

**Министерство науки и высшего образования Российской Федерации
ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ
“НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
УНИВЕРСИТЕТ ИТМО”**

ФАКУЛЬТЕТ СРЕДНЕГО ПРОФЕССИОНАЛЬНОГО ОБРАЗОВАНИЯ

**ОТЧЕТ
ПО ЛАБОРАТОРНОЙ РАБОТЕ № 8
«Знакомство с MongoDB»**

Специальность 09.02.07 «Информационные системы и программирование»

Дисциплина «Основы проектирования баз данных»

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1 ИНДИВИДУАЛЬНОЕ ЗАДАНИЕ

Цель работы: овладеть практическими навыками и умениями реализации баз данных в MongoDB.

Задание:

- 1) Попытайтесь уменьшить размер модели реляционной базы данных, с которой Вы работали.
- 2) Реализовать модель в MongoDB.
- 3) Заполнить модель данными, чтобы все запросы пункта 4) выдавали непустые строки.
- 4) Реализовать минимум 40% запросов, сделанных в работе по реляционным базам данных в MongoDB.

Выполнение задания:

1. Новая модель данных:

Коллекция Workers:

работники {

 _id работника :

 стаж работы :

 дата рождения :

 номер телефона :

 почта сотрудника :

}

Коллекция Animals:

животные {

 id животного :

 дата рождения :

 пол :

 имя :

 зона обитания : {

 _id

 название

 местоположение

 }

вид животного : (млекопитающие, птицы, рептилии)

доп характеристики : {

case птицы

место зимовки

город зимовки

case рептилии

температура тела

длительность спячки

}

массив вольеров : [{id, тип вольера, кол-во животных}, {id, тип вольера,
кол-во животных}, {id, тип вольера, кол-во животных}]

рацион []

кормление :[{

[завтрак, _id работника]

[обед, _id работника]

[ужин, _id работника]

дата кормления

}]

аллергии

лечение животного : [{

_id работника (ветеринара)

оценка здоровья

мед. отчет

дата

}]

}

2. Логи процесса реализации модели в MongoDB:

Заполнение коллекции работников:

```
db.workers.insert({_id : 1, experience : 5, dob : new Date(1997, 4, 1),  
phone_number : "89213043881", email : "flar78@gmail.com"})
```

```
db.workers.insert({_id : 2, experience : 10, dob : new Date(1995, 3, 4),  
phone_number : "89348756122", email : "loghorrean74@yandex.ru"})
```

```
db.workers.insert({_id : 3, experience : 7, dob : new Date(1987, 12, 30),  
phone_number : "89516782394", email : "litota@gmail.com"})
```

```
> db.workers.find().pretty()  
{  
  "_id" : 1,  
  "experience" : 5,  
  "dob" : ISODate("1997-04-01T21:00:00Z"),  
  "phone_number" : "89213043881",  
  "email" : "flar78@gmail.com"  
}  
{  
  "_id" : 2,  
  "experience" : 10,  
  "dob" : ISODate("1995-03-04T21:00:00Z"),  
  "phone_number" : "89348756122",  
  "email" : "loghorrean74@yandex.ru"  
}  
{  
  "_id" : 3,  
  "experience" : 7,  
  "dob" : ISODate("1987-12-30T21:00:00Z"),  
  "phone_number" : "89516782394",  
  "email" : "litota@gmail.com"  
}
```

