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Федеральное 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:

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Дата: «\_\_» \_\_\_\_\_ 2021 г.

Оценка \_\_\_\_\_

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**Цель работы:** 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.

## Выполнение работы

### 8.1.1

Заполнение коллекции единорогов unicorns;

Вставка в коллекцию единорогов документ, используя второй способ;

Проверка содержимого 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: 'Rooooooodles', 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 })
> db.unicorns.find()
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bc"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bd"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1be"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bf"), "name" : "Rooooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c0"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c1"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c2"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c3"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c4"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c5"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c6"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
>
> 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 })
> db.unicorns.find()
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bc"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bd"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1be"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bf"), "name" : "Rooooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c0"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c1"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c2"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c3"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c4"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c5"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c6"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("60c4c263ea0f3938b663b1c7"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
>
```

### 8.1.2

Запросы для вывода списков самцов и самок единорогов (список самок ограничен первыми тремя особями, списки отсортированы по имени);

Список всех самок, которые любят carrot, ограничен первой особью с помощью функций findOne и limit.

```

> db.unicorns.find({gender: "m"}).sort({name: 1})
{ "_id" : ObjectId("60c4c263eaf3938b663b1c7"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bc"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c2"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c5"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c3"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bf"), "name" : "Rooodooles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1be"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
>
> db.unicorns.find({gender: "f"}).limit(3).sort({name: 1})
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bd"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c1"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c4"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
>
> db.unicorns.find({loves: "carrot", gender: "f"})
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bd"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c0"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c6"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
> db.unicorns.find({loves: "carrot", gender: "f"}).limit(1)
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bd"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
> db.unicorns.findone({loves: "carrot", gender: "f"})
uncaught exception: TypeError: db.unicorns.findone is not a function :
@ (shell):1:1
> db.unicorns.findOne({loves: "carrot", gender: "f"})
{
  "_id" : ObjectId("60c4c12aea0f3938b663b1bd"),
  "name" : "Aurora",
  "loves" : [
    "carrot",
    "grape"
  ],
  "weight" : 450,
  "gender" : "f",
  "vampires" : 43
}

```

### 8.1.3

Запрос модифицирован для вывода списков самцов единорогов, исключив из результата информацию о предпочтениях и поле.

```

> db.unicorns.find({gender: "m"}, {loves: 0, gender: 0})
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bc"), "name" : "Horny", "weight" : 600, "vampires" : 63 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1be"), "name" : "Unicrom", "weight" : 984, "vampires" : 182 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bf"), "name" : "Rooodooles", "weight" : 575, "vampires" : 99 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c2"), "name" : "Kenny", "weight" : 690, "vampires" : 39 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c3"), "name" : "Raleigh", "weight" : 421, "vampires" : 2 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c5"), "name" : "Pilot", "weight" : 650, "vampires" : 54 }
{ "_id" : ObjectId("60c4c263eaf3938b663b1c7"), "name" : "Dunx", "weight" : 704, "vampires" : 165 }
>

```

количество возвращаемых документов. Бойкой параметр необязательный, но есть

### 8.1.4

Список единорогов в обратном порядке добавления.

```

> db.unicorns.find().sort({$natural: -1})
{ "_id" : ObjectId("60c4c263eaf3938b663b1c7"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c6"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c5"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c4"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c3"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c2"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c1"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c0"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bf"), "name" : "Rooodooles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1be"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bd"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60c4c12aea0f3938b663b1bc"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
>

```

### 8.1.5

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" : "Rooooooodles", "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 }
>
```

### 8.1.6

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

```
> db.unicorns.find({gender: "m", weight: {$gt: 500, $lt: 700}}, {_id: 0})
{ "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "name" : "Rooooooodles", "loves" : [ "apple" ], "weight" : 575, "gender" : "m", "vampires" : 99 }
{ "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
>
```

### 8.1.7

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

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

### 8.1.8

Все единороги, не имеющие ключ vampires.

```
> db.unicorns.find({vampires: {$exists: false}})
{ "_id" : ObjectId("60c4c12aea0f3938b663b1c6"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
>
```

### 8.1.9

Упорядоченный список имен самцов единорогов с информацией об их первом предпочтении.

