825"), "name" : "Raleigh", "loves" : [ "redbull" ], "weight" : 421, "gender" : "m", "vampires" : 7 }
{ "_id" : ObjectId("60b69d1a62e607a3e9f4b826"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("60b69d3a62e607a3e9f4b827"), "name" : "Pilot", "loves" : [ "apple", "watermelon", "chocolate" ], "weight" : 650, "gender" : "m", "vampires" : 59, "area" : DBRef("areas", "qwerty")
}
{ "_id" : ObjectId("60b69d4562e607a3e9f4b828"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("60b69d5162e607a3e9f4b829"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 170 }
{ "_id" : ObjectId("60b7a7375dc408ebab6796da"), "name" : "Barny", "loves" : [ "grape" ], "weight" : 340, "gender" : "m", "vampires" : 5 }
```

8.3.2 НАСТРОЙКА ИНДЕКСОВ

Практическое задание 8.3.2:

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

```
> db.users.ensureIndex({"name" : 1}, {"unique" : true})
uncaught exception: TypeError: db.users.ensureIndex is not a function :
```

8.3.3 УПРАВЛЕНИЕ ИНДЕКСАМИ

Практическое задание 8.3.3:

1. Получите информацию о всех индексах коллекции `unicorns` .

```
> db.users.getIndexes()
[ { "v" : 2, "key" : { "_id" : 1 }, "name" : "_id_" } ]
```

2. Удалите все индексы, кроме индекса для идентификатора.

```
> db.users.dropIndex("name_1")
{
        "ok" : 0,
        "errmsg" : "index not found with name [name_1]",
        "code" : 27,
        "codeName" : "IndexNotFound"
}
```

3. Попытайтесь удалить индекс для идентификатора.

```
> db.users.dropIndex("_id_")
{
        "ok" : 0,
        "errmsg" : "cannot drop _id index",
        "code" : 72,
        "codeName" : "InvalidOptions"
}
```

8.3.4 ПЛАН ЗАПРОСА

Практическое 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.

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

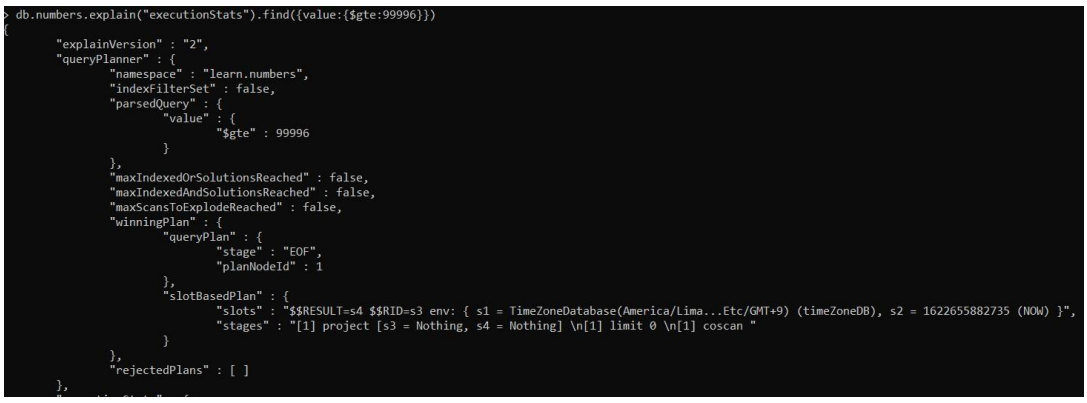
4. Создайте индекс для ключа `value`.

5. Получите информацию о всех индексах коллекции `numbres`.

6. Выполните запрос 2.

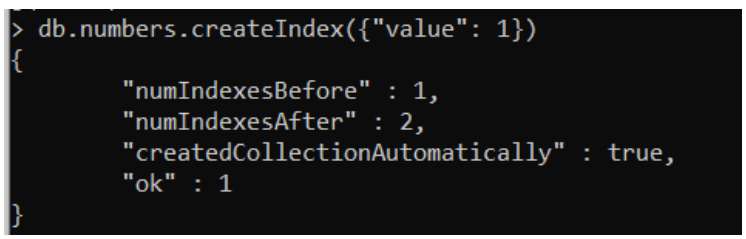
7. Проанализируйте план выполнения запроса с установленным индексом. Сколько потребовалось времени на выполнение запроса?

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



```
"executionStats" : {
        "executionSuccess" : true,
        "nReturned" : 0,
        "executionTimeMillis" : 11,
        "totalKeysExamined" : 0,
        "totalDocsExamined" : 0,
        "executionStages" : {
                "stage" : "project",
                "planNodeId" : 1,
                "nReturned" : 0,
                "executionTimeMillisEstimate" : 0,
                "opens" : 1,
                "closes" : 1,
                "saveState" : 0,
                "restoreState" : 0,
                "isEOF" : 1,
                "projections" : {
                        "3" : "Nothing ",
                        "4" : "Nothing "
                },
                "inputStage" : {
                        "stage" : "limit",
                        "planNodeId" : 1,
                        "nReturned" : 0,
                        "executionTimeMillisEstimate" : 0,
                        "opens" : 1,
                        "closes" : 1,
                        "saveState" : 0,
                        "restoreState" : 0,
                        "isEOF" : 1,
                        "limit" : 0,
                        "inputStage" : {
                                "stage" : "coscan",
                                "planNodeId" : 1,
                                "nReturned" : 0,
                                "executionTimeMillisEstimate" : 0,
                                "opens" : 1,
                                "closes" : 1,
                                "saveState" : 0,
                                "restoreState" : 0,
                                "isEOF" : 0
                        }
                }
        }
},
```

```
"command" : {
        "find" : "numbers",
        "filter" : {
                "value" : {
                        "$gte" : 99996
                }
        },
        "$db" : "learn"
},
"serverInfo" : {
        "host" : "DESKTOP-GS60OL6",
        "port" : 27017,
        "version" : "5.0.0-rc0",
        "gitVersion" : "9a324616c6557efc15ee6bf0c42587c0f475e573"
},
"serverParameters" : {
        "internalQueryFacetBufferSizeBytes" : 104857600,
        "internalQueryFacetMaxOutputDocSizeBytes" : 104857600,
        "internalLookupStageIntermediateDocumentMaxSizeBytes" : 104857600,
        "internalDocumentSourceGroupMaxMemoryBytes" : 104857600,
        "internalQueryMaxBlockingSortMemoryUsageBytes" : 104857600,
        "internalQueryProhibitBlockingMergeOnMongoS" : 0,
        "internalQueryMaxAddToSetBytes" : 104857600,
        "internalDocumentSourceSetWindowFieldsMaxMemoryBytes" : 104857600
},
"ok" : 1
```



```
> db.numbers.createIndex({"value": 1})
{
        "numIndexesBefore" : 1,
        "numIndexesAfter" : 2,
        "createdCollectionAutomatically" : true,
        "ok" : 1
}
```

После создания индекса value значение executionTimeMillis изменилось с 11 до 1. Это значит, что для ускорения работы стоит задавать индексы.

Вывод: в данной лабораторной работе мы овладели практическими навыками работы с CRUD- операциями, с вложенными объектами в коллекции базы данных MongoDB, агрегации и изменения данных, со ссылками и индексами в базе данных MongoDB.