Заполнение коллекции животных:

```
db.animals.insert({ _id : 1, dob : new Date(2015, 5, 5), gender : "male", name :  
"Dave", habitat : [{_id : 1, habitat_name : "Farm", habitat_characteristics : "Green land  
with grass and animals"}], type : "bird", characteristics : {wintering_place : "Russia",  
wintering_city : "Moscow"}, aviary : [{_id : 1, aviary_type : "summer",  
animal_number : 1}], ration : ["seeds"], feeding : [{breakfast : {food : "seeds",  
worker_id : 1}, lunch : {food : "none", worker_id : 1}, dinner : {food : "seeds",  
worker_id : 1}}], allergics : "none", treatment : [{worker_id : 2, assessment : "normal",  
report : "Animal is healthy", treatment_date : "none"}], kind_of_animal : "chicken"  
})
```

```

"_id" : 1,
"dob" : ISODate("2015-06-04T21:00:00Z"),
"gender" : "male",
"name" : "Dave",
"habitat" : [
  {
    "_id" : 1,
    "habitat_name" : "Farm",
    "habitat_characteristics" : "Green land with grass and animals"
  }
],
"type" : "bird",
"characteristics" : {
  "wintering_place" : "Russia",
  "wintering_city" : "Moscow"
},
"aviary" : [
  {
    "_id" : 1,
    "aviary_type" : "summer",
    "animal_number" : 1
  }
],
"ration" : [
  "seeds"
],
"feeding" : [
  {
    "breakfast" : {
      "food" : "seeds",
      "worker_id" : 1
    },
    "lunch" : {
      "food" : "none",
      "worker_id" : 1
    },
    "dinner" : {
      "food" : "seeds",
      "worker_id" : 1
    }
  }
],
"allergics" : "none",
"treatment" : [
  {
    "worker_id" : 2,
    "assessment" : "normal",
    "report" : "Animal is healthy",
    "treatment_date" : "none"
  }
],
"kind_of_animal" : "chicken"

```

```

db.animals.insert({ _id : 2, dob : new Date(2016, 7, 5), gender : "male", name :
"Peter", habitat : [{_id : 2, habitat_name : "Ocean", habitat_characteristics : "A blue
world with fish and sea animals"}], type : "mammals", aviary : [{_id : 2, aviary_type
: "winter", animal_number : 3}], ration : ["fish", "meat"], feeding : [{breakfast : {food
: ["tuna", "trout"], worker_id : 1}, lunch : {food : "meat", worker_id : 1}, dinner :

```

```
{food : "herring", worker_id : 1}}], allergies : ["pollen", "flowers"], treatment :  
[{"worker_id : 2, assessment : "within normal", report : "Animal is healthy",  
treatment_date : "none"}], kind_of_animal : "walrus" })
```

```
"_id" : 2,  
"dob" : ISODate("2016-07-05T21:00:00Z"),  
"gender" : "male",  
"name" : "Peter",  
"habitat" : [  
  {  
    "_id" : 2,  
    "habitat_name" : "Ocean",  
    "habitat_characteristics" : "A blue world with fish and sea animals"  
  }  
,  
  "type" : "mammal",  
  "aviary" : [  
    {  
      "_id" : 2,  
      "aviary_type" : "winter",  
      "animal_number" : 3  
    }  
  ],  
  "ration" : [  
    "fish",  
    "meat"  
  ],  
  "feeding" : [  
    {  
      "breakfast" : {  
        "food" : [  
          "tuna",  
          "trout"  
        ],  
        "worker_id" : 1  
      },  
      "lunch" : {  
        "food" : "meat",  
        "worker_id" : 1  
      },  
      "dinner" : {  
        "food" : "herring",  
        "worker_id" : 1  
      }  
    }  
  ],  
  "allergies" : [  
    "pollen",  
    "flowers"  
  ],  
  "treatment" : [  
    {  
      "worker_id" : 2,  
      "assessment" : "within normal",  
      "report" : "Animal is healthy",  
      "treatment_date" : "none"  
    }  
  ],  
  "kind_of_animal" : "walrus"
```

```
db.animals.insert({ _id : 3, dob : new Date(2019, 10, 8), gender : "female", name : "Arina", habitat : [{_id : 3, habitat_name : "Forest", habitat_characteristics : "A dark place with a lot of trees and predators"}], type : "mammal", aviary : [{_id : 3, aviary_type : "winter", animal_number : 1}], ration : ["meat", "birds"], feeding : [{breakfast : {food : "hare", worker_id : 1}, lunch : {food : "deer", worker_id : 1}, dinner : {food : "hare", worker_id : 1}}], allergies : "none", treatment : [{worker_id : 2, assessment : "within normal", report : "Animal is healthy", treatment_date : "none"}], kind_of_animal : "wolf" })
```

```
{
  "_id" : 3,
  "dob" : ISODate("2019-10-08T21:00:00Z"),
  "gender" : "female",
  "name" : "Arina",
  "habitat" : [
    {
      "_id" : 3,
      "habitat_name" : "Forest",
      "habitat_characteristics" : "A dark place with a lot of trees and predators"
    }
  ],
  "type" : "mammal",
  "aviary" : [
    {
      "_id" : 3,
      "aviary_type" : "winter",
      "animal_number" : 1
    }
  ],
  "ration" : [
    "meat",
    "birds"
  ],
  "feeding" : [
    {
      "breakfast" : {
        "food" : "hare",
        "worker_id" : 1
      },
      "lunch" : {
        "food" : "deer",
        "worker_id" : 1
      },
      "dinner" : {
        "food" : "hare",
        "worker_id" : 1
      }
    }
  ],
  "allergics" : "none",
  "treatment" : [
    {
      "worker_id" : 2,
      "assessment" : "within normal",
      "report" : "Animal is healthy",
      "treatment_date" : "none"
    }
  ],
  "kind_of_animal" : "wolf"
}
```

```
db.animals.insert({ _id : 4, dob : new Date(2015, 3, 18), gender : "male", name : "Griffin", habitat : [{_id : 4, habitat_name : "Desert", habitat_characteristics : "A dry
```

