Министерство образования и науки Российской Федерации
федеральное государственное автономное образовательное учреждение
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«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:

_____ Говоров А. И.

Дата: «____» _____ 2020г.

Оценка _____

Выполнил:

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_____ Быковская А.М.

Санкт-Петербург 2020

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 CA Erwin Data Modeler представлена на рисунке №1.
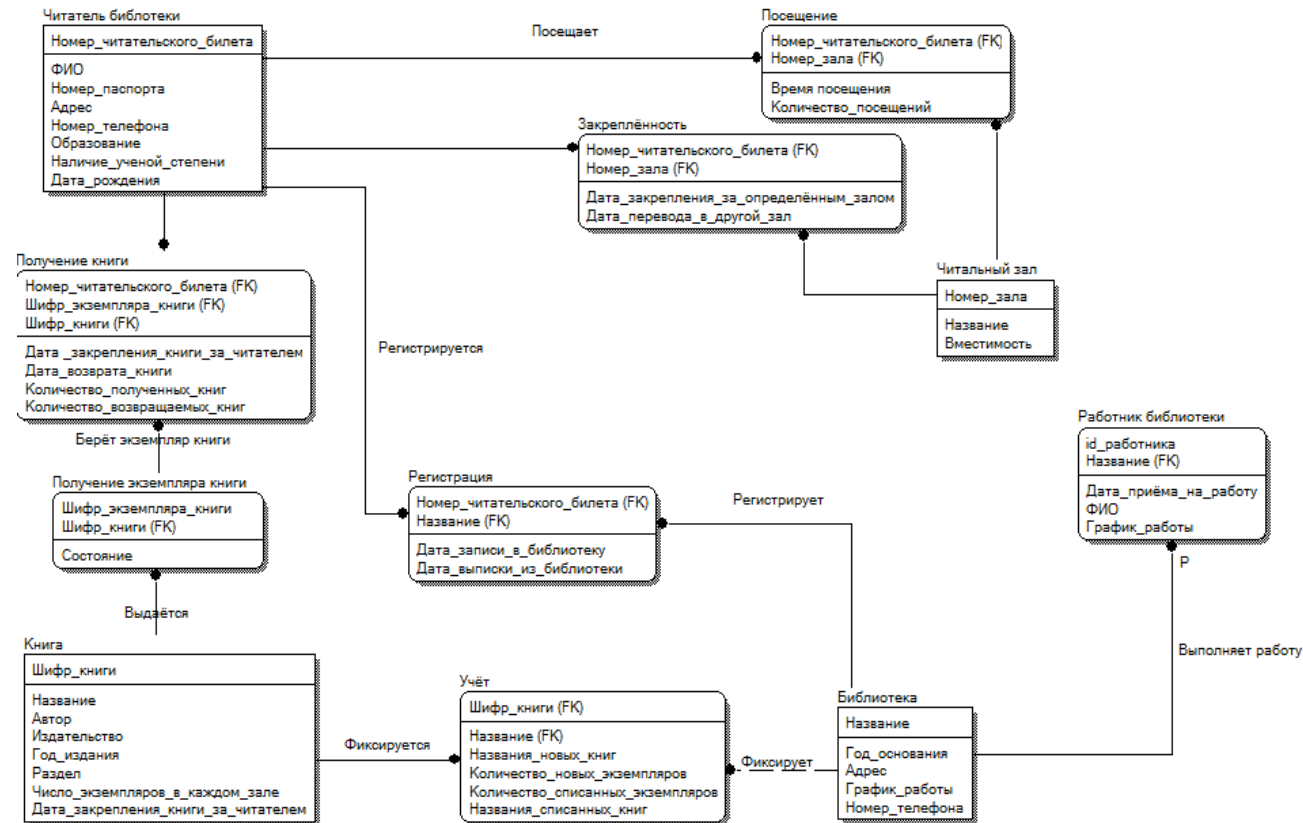

Рисунок 1 Схема инфологической модели данных БД, выполненная в среде CA ERwin Process Modeler

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'), kolichestvo_poluch_knig: 103, kolichestvo_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'), kolichestvo_poluch_knig: 15, kolichestvo_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'), kolichestvo_poluch_knig: 20, kolichestvo_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'), kolichestvo_poluch_knig: 22, kolichestvo_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:

a) Вывести информацию о читателях библиотеки и количестве посещений:

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([{$lookup: {from: "visit", localField: "id_chit_b:
of_visited": 1, _id: 0}}, {$sort: {"id_chit_bileta": 1}}]).pretty()
{
        "id_chit_bileta" : [
                {
                        "_id" : ObjectId("5f9dab388eb213a106afcf02"),
                        "id_chit_bileta" : 1,
                        "id_room" : 12,
                        "number_visited" : 5
                }
        ],
        "date_of_birth" : ISODate("1985-04-12T00:00:00Z")
}
{
        "id_chit_bileta" : [
                {
                        "_id" : ObjectId("5f9dab418eb213a106afcf03"),
                        "id_chit_bileta" : 2,
                        "id_room" : 10,
                        "number_visited" : 13
                }
        ],
        "date_of_birth" : ISODate("1993-06-17T00:00:00Z")
}
{
        "id_chit_bileta" : [
                {
                        "_id" : ObjectId("5f9dab478eb213a106afcf04"),
                        "id_chit_bileta" : 3,
                        "id_room" : 10,
                        "number_visited" : 23
                }
        ],
        "date_of_birth" : ISODate("2000-11-22T00:00:00Z")
}
{
        "id_chit_bileta" : [
                {
                        "_id" : ObjectId("5f9dab4f8eb213a106afcf05"),
                        "id_chit_bileta" : 4,
                        "id_room" : 11,
                        "number_visited" : 4
                }
        ],
        "date_of_birth" : ISODate("1994-01-30T00:00:00Z")
}
```

b) 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
}
```

c) 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") }
```

d) 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, "sostoynie": 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, "sostoynie": 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" } ], "so
stoynie" : "New" }
{ "id_book" : [ { "_id" : ObjectId("5f9d9d2b8eb213a106afcedd"), "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
oynie" : "Like New" }
{ "id_book" : [ { "_id" : ObjectId("5f9d9d2b8eb213a106afcedd"), "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
oynie" : "Bad" }
{ "id_book" : [ { "_id" : ObjectId("5f9d9d808eb213a106afcede"), "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" } ]
, "sostoynie" : "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
oynie" : "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
oynie" : "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
oynie" : "Good" }
{ "id_book" : [ { "_id" : ObjectId("5f9d9e168eb213a106afcee0"), "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
ostoynie" : "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.