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высшего образования
«САНКТ-ПЕТЕРБУРГСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
УНИВЕРСИТЕТ ИТМО»
Факультет среднего профессионального образования

ОТЧЕТ
О ЛАБОРАТОРНОЙ РАБОТЕ № 7

по теме: Знакомство с MongoDB

по дисциплине: Основы проектирования баз данных

Специальность 09.02.07 Информационные системы и программирование

Проверил:

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Оценка _____

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

Практическое задание:

Для выполнения работы Вам потребуется:

- a. Попытаться уменьшить размер модели реляционной базы данных, с которой Вы работали.
- b. Реализовать Вашу модель в MongoDB.
- c. Заполнить модель данными, настолько, чтобы все запросы, реализуемые Вами в пункте 2.d выдавали непустые строки.
- d. Реализовать минимум 40% Ваших запросов, сделанных в работе по реляционным базам данных в MongoDB.

Перечень запросов:

Необходимо реализовать некоторое количество SQL-запросов.

Запросы:

- a) Вывести информацию о читателях библиотеки и количестве посещений;
- b) Вывести информацию о книгах, которые были опубликованы в период с 16.07.1951 по 11.07.1960;
- c) Вывести информацию о всех читателях;
- d) Вывести книги и их состояния;
- e) Вывести книги в хорошем состоянии;
- f) Вывести информацию о наименьшем количестве посещений;
- g) Вывести читателей библиотеки, которые получили меньше 100 книг за всё время, которое они были зарегистрированы в библиотеке;

ВЫПОЛНЕНИЕ

1) Схема физической модели БД, спроектированной с использованием СА Erwin Data Modeler представлена на рисунке №1.

