МИНИСТЕРСТВО ОБРАЗОВАНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ

УЧРЕЖДЕНИЕ ОБРАЗОВАНИЯ
«БРЕСТСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ»

ФАКУЛЬТЕТ ЭЛЕКТРОННО-ИНФОРМАЦИОННЫХ СИСТЕМ

Кафедра интеллектуальных информационных технологий

Отчет по лабораторной работе No5

Специальность ПО11(о)

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Вариант 6

Цель работы: приобрести практические навыки разработки API и баз данных

Общее задание:

1. Реализовать базу данных из не менее 5 таблиц на заданную тематику 6) База данных Библиотека. При реализации продумать типизацию полей и внешние ключи в таблицах;

2. Визуализировать разработанную БД с помощью схемы, на которой отображены все таблицы и связи между ними;

3. На языке Python с использованием SQLAlchemy реализовать подключение к БД;

4. Реализовать основные операции с данными (выборку, добавление, удаление, модификацию);

5. Для каждой реализованной операции с использованием FastAPI реализовать отдельный эндпойнт;

Выполнение:

Код программы:

main.py:

```
from fastapi import FastAPI, HTTPException, Depends
from sqlalchemy.orm import Session
from database import SessionLocal, init_db
from crud import (
    create_book, get_books, get_book, update_book, delete_book,
    create_genre, get_genres, get_genre, update_genre, delete_genre,
    create_author, get_authors, get_author, update_author, delete_author,
    create_collection, get_collections, get_collection, update_collection, delete_collection,
    add_book_to_collection, remove_book_from_collection
)
import uvicorn

app = FastAPI()

@app.on_event("startup")
def on_startup():
    init_db()

def get_db():
    db = SessionLocal()
    try:
        yield db
    finally:
        db.close()

# Эндпоинты для Book
@app.post("/books/")
def create_book_endpoint(book: dict, db: Session = Depends(get_db)):
    return create_book(db, book)

@app.get("/books/")
def get_books_endpoint(skip: int = 0, limit: int = 100, db: Session = Depends(get_db)):
    return get_books(db, skip=skip, limit=limit)

@app.get("/books/{book_id}")
def get_book_endpoint(book_id: int, db: Session = Depends(get_db)):
    book = get_book(db, book_id)
    if not book:
        raise HTTPException(status_code=404, detail="Book not found")
    return book

@app.put("/books/{book_id}")
def update_book_endpoint(book_id: int, book: dict, db: Session = Depends(get_db)):
    updated_book = update_book(db, book_id, book)
    if not updated_book:
        raise HTTPException(status_code=404, detail="Book not found")
    return updated_book

@app.delete("/books/{book_id}")
def delete_book_endpoint(book_id: int, db: Session = Depends(get_db)):
    book = delete_book(db, book_id)
    if not book:
        raise HTTPException(status_code=404, detail="Book not found")
    return {"message": "Book deleted"}

# Аналогично создаем эндпоинты для Genre, Author, Collection и операций с книгами в подборках.
```

