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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«26» апрель 2025 г.

Брест 2025

Вариант 5

Цель работы: приобрести практические навыки разработки API и баз данных

Общее задание:

1. Реализовать базу данных из не менее 5 таблиц на заданную тематику. 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 models import Base
from crud import (
    create_component, get_components, get_component,
    update_component, delete_component,
    create_category, get_categories, get_category,
    update_category, delete_category,
    create_manufacturer, get_manufacturers, get_manufacturer,
    update_manufacturer, delete_manufacturer,
    create_build, get_builds, get_build,
    update_build, delete_build,
    add_component_to_build, remove_component_from_build
)
import uvicorn

app = FastAPI()

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

# Dependency для работы с базой данных
def get_db():
    db = SessionLocal()
    try:
```

```
        yield db
    finally:
        db.close()

# Эндпоинты для Component
@app.post("/components/")
def create_component_endpoint(component: dict, db: Session = Depends(get_db)):
    return create_component(db, component)

@app.get("/components/")
def get_components_endpoint(skip: int = 0, limit: int = 100, db: Session =
Depends(get_db)):
    return get_components(db, skip=skip, limit=limit)

@app.get("/components/{component_id}")
def get_component_endpoint(component_id: int, db: Session = Depends(get_db)):
    component = get_component(db, component_id)
    if not component:
        raise HTTPException(status_code=404, detail="Component not found")
    return component

@app.put("/components/{component_id}")
def update_component_endpoint(component_id: int, component: dict, db: Session =
Depends(get_db)):
    updated_component = update_component(db, component_id, component)
    if not updated_component:
        raise HTTPException(status_code=404, detail="Component not found")
    return updated_component

@app.delete("/components/{component_id}")
def delete_component_endpoint(component_id: int, db: Session = Depends(get_db)):
    component = delete_component(db, component_id)
    if not component:
        raise HTTPException(status_code=404, detail="Component not found")
    return {"message": "Component deleted"}

# Эндпоинты для Category
@app.post("/categories/")
def create_category_endpoint(category: dict, db: Session = Depends(get_db)):
    return create_category(db, category)

@app.get("/categories/")
def get_categories_endpoint(skip: int = 0, limit: int = 100, db: Session =
Depends(get_db)):
    return get_categories(db, skip=skip, limit=limit)

@app.get("/categories/{category_id}")
def get_category_endpoint(category_id: int, db: Session = Depends(get_db)):
    category = get_category(db, category_id)
    if not category:
        raise HTTPException(status_code=404, detail="Category not found")
    return category

@app.put("/categories/{category_id}")
def update_category_endpoint(category_id: int, category: dict, db: Session =
Depends(get_db)):
    updated_category = update_category(db, category_id, category)
    if not updated_category:
        raise HTTPException(status_code=404, detail="Category not found")
```

```
    return updated_category

@app.delete("/categories/{category_id}")
def delete_category_endpoint(category_id: int, db: Session = Depends(get_db)):
    category = delete_category(db, category_id)
    if not category:
        raise HTTPException(status_code=404, detail="Category not found")
    return {"message": "Category deleted"}

# Эндпоинты для Manufacturer
@app.post("/manufacturers/")
def create_manufacturer_endpoint(manufacturer: dict, db: Session = Depends(get_db)):
    return create_manufacturer(db, manufacturer)

@app.get("/manufacturers/")
def get_manufacturers_endpoint(skip: int = 0, limit: int = 100, db: Session =
Depends(get_db)):
    return get_manufacturers(db, skip=skip, limit=limit)

@app.get("/manufacturers/{manufacturer_id}")
def get_manufacturer_endpoint(manufacturer_id: int, db: Session = Depends(get_db)):
    manufacturer = get_manufacturer(db, manufacturer_id)
    if not manufacturer:
        raise HTTPException(status_code=404, detail="Manufacturer not found")
    return manufacturer

@app.put("/manufacturers/{manufacturer_id}")
def update_manufacturer_endpoint(manufacturer_id: int, manufacturer: dict, db: Session
= Depends(get_db)):
    updated_manufacturer = update_manufacturer(db, manufacturer_id, manufacturer)
    if not updated_manufacturer:
        raise HTTPException(status_code=404, detail="Manufacturer not found")
    return updated_manufacturer