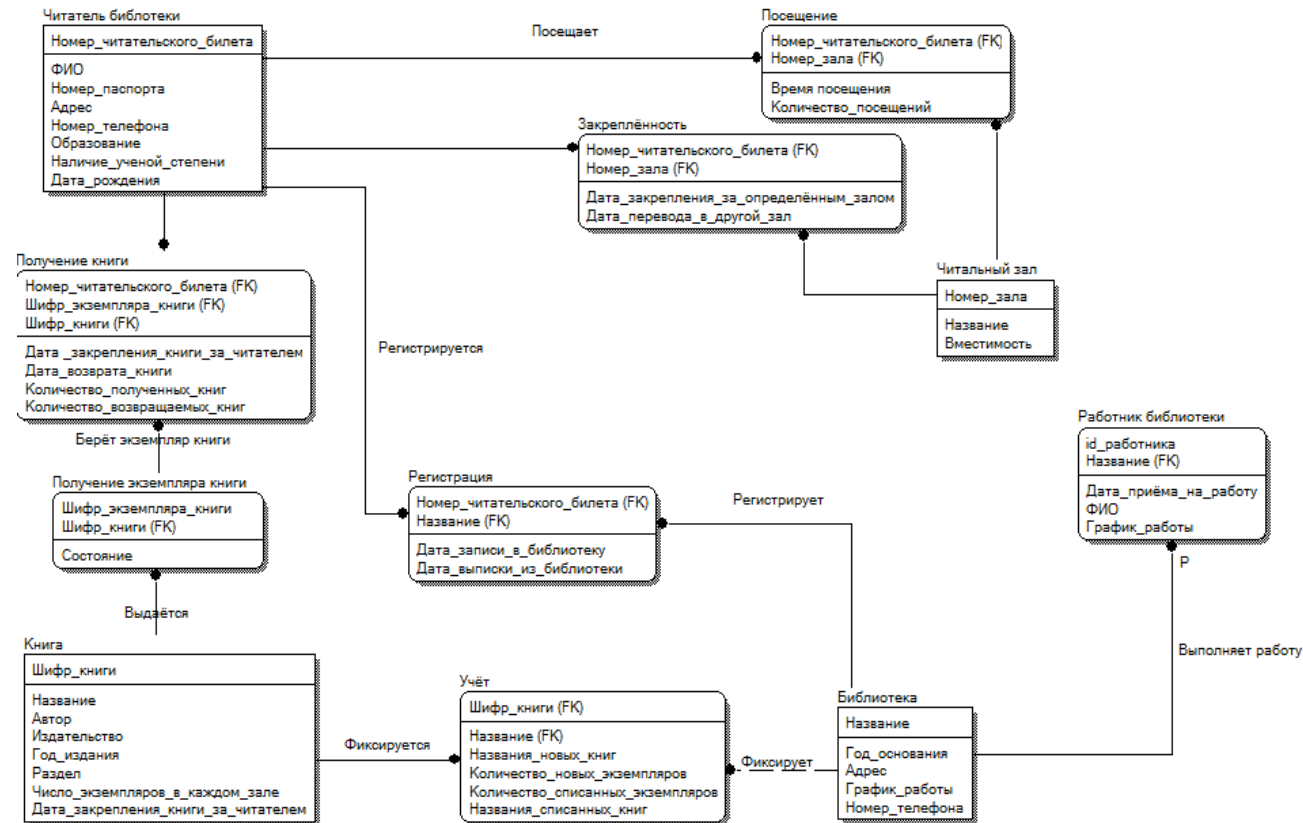


Рисунок 1 Схема инфологической модели данных БД, выполненная в среде СА ERwin Process Modeler