crud.py:

```
from sqlalchemy.orm import Session
from models import Book, Genre, Author, Collection

# CRUD для Book
def create_book(db: Session, book_data: dict):
    db_book = Book(**book_data)
    db.add(db_book)
    db.commit()
    db.refresh(db_book)
    return db_book

def get_books(db: Session, skip: int = 0, limit: int = 100):
    return db.query(Book).offset(skip).limit(limit).all()

def get_book(db: Session, book_id: int):
    return db.query(Book).filter(Book.id == book_id).first()

def update_book(db: Session, book_id: int, book_data: dict):
    db_book = db.query(Book).filter(Book.id == book_id).first()
    if db_book:
        for key, value in book_data.items():
            setattr(db_book, key, value)
        db.commit()
        db.refresh(db_book)
    return db_book

def delete_book(db: Session, book_id: int):
    db_book = db.query(Book).filter(Book.id == book_id).first()
    if db_book:
        db.delete(db_book)
        db.commit()
    return db_book

# CRUD для Genre
def create_genre(db: Session, genre_data: dict):
    db_genre = Genre(**genre_data)
    db.add(db_genre)
    db.commit()
    db.refresh(db_genre)
    return db_genre

def get_genres(db: Session, skip: int = 0, limit: int = 100):
    return db.query(Genre).offset(skip).limit(limit).all()

def get_genre(db: Session, genre_id: int):
    return db.query(Genre).filter(Genre.id == genre_id).first()

def update_genre(db: Session, genre_id: int, genre_data: dict):
    db_genre = db.query(Genre).filter(Genre.id == genre_id).first()
    if db_genre:
        for key, value in genre_data.items():
            setattr(db_genre, key, value)
        db.commit()
        db.refresh(db_genre)
    return db_genre

def delete_genre(db: Session, genre_id: int):
    db_genre = db.query(Genre).filter(Genre.id == genre_id).first()
    if db_genre:
        db.delete(db_genre)
        db.commit()
    return db_genre

# CRUD для Author
def create_author(db: Session, author_data: dict):
    db_author = Author(**author_data)
    db.add(db_author)
    db.commit()
    db.refresh(db_author)
    return db_author

def get_authors(db: Session, skip: int = 0, limit: int = 100):
    return db.query(Author).offset(skip).limit(limit).all()

def get_author(db: Session, author_id: int):
    return db.query(Author).filter(Author.id == author_id).first()

def update_author(db: Session, author_id: int, author_data: dict):
    db_author = db.query(Author).filter(Author.id == author_id).first()
    if db_author:
        for key, value in author_data.items():
            setattr(db_author, key, value)
        db.commit()
        db.refresh(db_author)
    return db_author

def delete_author(db: Session, author_id: int):
    db_author = db.query(Author).filter(Author.id == author_id).first()
    if db_author:
        db.delete(db_author)
        db.commit()
    return db_author

# CRUD для Collection
def create_collection(db: Session, collection_data: dict):
    db_collection = Collection(**collection_data)
    db.add(db_collection)
    db.commit()
    db.refresh(db_collection)
    return db_collection

def get_collections(db: Session, skip: int = 0, limit: int = 100):
    return db.query(Collection).offset(skip).limit(limit).all()

def get_collection(db: Session, collection_id: int):
    return db.query(Collection).filter(Collection.id == collection_id).first()

def update_collection(db: Session, collection_id: int, collection_data: dict):
    db_collection = db.query(Collection).filter(Collection.id == collection_id).first()
    if db_collection:
        for key, value in collection_data.items():
            setattr(db_collection, key, value)
        db.commit()
        db.refresh(db_collection)
    return db_collection

def delete_collection(db: Session, collection_id: int):
    db_collection = db.query(Collection).filter(Collection.id == collection_id).first()
    if db_collection:
        db.delete(db_collection)
        db.commit()
    return db_collection

# Добавление и удаление книги в подборку
def add_book_to_collection(db: Session, collection_id: int, book_id: int):
    collection = db.query(Collection).filter(Collection.id == collection_id).first()
    book = db.query(Book).filter(Book.id == book_id).first()
    if collection and book:
        collection.books.append(book)
        db.commit()
        db.refresh(collection)
    return collection

def remove_book_from_collection(db: Session, collection_id: int, book_id: int):
    collection = db.query(Collection).filter(Collection.id == collection_id).first()
    book = db.query(Book).filter(Book.id == book_id).first()
    if collection and book:
        collection.books.remove(book)
        db.commit()
        db.refresh(collection)
    return collection
```

const.py:

```
from dataclasses import dataclass

@dataclass
class Const:
    DATABASE_URL: str = "sqlite:///./library.db"
```

database.py:

```
from sqlalchemy import create_engine
from sqlalchemy.ext.declarative import declarative_base
from sqlalchemy.orm import sessionmaker
from const import Const

# Создаем движок для работы с базой данных
engine = create_engine(Const.DATABASE_URL, connect_args={"check_same_thread": False})

# Создаем локальную сессию для работы с БД
SessionLocal = sessionmaker(autocommit=False, autoflush=False, bind=engine)

# Базовый класс для моделей
Base = declarative_base()

# Функция для инициализации базы данных
def init_db():
    Base.metadata.create_all(bind=engine)
```

models.py:

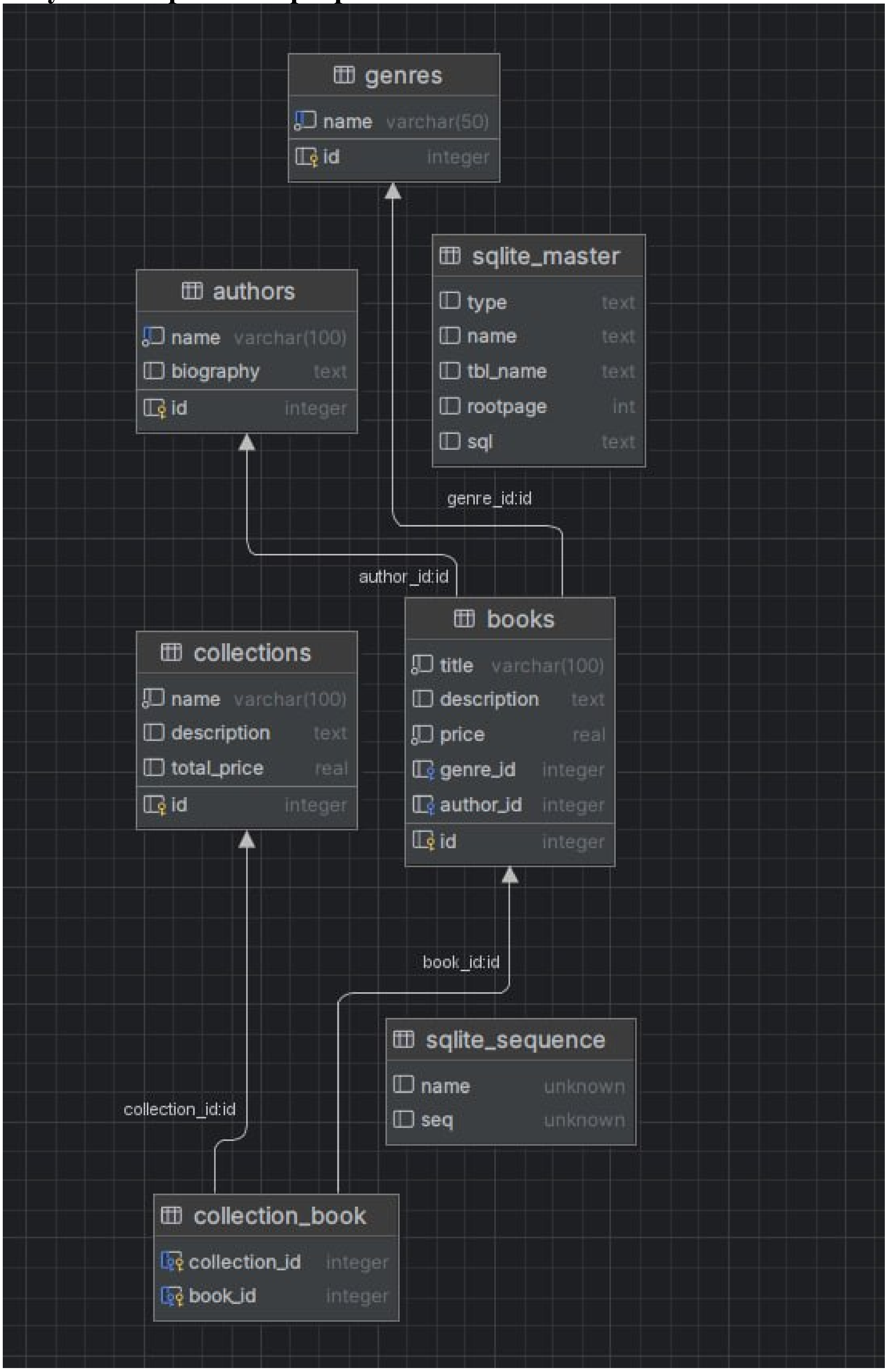
```
from sqlalchemy import Column, Integer, String, Float, ForeignKey, Table
from sqlalchemy.orm import relationship
from database import Base

# Связь многие-ко-многим между Collection и Book
collection_book = Table(
    'collection_book', Base.metadata,
    Column('collection_id', Integer, ForeignKey('collections.id')),
    Column('book_id', Integer, ForeignKey('books.id'))
)

class Genre(Base):
    __tablename__ = "genres"
    id = Column(Integer, primary_key=True, index=True)
    name = Column(String(50), nullable=False, unique=True)
    books = relationship("Book", back_populates="genre")

class Author(Base):
    __tablename__ = "authors"
    id = Column(Integer, primary_key=True, index=True)
    name = Column(String(100), nullable=False, unique=True)
    biography = Column(String(500))
    books = relationship("Book", back_populates="author")

class Book(Base):
    __tablename__ = "books"
    id = Column(Integer, primary_key=True, index=True)
    title = Column(String(100), nullable=False)
    description = Column(String(250))
    price = Column(Float, nullable=False)
    genre_id = Column(Integer, ForeignKey("genres.id"))
    author_id = Column(Integer, ForeignKey("authors.id"))
    genre = relationship("Genre", back_populates="books")
    author = relationship("Author", back_populates="books")
    collections = relationship("Collection", secondary=collection_book, back_populates="books")

class Collection(Base):
    __tablename__ = "collections"
    id = Column(Integer, primary_key=True, index=True)
    name = Column(String(100), nullable=False)
    description = Column(String(250))
    total_price = Column(Float)
    books = relationship("Book", secondary=collection_book, back_populates="collections")
```