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

### 8.2.1

Создание коллекции towns;

Запрос, который возвращает список городов с независимыми мэрами (party="I", выведено только название города и информация о мэре);

Запрос, который возвращает список беспартийных мэров (party отсутствует, выведено только название города и информация о мэре).

```
uncaught exception: SyntaxError: unexpected token: '{' :
@(shell):1:16
> db.towns.insert {name: "Punxsutawney ",
... populatiuon: 6200,
... last_sensu: ISODate("2008-01-31"),
... famous_for: [""],
... mayor: { name: "Jim Wehrle"}}
uncaught exception: SyntaxError: unexpected token: '{' :
@(shell):1:16
> db.towns.insert ({name: "Punxsutawney ", populatiuon: 6200, last_sensu: ISODate("2008-01-31"), famous_for: [""], mayor:
WriteResult({ "nInserted" : 1 })
> db.towns.insert ({name: "New York",
... populatiuon: 22200000,
... last_sensu: ISODate("2009-07-31"),
... famous_for: ["status of liberty", "food"],
... mayor: { name: "Michael Bloomberg", party: "I"}})
WriteResult({ "nInserted" : 1 })
> db.towns.insert ({name: "Portland",
... populatiuon: 528000,
... last_sensu: ISODate("2009-07-20"),
... famous_for: ["beer", "food"],
... mayor: { name: "Sam Adams", party: "D"}})
WriteResult({ "nInserted" : 1 })
> db.towns.find({"mayor.party": "I"}, {_id: 0, name: 1, mayor: 1})
{ "name" : "New York", "mayor" : { "name" : "Michael Bloomberg", "party" : "I" } }
> db.towns.find({"mayor.party": {$exist: false}}, {_id: 0, name: 1, mayor: 1})
Error: error: {
  "ok" : 0,
  "errmsg" : "unknown operator: $exist",
  "code" : 2,
  "codeName" : "BadValue"
}
> db.towns.find({"mayor.party": {$exists: false}}, {_id: 0, name: 1, mayor: 1})
{ "name" : "Punxsutawney ", "mayor" : { "name" : "Jim Wehrle" } }
>
```

### 8.2.2

Функция для вывода списка самцов единорогов;

Курсор для этого списка из первых двух особей с сортировкой в лексикографическом порядке;

Выведен результат, используя forEach.

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

### 8.2.3

Количество самок единорогов весом от полутонны до 600 кг.

```
WriteResult({ "nInserted" : 1 })
> db.unicorns.find({gender: 'f', weight: {$gte: 500, $lte: 600}}).count()
2
>
```

## 8.2.4

Список предпочтений.

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

## 8.2.5

Количество особей единорогов обоих полов.

```
> db.unicorns.aggregate([{"$group" : {"_id":"$gender", count:{$sum:1}}]})
{ "_id" : "m", "count" : 6 }
{ "_id" : "f", "count" : 5 }
>
```

## 8.2.6

Выполнена команда:

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

Проверено содержимое коллекции unicorns.

```
> db.unicorns.save({name: 'Barney', loves: ['grape'],
... weight: 340, gender: 'm'})
WriteResult({"nInserted" : 1 })
> db.unicorns.save({name: 'Barney', loves: ['grape'], weight: 340, gender: 'm'})
...
> db.unicorns.find()
{ "_id" : ObjectId("60c5019904dcae810312d2a9"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("60c5019904dcae810312d2aa"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60c5019904dcae810312d2ab"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("60c5019904dcae810312d2ac"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60c5019904dcae810312d2ad"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 733, "gender" : "f", "vampires" : 40 }
{ "_id" : ObjectId("60c5019904dcae810312d2ae"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60c5019904dcae810312d2af"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60c5019904dcae810312d2b0"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("60c5019904dcae810312d2b1"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60c5019904dcae810312d2b2"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("60c5019904dcae810312d2b3"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("60c5046d04dcae810312d2b4"), "name" : "Barney", "loves" : [ "grape" ], "weight" : 340, "gender" : "m" }
```