2) Логи модели:

```
db.createCollection("book")
db.createCollection("library")
db.createCollection("library_worker")
db.createCollection("accounting")
db.createCollection("reader")
db.createCollection("visit")
db.createCollection("registration")
db.createCollection("poluchenie_book")
db.createCollection("reading_room")
db.createCollection("fastening")
db.createCollection("poluchenie_examp_book")
```

```
db.accounting.insert({id_book: 1, name: "Brave New World", number_new_instances: 13, number_copies_written_of: 5})
```

```
db.accounting.insert({id_book: 2, name: "Nineteen Eighty-Four", number_new_instances: 6, number_copies_written_of: 2})
```

```
db.accounting.insert({id_book: 3, name: "The Catcher in the Rye", number_new_instances: 23, number_copies_written_of: 11})
```

```
db.accounting.insert({id_book: 4, name: "To Kill a Mockingbird", number_new_instances: 9, number_copies_written_of: 13})
```

```
db.accounting.insert({id_book: 5, name: "Lord of the Flies", number_new_instances: 17, number_copies_written_of: 24})
```

```
db.book.insert({id_book: 1, name: "Brave New World", author: "Aldous Huxley", publishing_house: "Chatto & Windus", year_publishing: new Date('1932-01-01'), section: "science fiction", chislo_exempl_v_zale: 25})
```

```
db.book.insert({id_book: 2, name: "Nineteen Eighty-Four", author: "George Orwell", publishing_house: "Secker and Warburg", year_publishing: new Date('1949-06-08'), section: "novel", chislo_exempl_v_zale: 30})
```

```
db.book.insert({id_book: 3, name: "The Cather in the Rye", author: "Jerome David", publishing_house: "Little, Brown and Company", year_publishing: new Date('1951-07-16'), section: "novel", chislo_exempl_v_zale: 45})
```

```
db.book.insert({id_book: 4, name: "To Kill a Mockinbird", author: "Nelle Harper Lee", publishing_house: "J.B. Lippincott", year_publishing: new Date('1960-07-11'), section: "novel", chislo_exempl_v_zale: 36})
```

```
db.book.insert({id_book: 5, name: "Lord of the Flies", author: "William Gerald Golding", publishing_house: "Faber and Faber", year_publishing: new Date('1954-09-17'), section: "novel", chislo_exempl_v_zale: 54})
```

```
db.fastening.insert({id_chit_bileta: 1, room_number: 12, date_assigned_to_a_paricular_room: new Date('1998-08-16'), date_of_transfer_to_another_room: new Date('2002-05-14')})
```

```
db.fastening.insert({id_chit_bileta: 2, room_number: 10, date_assigned_to_a_paricular_room: new Date('2010-10-24'), date_of_transfer_to_another_room: new Date('2017-02-17')})
```

```
db.fastening.insert({id_chit_bileta: 3, room_number: 10, date_assigned_to_a_paricular_room: new Date('2016-10-7'), date_of_transfer_to_another_room: new Date('2020-11-18')})
```

```
db.fastening.insert({id_chit_bileta: 4, room_number: 11, date_assigned_to_a_paricular_room: new Date('2003-04-26'), date_of_transfer_to_another_room: new Date('2012-10-29')})
```

```
db.library.insert({name: "ITMO Library", year_of_foundation: new Date('1797-05-14'), adress: "Pesochnay naberegnay 14", schedule: "09:00-20:00", phone_number: 88122713796})
```

```
db.library_worker.insert({id_worker: 111, name_worker: "Kovalev D.F.", library_name: "ITMO Library", employment_date: new Date('2019-08-20'), shedule: "09:00-14:00"})
```

```
db.library_worker.insert({id_worker: 112, name_worker: "Golubeva V.A.", library_name: "ITMO Library", employment_date: new Date('2001-09-11'), shedule: "09:00-16:00"})
```

```
db.library_worker.insert({id_worker: 113, name_worker: "Makarova O.L.", library_name: "ITMO Library", employment_date: new Date('1996-12-03'), shedule: "14:00-20:00"})
```

```
db.library_worker.insert({id_worker: 114, name_worker: "Fedosova E.B.", library_name: "ITMO Library", employment_date: new Date('2015-06-23'), shedule: "09:00-18:00"})
```

```
db.library_worker.insert({id_worker: 115, name_worker: "Larionova M.R.", library_name: "ITMO Library", employment_date: new Date('2001-09-11'), shedule: "12:00-18:00"})
```

```
db.poluchenie_exemp_book.insert({id_exemp: 11, id_book: 1, sostoynie: "New"})
```

```
db.poluchenie_exemp_book.insert({id_exemp: 12, id_book: 2, sostoynie: "Like New"})
```

```
db.poluchenie_exemp_book.insert({id_exemp: 13, id_book: 3, sostoynie: "New"})
```

```
db.poluchenie_exemp_book.insert({id_exemp: 14, id_book: 4, sostoynie: "Good"})
```

```
db.poluchenie_exemp_book.insert({id_exemp: 15, id_book: 5, sostoynie: "Acceptable"})
```

```
db.poluchenie_exemp_book.insert({id_exemp: 16, id_book: 2, sostoynie: "Bad"})
```

```
db.poluchenie_exemp_book.insert({id_exemp: 17, id_book: 4, sostoynie: "Bad"})
```

```
db.poluchenie_exemp_book.insert({id_exemp: 18, id_book: 4, sostoynie:
"Good"})
```

```
db.poluchenie_book.insert({id_chit_bileta: 1, id_exemp: 11, id_book: 1,
date_book_to_reader: new Date('2000-09-12'), date_vozvrata: new Date('2001-02-
15'), kolichество_poluch_knig: 103, kolichество_vozvrash_knig: 103})
```

```
db.poluchenie_book.insert({id_chit_bileta: 2, id_exemp: 12, id_book: 2,
date_book_to_reader: new Date('2014-03-17'), date_vozvrata: new Date('2014-07-
23'), kolichество_poluch_knig: 15, kolichество_vozvrash_knig: 11})
```

```
db.poluchenie_book.insert({id_chit_bileta: 3, id_exemp: 13, id_book: 3,
date_book_to_reader: new Date('2019-11-07'), date_vozvrata: new Date('2019-11-
30'), kolichество_poluch_knig: 20, kolichество_vozvrash_knig: 18})
```

```
db.poluchenie_book.insert({id_chit_bileta: 4, id_exemp: 14, id_book: 4,
date_book_to_reader: new Date('2008-04-22'), date_vozvrata: new Date('2009-05-
18'), kolichество_poluch_knig: 22, kolichество_vozvrash_knig: 21})
```

```
db.reader.insert({id_chit_bileta: 1, reader_name: "Ivanov R.I.", passport:
345655, adress: "Vyazemsky Lane 4", phone: 79041234567, education: "ITMO",
nalichie_ychenoy_stepeni: "Yes", date_of_birth: new Date('1985-04-12')})
```

```
db.reader.insert({id_chit_bileta: 2, reader_name: "Smirnov V.A.", passport:
243564, adress: "Abrosimova St. 145", phone: 79045647385, education: "ITMO",
nalichie_ychenoy_stepeni: "No", date_of_birth: new Date('1993-06-17')})
```

```
db.reader.insert({id_chit_bileta: 3, reader_name: "Petrov A.D.", passport:
453678, adress: "Alexander Nevsky 32", phone: 79046345684, education: "SPB
GASY", nalichie_ychenoy_stepeni: "No", date_of_birth: new Date('2000-11-22')})
```

```
db.reader.insert({id_chit_bileta: 4, reader_name: "Frolov K.L.", passport:
346622, adress: "Griboedova emb. 17", phone: 79049789009, education: "SPB
GASY", nalichie_ychenoy_stepeni: "Yes", date_of_birth: new Date('1994-01-30')})
```



```
db.reading_room.insert({id_room: 10, name: "Reading room for Students",  
capacity: 25})
```

```
db.reading_room.insert({id_room: 11, name: "Reading room for Children",  
capacity: 15})
```

```
db.reading_room.insert({id_room: 12, name: "General reading room", capac-  
ity: 50})
```

```
db.registration.insert({id_chit_bileta: 1, library_name: "ITMO Library",  
date_recorded_to_the_library: new Date('1998-08-16'), date_of_dis-  
charge_from_the_library: new Date('2019-03-22')})
```

```
db.registration.insert({id_chit_bileta: 2, library_name: "ITMO Library",  
date_recorded_to_the_library: new Date('2010-12-24'), date_of_dis-  
charge_from_the_library: new Date('2021-12-24')})
```

```
db.registration.insert({id_chit_bileta: 3, library_name: "ITMO Library",  
date_recorded_to_the_library: new Date('2016-10-07'), date_of_dis-  
charge_from_the_library: new Date('2024-10-08')})
```

```
db.registration.insert({id_chit_bileta: 4, library_name: "ITMO Library",  
date_recorded_to_the_library: new Date('2003-03-19'), date_of_dis-  
charge_from_the_library: new Date('2013-03-20')})
```

```
db.visit.insert({id_chit_bileta: 1, id_room: 12, number_visited: 5})
```

```
db.visit.insert({id_chit_bileta: 2, id_room: 10, number_visited: 13})
```

```
db.visit.insert({id_chit_bileta: 3, id_room: 10, number_visited: 23})
```

```
db.visit.insert({id_chit_bileta: 4, id_room: 11, number_visited: 4})
```