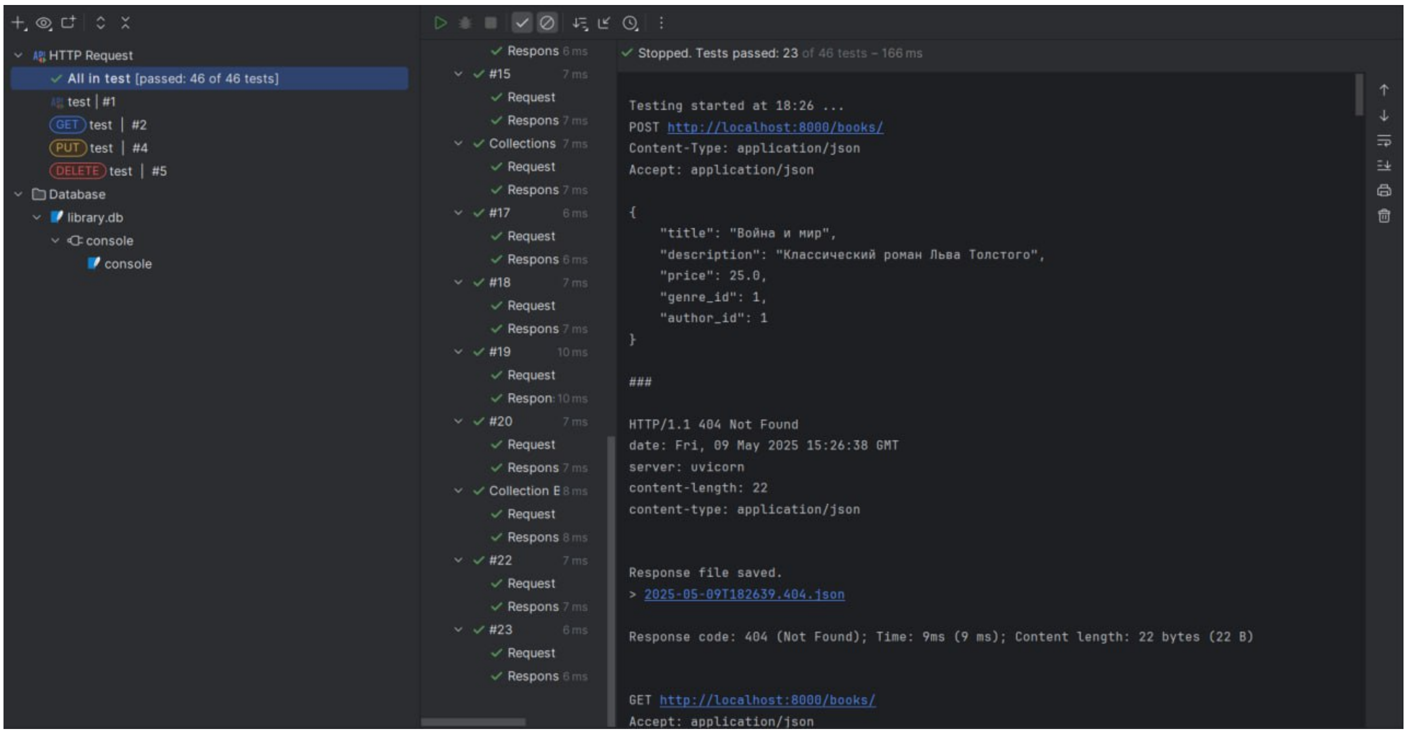
test.http:

```
### Books
# Create a new book
POST http://localhost:8000/books/
Content-Type: application/json
Accept: application/json

{
    "title": "Война и мир",
    "description": "Классический роман Льва Толстого",
    "price": 25.0,
    "genre_id": 1,
    "author_id": 1
}

###
# Get all books
GET http://localhost:8000/books/
Accept: application/json

###
# Get a specific book
GET http://localhost:8000/books/1
Accept: application/json

###
# Update a book
PUT http://localhost:8000/books/1
Content-Type: application/json
Accept: application/json

{
    "title": "Анна Каренина",
    "price": 20.0
}

###
# Delete a book
DELETE http://localhost:8000/books/1
Accept: application/json

### Genres
# Create a new genre
POST http://localhost:8000/genres/
Content-Type: application/json
Accept: application/json

{
    "name": "Роман"
}

###
# Get all genres
GET http://localhost:8000/genres/
Accept: application/json

###
# Get a specific genre
GET http://localhost:8000/genres/1
Accept: application/json

###
# Update a genre
PUT http://localhost:8000/genres/1
Content-Type: application/json
Accept: application/json

{
    "name": "Драма"
}

###
# Delete a genre
DELETE http://localhost:8000/genres/1
Accept: application/json

### Authors
# Create a new author
POST http://localhost:8000/authors/
Content-Type: application/json
Accept: application/json

{
    "name": "Лев Толстой",
    "biography": "Русский писатель, философ и мыслитель"
}

###
# Get all authors
GET http://localhost:8000/authors/