land with a lot of sand and bugs"}], type : "reptile", characteristics : {body_temperature : 20, hibernation : 120}, aviary : [{_id : 4, aviary_type : "summer", animal_number : 6}], ration : ["invertebrates"], feeding : [{breakfast : {food : "spiders", worker_id : 1}, lunch : {food : "mollusks", worker_id : 1}, dinner : {food : "shrooms", worker_id : 1}}], allergics : "bees, some medicines", treatment : [{worker_id : 2, assessment : "great", report : "Animal is healthy", treatment_date : "none"}], kind_of_animal : "lizard" })

```
"_id" : 4,
"dob" : ISODate("2015-03-18T21:00:00Z"),
"gender" : "male",
"name" : "Griffin",
"habitat" : [
  {
    "_id" : 4,
    "habitat_name" : "Desert",
    "habitat_characteristics" : "A dry land with a lot of sand and bugs"
  }
],
"type" : "reptile",
"characteristics" : {
  "body_temperature" : 20,
  "hibernation" : "120"
},
"aviary" : [
  {
    "_id" : 4,
    "aviary_type" : "summer",
    "animal_number" : 6
  }
],
"ration" : "invertebrates",
"feeding" : [
  {
    "breakfast" : {
      "food" : "spiders",
      "worker_id" : 1
    },
    "lunch" : {
      "food" : "mollusks",
      "worker_id" : 1
    },
    "dinner" : {
      "food" : "shrooms",
      "worker_id" : 1
    }
  }
],
"allergics" : "bees, some medicines",
"treatment" : [
  {
    "worker_id" : 2,
    "assessment" : "great",
    "report" : "Animal is healthy",
    "treatment_date" : "none"
  }
],
"kind_of_animal" : "lizard"
```



```
db.animals.insert({ _id : 5, dob : new Date(2017, 3, 19), gender : "female", name : "Osoka", habitat : [{_id : 1, habitat_name : "Farm", habitat_characteristics : "Green land with grass and animals"}], type : "mammal", aviary : [{_id : 1, aviary_type : "summer", animal_number : 2}], ration : "hay", feeding : [{breakfast : {food : "hay", worker_id : 1}, lunch : {food : "grass", worker_id : 1}, dinner : {food : "dried grass", worker_id : 1}}], allergies : "none", treatment : [{worker_id : 2, assessment : "low health", report : "required taking medicines for ailments", procedure : "Taking medicines 2 times a day", treatment_date : new Date(2020, 2, 20)}], kind_of_animal : "rabbit" })
```

```
{
  "_id" : 5,
  "dob" : ISODate("2017-03-19T21:00:00Z"),
  "gender" : "female",
  "name" : "Osoka",
  "habitat" : [
    {
      "_id" : 1,
      "habitat_name" : "Farm",
      "habitat_characteristics" : "Green land with grass and animals"
    }
  ],
  "type" : "mammal",
  "aviary" : [
    {
      "_id" : 1,
      "aviary_type" : "summer",
      "animal_number" : 2
    }
  ],
  "ration" : "hay",
  "feeding" : [
    {
      "breakfast" : {
        "food" : "hay",
        "worker_id" : 1
      },
      "lunch" : {
        "food" : "grass",
        "worker_id" : 1
      },
      "dinner" : {
        "food" : "dried grass",
        "worker_id" : 1
      }
    }
  ],
  "allergics" : "none",
  "treatment" : [
    {
      "worker_id" : 2,
      "assessment" : "low health",
      "report" : "required taking medicines for ailments",
      "procedure" : "Taking medicines 2 times a day",
      "treatment_date" : ISODate("2020-02-20T21:00:00Z")
    }
  ],
  "kind_of_animal" : "rabbit"
}
```