3) Запросы:

а) Вывести информацию о читателях библиотеки и количестве посещениях:

```
db.reader.aggregate([{$lookup: {from: "visit", localField: "id_chit_bileta", foreignField: "id_chit_bileta", as: "id_chit_bileta"}}, {$project: {"id_chit_bileta": 1, "date_of_birth": 1, "id_room": 1, "number_of_visited": 1, "_id": 0}}, {$sort: {"id_chit_bileta": 1}}])
```

```
> db.reader.aggregate([{$lookup: {from: "visit", localField: "id_chit_bileta", foreignField: "id_chit_bileta", as: "id_chit_bileta"}, {$project: {"id_chit_bileta": 1, "date_of_birth": 1, "id_room": 1, "number_of_visited": 1, "_id": 0}}, {$sort: {"id_chit_bileta": 1}}]).pretty()
{
  "id_chit_bileta" : [
    {
      "_id" : ObjectId("5f9dab388eb213a106afc02"),
      "id_chit_bileta" : 1,
      "id_room" : 12,
      "number_visited" : 5
    }
  ],
  "date_of_birth" : ISODate("1985-04-12T00:00:00Z")
}
{
  "id_chit_bileta" : [
    {
      "_id" : ObjectId("5f9dab418eb213a106afc03"),
      "id_chit_bileta" : 2,
      "id_room" : 10,
      "number_visited" : 13
    }
  ],
  "date_of_birth" : ISODate("1993-06-17T00:00:00Z")
}
{
  "id_chit_bileta" : [
    {
      "_id" : ObjectId("5f9dab478eb213a106afc04"),
      "id_chit_bileta" : 3,
      "id_room" : 10,
      "number_visited" : 23
    }
  ],
  "date_of_birth" : ISODate("2000-11-22T00:00:00Z")
}
{
  "id_chit_bileta" : [
    {
      "_id" : ObjectId("5f9dab4f8eb213a106afc05"),
      "id_chit_bileta" : 4,
      "id_room" : 11,
      "number_visited" : 4
    }
  ],
  "date_of_birth" : ISODate("1994-01-30T00:00:00Z")
}
```