## 8.2.7

Для самки единорога Айна внесены изменения в БД: теперь ее вес 800, она убила 51 вампира;

Проверено содержимое коллекции unicorns.

```
> db.unicorns.update({name: "Ayna"}, {name: "Ayna", loves: ["strawberry", "lemon"], weight: 800, gender: "f", vampires: 51})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.find()
{ "_id" : ObjectId("60c5019904dcae810312d2a9"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("60c5019904dcae810312d2aa"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60c5019904dcae810312d2ab"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("60c5019904dcae810312d2ac"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60c5019904dcae810312d2ad"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 800, "gender" : "f", "vampires" : 51 }
{ "_id" : ObjectId("60c5019904dcae810312d2ae"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60c5019904dcae810312d2af"), "name" : "Raleigh", "loves" : [ "apple", "sugar" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60c5019904dcae810312d2b0"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("60c5019904dcae810312d2b1"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60c5019904dcae810312d2b2"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("60c5019904dcae810312d2b3"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("60c5046d04dcae810312d2b4"), "name" : "Barney", "loves" : [ "grape" ], "weight" : 340, "gender" : "m" }
```

## 8.2.8

Для самца единорога Raleigh внесены изменения в БД: теперь он любит рэдбул;

Проверено содержимое коллекции unicorns.

```
> db.unicorns.update({name: "Raleigh"}, {$set: {loves: ["Redbull"]}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.find()
{ "_id" : ObjectId("60c5019904dcae810312d2a9"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 63 }
{ "_id" : ObjectId("60c5019904dcae810312d2aa"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 43 }
{ "_id" : ObjectId("60c5019904dcae810312d2ab"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 182 }
{ "_id" : ObjectId("60c5019904dcae810312d2ac"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 80 }
{ "_id" : ObjectId("60c5019904dcae810312d2ad"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 800, "gender" : "f", "vampires" : 51 }
{ "_id" : ObjectId("60c5019904dcae810312d2ae"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 39 }
{ "_id" : ObjectId("60c5019904dcae810312d2af"), "name" : "Raleigh", "loves" : [ "Redbull" ], "weight" : 421, "gender" : "m", "vampires" : 2 }
{ "_id" : ObjectId("60c5019904dcae810312d2b0"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 33 }
{ "_id" : ObjectId("60c5019904dcae810312d2b1"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 54 }
{ "_id" : ObjectId("60c5019904dcae810312d2b2"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f" }
{ "_id" : ObjectId("60c5019904dcae810312d2b3"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 165 }
{ "_id" : ObjectId("60c5046d04dcae810312d2b4"), "name" : "Barney", "loves" : [ "grape" ], "weight" : 340, "gender" : "m" }
```

## 8.2.9

Всем самцам единорогов увеличено количество убитых вампиров на 5;

Проверено содержимое коллекции unicorns.

```
> db.unicorns.update({}, {$inc: {vampires: 5}}, {multi: true})
WriteResult({ "nMatched" : 12, "nUpserted" : 0, "nModified" : 12 })
> db.unicorns.find()
{ "_id" : ObjectId("60c5019904dcae810312d2a9"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 68 }
{ "_id" : ObjectId("60c5019904dcae810312d2aa"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 48 }
{ "_id" : ObjectId("60c5019904dcae810312d2ab"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 187 }
{ "_id" : ObjectId("60c5019904dcae810312d2ac"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 85 }
{ "_id" : ObjectId("60c5019904dcae810312d2ad"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 800, "gender" : "f", "vampires" : 56 }
{ "_id" : ObjectId("60c5019904dcae810312d2ae"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 44 }
{ "_id" : ObjectId("60c5019904dcae810312d2af"), "name" : "Raleigh", "loves" : [ "Redbull" ], "weight" : 421, "gender" : "m", "vampires" : 7 }
{ "_id" : ObjectId("60c5019904dcae810312d2b0"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 38 }
{ "_id" : ObjectId("60c5019904dcae810312d2b1"), "name" : "Pilot", "loves" : [ "apple", "watermelon" ], "weight" : 650, "gender" : "m", "vampires" : 59 }
{ "_id" : ObjectId("60c5019904dcae810312d2b2"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f", "vampires" : 5 }
{ "_id" : ObjectId("60c5019904dcae810312d2b3"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 170 }
{ "_id" : ObjectId("60c5046d04dcae810312d2b4"), "name" : "Barney", "loves" : [ "grape" ], "weight" : 340, "gender" : "m", "vampires" : 5 }
```