3. Текст запросов со скриншотами запроса и результата:

Запрос 1: вывести id, вид и дату рождения млекопитающих, родившихся раньше 2016 года:

```
> db.animals.find({dob : {$gt : ISODate("2016-12-31T00:00:00Z")}, type : "mammal"}, {_id : 1, kind_of_animal : 1, dob : 1})
{ "_id" : 3, "dob" : ISODate("2019-10-08T21:00:00Z"), "kind_of_animal" : "wolf" }
{ "_id" : 5, "dob" : ISODate("2017-03-19T21:00:00Z"), "kind_of_animal" : "rabbit" }
```

Запрос 2: вывести id вольера, кол-во животных в нем и id этого животного в случаях, когда в вольере проживает больше одного животного:

```
> db.animals.find({"aviary.animal_number" : {$gt : 1}}, {"aviary._id" : 1, "aviary.animal_number" : 1, "_id" : 1}).sort({"aviary._id" : 1}).pretty()
{ "_id" : 5, "aviary" : [ { "_id" : 1, "animal_number" : 2 } ] }
{ "_id" : 2, "aviary" : [ { "_id" : 2, "animal_number" : 3 } ] }
{ "_id" : 4, "aviary" : [ { "_id" : 4, "animal_number" : 6 } ] }
```

Запрос 3: вывести информацию по животным женского пола, родившихся раньше 2015 года:

```
> db.animals.find({gender : "female", dob : {$gt : ISODate("2016-12-31T00:00:00Z")}}, {_id : 1, dob : 1, gender : 1, name : 1, kind_of_animal : 1}).pretty()
{
  "_id" : 3,
  "dob" : ISODate("2019-10-08T21:00:00Z"),
  "gender" : "female",
  "name" : "Arina",
  "kind_of_animal" : "wolf"
}
{
  "_id" : 5,
  "dob" : ISODate("2017-03-19T21:00:00Z"),
  "gender" : "female",
  "name" : "Osoka",
  "kind_of_animal" : "rabbit"
}
```

Запрос 4: вывести id и вид животных, которых хотя бы раз кормил работник зоопарка с id = 1:

```
> db.animals.find({$or : [{"feeding.breakfast.worker_id" : 1}, {"feeding.lunch.worker_id" : 1}, {"feeding.dinner.worker_id" : 1}]}, {_id : 1, kind_of_animal : 1}).pretty()
{ "_id" : 1, "kind_of_animal" : "chicken" }
{ "_id" : 2, "kind_of_animal" : "walrus" }
{ "_id" : 3, "kind_of_animal" : "wolf" }
{ "_id" : 4, "kind_of_animal" : "lizard" }
{ "_id" : 5, "kind_of_animal" : "rabbit" }
```

Запрос 5: вывести id зон обитания, которая является фермой и все id животных женского пола на ней:

```
> db.animals.find({gender : "female", "habitat.habitat_name" : "Farm"}, {"habitat._id" : 1, "_id" : 1, "kind_of_animal" : 1}).pretty()
{
  "_id" : 5,
  "habitat" : [
    {
      "_id" : 1
    }
  ],
  "kind_of_animal" : "rabbit"
}
```

Запрос 6: вывести id, имена и виды млекопитающих женского пола, родившихся раньше 2019 года:

```
> db.animals.find({gender : "female", type : "mammal", dob : {$lt : ISODate("2019-00-00T00:00:00Z")}}, {"name" : 1, "_id" : 1, "kind_of_animal" : 1, gender : 1}).pretty()
{
  "_id" : 5,
  "gender" : "female",
  "name" : "Osoka",
  "kind_of_animal" : "rabbit"
}
```

Запрос MapReduce: вывести всех животных и все их виды от отдельности:

```
> db.animals.mapReduce(function() {emit(this.type, this.kind_of_animal)}, function(key, value) {return value.join()}, {out : {inline : 1}})
{
  "results" : [
    {
      "_id" : "bird",
      "value" : "chicken"
    },
    {
      "_id" : "mammal",
      "value" : "walrus,wolf,rabbit"
    },
    {
      "_id" : "reptile",
      "value" : "lizard"
    }
  ],
}
```