б) Вывести информацию о книгах, которые были опубликованы в период с 16.07.1951 по 11.07.1960:

```
db.book.find({year_publishing: {$gte : ISODate('1951-07-16'), $lte: ISODate('1960-07-11')}}), {_id: 0})
```

```
> db.book.find({year_publishing: {$gte : ISODate('1951-07-16')}})
{
  "id_book" : 3,
  "name" : "The Cather in the Rye",
  "author" : "Jerome David",
  "publishing_house" : "Little, Brown and Company",
  "year_publishing" : ISODate("1951-07-16T00:00:00Z"),
  "section" : "novel",
  "chislo_exempl_v_zale" : 45
}
{
  "id_book" : 4,
  "name" : "To Kill a Mockinbird",
  "author" : "Nelle Harper Lee",
  "publishing_house" : "J.B. Lippincott",
  "year_publishing" : ISODate("1960-07-11T00:00:00Z"),
  "section" : "novel",
  "chislo_exempl_v_zale" : 36
}
{
  "id_book" : 5,
  "name" : "Lord of the Flies",
  "author" : "William Gerald Golding",
  "publishing_house" : "Faber and Faber",
  "year_publishing" : ISODate("1954-09-17T00:00:00Z"),
  "section" : "novel",
  "chislo_exempl_v_zale" : 54
}
```

с) Вывести информацию о всех читателях:

`db.reader.find({}, {_id:0}).pretty()`

```
> db.reader.find({}, {_id:0})
{ "id_chit_bileta" : 1, "reader_name" : "Ivanov R.I.", "passport" : 345655, "adress" : "Vyazemsky Lane 4", "phone" : 79041234567, "education" : "ITMO"
, "nalichie_ychenoy_stepeni" : "Yes", "date_of_birth" : ISODate("1985-04-12T00:00:00Z") }
{ "id_chit_bileta" : 2, "reader_name" : "Smirnov V.A.", "passport" : 243564, "adress" : "Abrosimova St. 145", "phone" : 79045647385, "education" : "IT
MO", "nalichie_ychenoy_stepeni" : "No", "date_of_birth" : ISODate("1993-06-17T00:00:00Z") }
{ "id_chit_bileta" : 3, "reader_name" : "Petrov A.D.", "passport" : 453678, "adress" : "Alexander Nevsky 32", "phone" : 79046345684, "education" : "SP
B GASY", "nalichie_ychenoy_stepeni" : "No", "date_of_birth" : ISODate("2000-11-22T00:00:00Z") }
{ "id_chit_bileta" : 4, "reader_name" : "Frolov K.L.", "passport" : 346622, "adress" : "Griboedova emb. 17", "phone" : 79049789009, "education" : "SPB
GASY", "nalichie_ychenoy_stepeni" : "Yes", "date_of_birth" : ISODate("1994-01-30T00:00:00Z") }
```

д) Вывести книги и их состояния:

`db.poluchenie_exemp_book.aggregate([{$lookup: {from: "book", localField: "id_book", foreignField: "id_book", as: "id_book"}}, {$project: {"id_book": 1, "sostoyenie": 1, "book_name": 1, _id: 0}}, {$sort: {"id_book": 1}}])`

```
> db.poluchenie_exemp_book.aggregate([{$lookup: {from: "book", localField: "id_book", foreignField: "id_book", as: "id_book"}}, {$project: {"id_book":
1, "sostoyenie": 1, "book_name": 1, _id: 0}}, {$sort: {"id_book": 1}}])
{ "id_book" : [ { "_id" : ObjectId("5f9d9cdf8eb213a106afcedc"), "id_book" : 1, "author" : "Aldous Huxley", "publishing_house" : "Chatto & Windus", "ye
ar_publishing" : ISODate("1932-01-01T00:00:00Z"), "section" : "science fiction", "chislo_exempl_v_zale" : 25, "book_name" : "Brave New World" } ], "sost
oyenie" : "New" }
{ "id_book" : [ { "_id" : ObjectId("5f9d9dd2b8eb213a106afcedd"), "id_book" : 2, "author" : "George Orwell", "publishing_house" : "Secker and Warburg",
"year_publishing" : ISODate("1949-06-08T00:00:00Z"), "section" : "novel", "chislo_exempl_v_zale" : 30, "book_name" : "Nineteen Eighty-Four" } ], "sost
oyenie" : "Like New" }
{ "id_book" : [ { "_id" : ObjectId("5f9d9dd2b8eb213a106afcedd"), "id_book" : 2, "author" : "George Orwell", "publishing_house" : "Secker and Warburg",
"year_publishing" : ISODate("1949-06-08T00:00:00Z"), "section" : "novel", "chislo_exempl_v_zale" : 30, "book_name" : "Nineteen Eighty-Four" } ], "sost
oyenie" : "Bad" }
{ "id_book" : [ { "_id" : ObjectId("5f9d9dd808eb213a106afcedc"), "id_book" : 3, "author" : "Jerome David", "publishing_house" : "Little, Brown and Comp
any", "year_publishing" : ISODate("1951-07-16T00:00:00Z"), "section" : "novel", "chislo_exempl_v_zale" : 45, "book_name" : "The Cather in the Rye" } ], "sost
oyenie" : "New" }
{ "id_book" : [ { "_id" : ObjectId("5f9d9dd18eb213a106afcedf"), "id_book" : 4, "author" : "Nelle Harper Lee", "publishing_house" : "J.B. Lippincott",
"year_publishing" : ISODate("1960-07-11T00:00:00Z"), "section" : "novel", "chislo_exempl_v_zale" : 36, "book_name" : "To Kill a Mockinbird" } ], "sost
oyenie" : "Good" }
{ "id_book" : [ { "_id" : ObjectId("5f9d9dd18eb213a106afcedf"), "id_book" : 4, "author" : "Nelle Harper Lee", "publishing_house" : "J.B. Lippincott",
"year_publishing" : ISODate("1960-07-11T00:00:00Z"), "section" : "novel", "chislo_exempl_v_zale" : 36, "book_name" : "To Kill a Mockinbird" } ], "sost
oyenie" : "Bad" }
{ "id_book" : [ { "_id" : ObjectId("5f9d9dd18eb213a106afcedf"), "id_book" : 4, "author" : "Nelle Harper Lee", "publishing_house" : "J.B. Lippincott",
"year_publishing" : ISODate("1960-07-11T00:00:00Z"), "section" : "novel", "chislo_exempl_v_zale" : 36, "book_name" : "To Kill a Mockinbird" } ], "sost
oyenie" : "Good" }
{ "id_book" : [ { "_id" : ObjectId("5f9d9dd168eb213a106afcee0"), "id_book" : 5, "author" : "William Gerald Golding", "publishing_house" : "Faber and Fa
ber", "year_publishing" : ISODate("1954-09-17T00:00:00Z"), "section" : "novel", "chislo_exempl_v_zale" : 54, "book_name" : "Lord of the Flies" } ], "s
ostoyenie" : "Acceptable" }
```

e) Вывести информацию обо всех выданных книгах:

```
db.poluchenie_exemp_book.find({sostoynie: "Good"}, {_id:0})
```

```
> db.poluchenie_exemp_book.find({sostoynie: "Good"}, {_id:0})
{ "id_exemp" : 14, "id_book" : 4, "sostoynie" : "Good" }
{ "id_exemp" : 18, "id_book" : 4, "sostoynie" : "Good" }
```

f) Вывести информацию наименьшем посещении:

```
db.visit.aggregate([{$group: {_id: 0, minVisit: {$min: "$number_visited"}}}])
```

```
> db.visit.aggregate([{$group: {_id: 0, minVisit: {$min: "$number_visited"}}}])
{ "_id" : 0, "minVisit" : 4 }
```

g) Вывести книги, экземпляров которых меньше 40:

```
db.book.find({chislo_exempl_v_zale :{$lt: 40}},{_id:0, year_publishing:0})
```

```
> db.book.find({chislo_exempl_v_zale :{$lt: 40}},{_id:0, year_publishing:0}).pretty()
{
  "id_book" : 1,
  "author" : "Aldous Huxley",
  "publishing_house" : "Chatto & Windus",
  "section" : "science fiction",
  "chislo_exempl_v_zale" : 25,
  "book_name" : "Brave New World"
}
{
  "id_book" : 2,
  "author" : "George Orwell",
  "publishing_house" : "Secker and Warburg",
  "section" : "novel",
  "chislo_exempl_v_zale" : 30,
  "book_name" : "Nineteen Eighty-Four"
}
{
  "id_book" : 4,
  "author" : "Nelle Harper Lee",
  "publishing_house" : "J.B. Lippincott",
  "section" : "novel",
  "chislo_exempl_v_zale" : 36,
  "book_name" : "To Kill a Mockinbird"
}
```

ВЫВОД

В лабораторной работе №7 были получены практические навыки создания базы данных в MongoDB, заполнение их рабочими данными и выполнение запросов.