## 8.2.10

Изменена информация о городе Портланд: мэр этого города теперь беспартийный;

Проверено содержимое коллекции towns.

```
> db.towns.update({name: "Portland"}, {$set: {"mayor.party": "I"}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.towns.find()
{ "_id" : ObjectId("60c5080604dcae810312d2b5"), "name" : "Punxsutawney ", "populatiuon" : 6200, "last_sensus" : ISODate("2008-01-31T00:00:00Z"), "famous_for" : [ "" ], "mayor" : { "name" : "Jim Wehrle" } }
{ "_id" : ObjectId("60c5081f04dcae810312d2b6"), "name" : "New York", "populatiuon" : 22200000, "last_sensus" : ISODate("2009-07-31T00:00:00Z"), "famous_for" : [ "stat us of liberty", "food" ], "mayor" : { "name" : "Michael Bloomberg", "party" : "I" } }
{ "_id" : ObjectId("60c5083a04dcae810312d2b7"), "name" : "Portland", "populatiuon" : 528000, "last_sensus" : ISODate("2009-07-20T00:00:00Z"), "famous_for" : [ "beer", "food" ], "mayor" : { "name" : "Sam Adams", "party" : "I" } }
>
```

### 8.2.11

Изменена информация о самце единорога Pilot: теперь он любит и шоколад.

Проверено содержимое коллекции unicorns.

```
> db.unicorns.update({name: "Pilot"}, {$push: {loves: "chocolate"}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.find()
{ "_id" : ObjectId("60c5019904dcae810312d2a9"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 68 }
{ "_id" : ObjectId("60c5019904dcae810312d2aa"), "name" : "Aurora", "loves" : [ "carrot", "grape" ], "weight" : 450, "gender" : "f", "vampires" : 48 }
{ "_id" : ObjectId("60c5019904dcae810312d2ab"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 187 }
{ "_id" : ObjectId("60c5019904dcae810312d2ac"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 85 }
{ "_id" : ObjectId("60c5019904dcae810312d2ad"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 800, "gender" : "f", "vampires" : 56 }
{ "_id" : ObjectId("60c5019904dcae810312d2ae"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 44 }
{ "_id" : ObjectId("60c5019904dcae810312d2af"), "name" : "Raleigh", "loves" : [ "Redbull" ], "weight" : 421, "gender" : "m", "vampires" : 7 }
{ "_id" : ObjectId("60c5019904dcae810312d2b0"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 38 }
{ "_id" : ObjectId("60c5019904dcae810312d2b1"), "name" : "Pilot", "loves" : [ "apple", "watermelon", "chocolate" ], "weight" : 650, "gender" : "m", "vampires" : 59 }
{ "_id" : ObjectId("60c5019904dcae810312d2b2"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f", "vampires" : 5 }
{ "_id" : ObjectId("60c5019904dcae810312d2b3"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 170 }
{ "_id" : ObjectId("60c5046d04dcae810312d2b4"), "name" : "Barney", "loves" : [ "grape" ], "weight" : 340, "gender" : "m", "vampires" : 5 }
```

### 8.2.12

Изменена информация о самке единорога Aurora: теперь она любит еще и сахар, и лимоны.