Accept: application/json

###
# Get a specific author
GET http://localhost:8000/authors/1
Accept: application/json

###
# Update an author
PUT http://localhost:8000/authors/1
Content-Type: application/json
Accept: application/json

{
    "name": "Фёдор Достоевский",
    "biography": "Русский писатель и философ"
}
```

```
###
# Delete an author
DELETE http://localhost:8000/authors/1
Accept: application/json

### Collections
# Create a new collection
POST http://localhost:8000/collections/
Content-Type: application/json
Accept: application/json

{
    "name": "Классика русской литературы",
    "description": "Подборка лучших произведений русских авторов",
    "total_price": 100.0
}

###
# Get all collections
GET http://localhost:8000/collections/
Accept: application/json

###
# Get a specific collection
GET http://localhost:8000/collections/1
Accept: application/json

###
# Update a collection
PUT http://localhost:8000/collections/1
Content-Type: application/json
Accept: application/json

{
    "name": "Мировая классика",
    "total_price": 120.0
}

###
# Delete a collection
DELETE http://localhost:8000/collections/1
Accept: application/json

### Collection Books Management
# Add a book to collection
POST http://localhost:8000/collections/1/books/2
Accept: application/json

###
# Remove a book from collection
DELETE http://localhost:8000/collections/1/books/2
Accept: application/json

###
# Get collection with books
GET http://localhost:8000/collections/1
Accept: application/json
```