Проверено 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("60c5019904dcae810312d2a9"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 68 }
{ "_id" : ObjectId("60c5019904dcae810312d2aa"), "name" : "Aurora", "loves" : [ "carrot", "grape", "sugar", "lemon" ], "weight" : 450, "gender" : "f", "vampires" : 48 }
{ "_id" : ObjectId("60c5019904dcae810312d2ab"), "name" : "Unicrom", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 187 }
{ "_id" : ObjectId("60c5019904dcae810312d2ac"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 85 }
{ "_id" : ObjectId("60c5019904dcae810312d2ad"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 800, "gender" : "f", "vampires" : 56 }
{ "_id" : ObjectId("60c5019904dcae810312d2ae"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 44 }
{ "_id" : ObjectId("60c5019904dcae810312d2af"), "name" : "Raleigh", "loves" : [ "Redbull" ], "weight" : 421, "gender" : "m", "vampires" : 7 }
{ "_id" : ObjectId("60c5019904dcae810312d2b0"), "name" : "Leia", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 38 }
{ "_id" : ObjectId("60c5019904dcae810312d2b1"), "name" : "Pilot", "loves" : [ "apple", "watermelon", "chocolate" ], "weight" : 650, "gender" : "m", "vampires" : 59 }
{ "_id" : ObjectId("60c5019904dcae810312d2b2"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f", "vampires" : 5 }
{ "_id" : ObjectId("60c5019904dcae810312d2b3"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 170 }
{ "_id" : ObjectId("60c5046d04dcae810312d2b4"), "name" : "Barney", "loves" : [ "grape" ], "weight" : 340, "gender" : "m", "vampires" : 5 }
```

### 8.2.13

Создана коллекция towns;

Удалены документы с беспартийными мэрами;

Проверено содержание коллекции;

Очищена коллекция;

Просмотрен список доступных коллекций.

```
> db.towns.remove({"mayor.party": "I"}, false)
WriteResult({ "nRemoved" : 1 })
> db.towns.find()
{ "_id" : ObjectId("60c5080604dcae810312d2b5"), "name" : "Punxsutawney ", "populatiuon" : 6200, "last_sensus" : ISODate("2008-01-31T00:00:00Z"), "famous_for" : [ "" ], "mayor" : { "name" : "Jim Wehrle" } }
> db.towns.remove({})
WriteResult({ "nRemoved" : 1 })
> db.towns.find()
towns
> show collections
towns
>
```



### 8.3.1

Создана коллекция зон обитания единорогов, указав в качестве идентификатора кратко название зоны, далее включив полное название и описание;

Включена для нескольких единорогов в документы ссылка на зону обитания, используя второй способ автоматического связывания;

Проверено содержание коллекции единорогов.

```
> db.habitat.insert({_id: "wfl", name: 'waterfall', description: "magic waterfall that makes time stop"})
WriteResult({ "nInserted" : 1 })
> db.habitat.insert({_id: "pvy", name: 'pink valley', description: "sugary pink grass covers the whole valley"})
WriteResult({ "nInserted" : 1 })
> db.habitat.insert({_id: "fli", name: 'floating island', description: "beautiful island floating above the great void" })
WriteResult({ "nInserted" : 1 })
> db.habitat.find()
{ "_id" : "wfl", "name" : "waterfall", "description" : "magic waterfall that makes time stop" }
{ "_id" : "pvy", "name" : "pink valley", "description" : "sugary pink grass covers the whole valley" }
{ "_id" : "fli", "name" : "floating island", "description" : "beautiful island floating above the great void" }
>
> db.unicorns.update((name: "Horny"), {$set: {habitat: {$ref: "habitat", $id: "wfl"}}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.update((name: "Ayna"), {$set: {habitat: {$ref: "habitat", $id: "pvy"}}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.update((name: "Pilot"), {$set: {habitat: {$ref: "habitat", $id: "fli"}}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
> db.unicorns.find()
{ "_id" : ObjectId("60c5019904dcae810312d2a9"), "name" : "Horny", "loves" : [ "carrot", "papaya" ], "weight" : 600, "gender" : "m", "vampires" : 68, "habitat" : DBRef("habitat", "wfl") }
{ "_id" : ObjectId("60c5019904dcae810312d2aa"), "name" : "Aurora", "loves" : [ "carrot", "grape", "sugar", "lemon" ], "weight" : 450, "gender" : "f", "vampires" : 48 }
{ "_id" : ObjectId("60c5019904dcae810312d2ab"), "name" : "Unicron", "loves" : [ "energon", "redbull" ], "weight" : 984, "gender" : "m", "vampires" : 107 }
{ "_id" : ObjectId("60c5019904dcae810312d2ac"), "name" : "Solnara", "loves" : [ "apple", "carrot", "chocolate" ], "weight" : 550, "gender" : "f", "vampires" : 85 }
{ "_id" : ObjectId("60c5019904dcae810312d2ad"), "name" : "Ayna", "loves" : [ "strawberry", "lemon" ], "weight" : 800, "gender" : "f", "vampires" : 56, "habitat" : DBRef("habitat", "pvy") }
{ "_id" : ObjectId("60c5019904dcae810312d2ae"), "name" : "Kenny", "loves" : [ "grape", "lemon" ], "weight" : 690, "gender" : "m", "vampires" : 44 }
{ "_id" : ObjectId("60c5019904dcae810312d2af"), "name" : "Raleigh", "loves" : [ "Redbull" ], "weight" : 421, "gender" : "m", "vampires" : 7 }
{ "_id" : ObjectId("60c5019904dcae810312d2b0"), "name" : "Leis", "loves" : [ "apple", "watermelon" ], "weight" : 601, "gender" : "f", "vampires" : 38 }
{ "_id" : ObjectId("60c5019904dcae810312d2b1"), "name" : "Pilot", "loves" : [ "apple", "watermelon", "chocolate" ], "weight" : 650, "gender" : "m", "vampires" : 59, "habitat" : DBRef("habitat", "fli") }
{ "_id" : ObjectId("60c5019904dcae810312d2b2"), "name" : "Nimue", "loves" : [ "grape", "carrot" ], "weight" : 540, "gender" : "f", "vampires" : 5 }
{ "_id" : ObjectId("60c5019904dcae810312d2b3"), "name" : "Dunx", "loves" : [ "grape", "watermelon" ], "weight" : 704, "gender" : "m", "vampires" : 170 }
{ "_id" : ObjectId("60c5046d04dcae810312d2b4"), "name" : "Barney", "loves" : [ "grape" ], "weight" : 340, "gender" : "m", "vampires" : 5 }
```

### 8.3.2

### 8.3.3

Проверено, можно ли задать для коллекции unicorns индекс для ключа name с флагом unique;

Получена информация о всех индексах коллекции unicorns;

Удалены все индексы, кроме индекса для идентификатора;

Попытка удалить индекс для идентификатора.

```
> db.unicorns.ensureindex({name: 1}, {unique: true})
uncaught exception: TypeError: db.unicorns.ensureindex is not a function :
@(shell):1:1
> db.unicorns.ensureIndex({name: 1}, {unique: true})
{
  "createdCollectionAutomatically" : false,
  "numIndexesBefore" : 1,
  "numIndexesAfter" : 2,
  "ok" : 1
}
> db.unicorns.getIndexes()
[
  {
    "v" : 2,
    "key" : {
      "_id" : 1
    },
    "name" : "_id_"
  },
  {
    "v" : 2,
    "unique" : true,
    "key" : {
      "name" : 1
    },
    "name" : "name_1"
  }
]
> db.unicorns.dropIndex("name_1")
{ "nIndexesWas" : 2, "ok" : 1 }
> db.unicorns.dropIndex("_id_")
{
  "ok" : 0,
  "errmsg" : "cannot drop _id index",
  "code" : 72,
  "codeName" : "InvalidOptions"
}
>
```

#### 8.3.4

Создана объемная коллекция numbers, задействовав курсор:

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

Выбрано последних четыре документа;

Проанализирован план выполнения запроса 2. Сколько потребовалось времени на выполнение запроса (по значению параметра executionTimeMillis);

Создан индекс для ключа value;

Получена информация о всех индексах коллекции numbers.

Выполнен запрос 2;

Проанализирован план выполнения запроса с установленным индексом. Сколько потребовалось времени на выполнение запроса; Сравнение времени выполнения запросов с индексом и без. Какой запрос более эффективен.