Результаты работы программы:

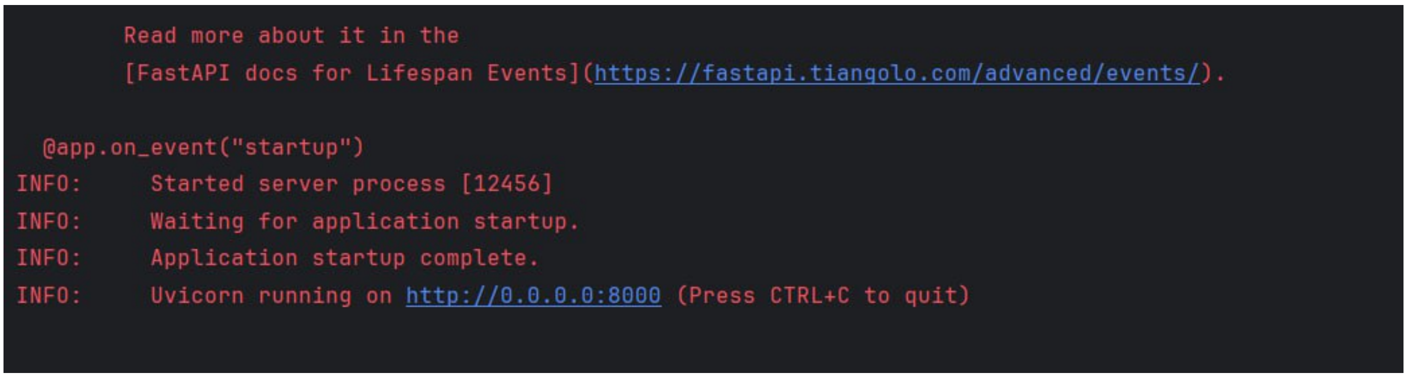




```
HTTP Request
  ✓ All in test [passed: 46 of 46 tests]
    test | #1
    GET test | #2
    PUT test | #4
    DELETE test | #5
Database
  library.db
    console
      console
```

```
  ✓ Respons 6 ms
✓ #15 7 ms
  ✓ Request
  ✓ Respons 7 ms
✓ Collections 7 ms
  ✓ Request
  ✓ Respons 7 ms
✓ #17 6 ms
  ✓ Request
  ✓ Respons 6 ms
✓ #18 7 ms
  ✓ Request
  ✓ Respons 7 ms
✓ #19 10 ms
  ✓ Request
  ✓ Respon: 10 ms
✓ #20 7 ms
  ✓ Request
  ✓ Respons 7 ms
✓ Collection E 8 ms
  ✓ Request
  ✓ Respons 8 ms
✓ #22 7 ms
  ✓ Request
  ✓ Respons 7 ms
✓ #23 6 ms
  ✓ Request
  ✓ Respons 6 ms
```

```
✓ Stopped. Tests passed: 23 of 46 tests – 166 ms

Testing started at 18:26 ...
POST http://localhost:8000/books/
Content-Type: application/json
Accept: application/json

{
    "title": "Война и мир",
    "description": "Классический роман Льва Толстого",
    "price": 25.0,
    "genre_id": 1,
    "author_id": 1
}

###

HTTP/1.1 404 Not Found
date: Fri, 09 May 2025 15:26:38 GMT
server: uvicorn
content-length: 22
content-type: application/json


Response file saved.
> 2025-05-09T182639.404.json

Response code: 404 (Not Found); Time: 9ms (9 ms); Content length: 22 bytes (22 B)


GET http://localhost:8000/books/
Accept: application/json
```



```
        Read more about it in the
        [FastAPI docs for Lifespan Events](https://fastapi.tiangolo.com/advanced/events/).

  @app.on_event("startup")
INFO:     Started server process [12456]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
INFO:     Uvicorn running on http://0.0.0.0:8000 (Press CTRL+C to quit)
```

Использовал SQLite для данной лабораторной работы.

Вывод: приобрёл практические навыки разработки API и базы данных.