```
> use numbers
switched to db numbers
> for(i = 0; i < 100000; i++){db.numbers.insert({value: i})}
WriteResult({ "nInserted" : 1 })
>
> db.numbers.find().sort({value: -1}).limit(4)
{ "_id" : ObjectId("60c520de3e6927d91184838d"), "value" : 99999 }
{ "_id" : ObjectId("60c520de3e6927d91184838c"), "value" : 99998 }
{ "_id" : ObjectId("60c520de3e6927d91184838b"), "value" : 99997 }
{ "_id" : ObjectId("60c520de3e6927d91184838a"), "value" : 99996 }
>
```

```

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

    },
    "winningPlan" : {
      "stage" : "SORT",
      "sortPattern" : {
        "value" : -1
      },
      "memLimit" : 104857600,
      "limitAmount" : 4,
      "type" : "simple",
      "inputStage" : {
        "stage" : "COLLSCAN",
        "direction" : "forward"
      }
    },
    "rejectedPlans" : [ ]
  },
  "executionStats" : {
    "executionSuccess" : true,
    "nReturned" : 4,
    "executionTimeMillis" : 52,
    "totalKeysExamined" : 0,
    "totalDocsExamined" : 100000,
    "executionStages" : {
      "stage" : "SORT",
      "nReturned" : 4,
      "executionTimeMillisEstimate" : 0,
      "works" : 100007,
      "advanced" : 4,
      "needTime" : 100002,
      "needYield" : 0,
      "saveState" : 100,
      "restoreState" : 100,
      "isEOF" : 1,
      "sortPattern" : {
        "value" : -1
      },
    },
    "memLimit" : 104857600,
    "limitAmount" : 4,
    "type" : "simple",
    "totalDataSizeSorted" : 5300000,
    "usedDisk" : false,
    "inputStage" : {
      "stage" : "COLLSCAN",
      "nReturned" : 100000,
      "executionTimeMillisEstimate" : 0,
      "works" : 100002,
      "advanced" : 100000,
      "needTime" : 1,
      "needYield" : 0,
      "saveState" : 100,
    }
  }
}

```

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

```

> db.numbers.explain("executionStats").find().sort({value: -1}).limit(4)
{
  "queryPlanner" : {
    "plannerVersion" : 1,
    "namespace" : "numbers.numbers",
    "indexFilterSet" : false,
    "parsedQuery" : {
      },
    "winningPlan" : {
      "stage" : "LIMIT",
      "limitAmount" : 4,
      "inputStage" : {
        "stage" : "FETCH",
        "inputStage" : {
          "stage" : "IXSCAN",
          "keyPattern" : {
            "value" : 1
          },
          "indexName" : "value_1",
          "isMultiKey" : false,
          "multiKeyPaths" : {
            "value" : [ ]
          },
          "isUnique" : false,
          "isSparse" : false,
          "isPartial" : false,
          "indexVersion" : 2,
          "direction" : "backward",
          "indexBounds" : {
            "value" : [
              "[MaxKey, MinKey]"
            ]
          }
        }
      }
    },
    "rejectedPlans" : [ ]
  },
  "executionStats" : {
    "executionSuccess" : true,
    "nReturned" : 4,
    "executionTimeMillis" : 1,
    "totalKeysExamined" : 4,
    "totalDocsExamined" : 4,
    "executionStages" : {
      "stage" : "LIMIT",
      "nReturned" : 4,
      "executionTimeMillisEstimate" : 0,
      "works" : 5,
      "advanced" : 4,
      "needTime" : 0,
      "needYield" : 0,
      "saveState" : 0,
      "restoreState" : 0,
      "isEOF" : 1,
      "limitAmount" : 4,
      "inputStage" : {
        "stage" : "FETCH",
        "nReturned" : 4,
        "executionTimeMillisEstimate" : 0,
        "works" : 4,

```