@app.delete("/manufacturers/{manufacturer_id}")
def delete_manufacturer_endpoint(manufacturer_id: int, db: Session = Depends(get_db)):
    manufacturer = delete_manufacturer(db, manufacturer_id)
    if not manufacturer:
        raise HTTPException(status_code=404, detail="Manufacturer not found")
    return {"message": "Manufacturer deleted"}

# Эндпоинты для Build
@app.post("/builds/")
def create_build_endpoint(build: dict, db: Session = Depends(get_db)):
    return create_build(db, build)

@app.get("/builds/")
def get_builds_endpoint(skip: int = 0, limit: int = 100, db: Session =
Depends(get_db)):
    return get_builds(db, skip=skip, limit=limit)

@app.get("/builds/{build_id}")
def get_build_endpoint(build_id: int, db: Session = Depends(get_db)):
    build = get_build(db, build_id)
    if not build:
        raise HTTPException(status_code=404, detail="Build not found")
    return build

@app.put("/builds/{build_id}")
```

```
def update_build_endpoint(build_id: int, build: dict, db: Session = Depends(get_db)):
    updated_build = update_build(db, build_id, build)
    if not updated_build:
        raise HTTPException(status_code=404, detail="Build not found")
    return updated_build

@app.delete("/builds/{build_id}")
def delete_build_endpoint(build_id: int, db: Session = Depends(get_db)):
    build = delete_build(db, build_id)
    if not build:
        raise HTTPException(status_code=404, detail="Build not found")
    return {"message": "Build deleted"}

# Эндпоинты для управления компонентами в сборке
@app.post("/builds/{build_id}/components/{component_id}")
def add_component_endpoint(build_id: int, component_id: int, db: Session =
Depends(get_db)):
    build = add_component_to_build(db, build_id, component_id)
    if not build:
        raise HTTPException(status_code=404, detail="Build or Component not found")
    return build

@app.delete("/builds/{build_id}/components/{component_id}")
def remove_component_endpoint(build_id: int, component_id: int, db: Session =
Depends(get_db)):
    build = remove_component_from_build(db, build_id, component_id)
    if not build:
        raise HTTPException(status_code=404, detail="Build or Component not found")
    return build

if __name__ == "__main__":
    uvicorn.run(app, host="0.0.0.0", port=8000)
```

crud.py:

```
from sqlalchemy.orm import Session
from models import Component, Category, Manufacturer, Build

# CRUD для Component
def create_component(db: Session, component_data: dict):
    db_component = Component(**component_data)
    db.add(db_component)
    db.commit()
    db.refresh(db_component)
    return db_component

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

def get_component(db: Session, component_id: int):
    return db.query(Component).filter(Component.id == component_id).first()

def update_component(db: Session, component_id: int, component_data: dict):
    db_component = db.query(Component).filter(Component.id == component_id).first()
    if db_component:
        for key, value in component_data.items():
            setattr(db_component, key, value)
```

```
        db.commit()
        db.refresh(db_component)
    return db_component

def delete_component(db: Session, component_id: int):
    db_component = db.query(Component).filter(Component.id == component_id).first()
    if db_component:
        db.delete(db_component)
        db.commit()
    return db_component

# CRUD для Category
def create_category(db: Session, category_data: dict):
    db_category = Category(**category_data)
    db.add(db_category)
    db.commit()
    db.refresh(db_category)
    return db_category

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

def get_category(db: Session, category_id: int):
    return db.query(Category).filter(Category.id == category_id).first()

def update_category(db: Session, category_id: int, category_data: dict):
    db_category = db.query(Category).filter(Category.id == category_id).first()
    if db_category:
        for key, value in category_data.items():
            setattr(db_category, key, value)
        db.commit()
        db.refresh(db_category)
    return db_category

def delete_category(db: Session, category_id: int):
    db_category = db.query(Category).filter(Category.id == category_id).first()
    if db_category:
        db.delete(db_category)
        db.commit()
    return db_category

# CRUD для Manufacturer
def create_manufacturer(db: Session, manufacturer_data: dict):
    db_manufacturer = Manufacturer(**manufacturer_data)
    db.add(db_manufacturer)
    db.commit()
    db.refresh(db_manufacturer)
    return db_manufacturer

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

def get_manufacturer(db: Session, manufacturer_id: int):
    return db.query(Manufacturer).filter(Manufacturer.id == manufacturer_id).first()

def update_manufacturer(db: Session, manufacturer_id: int, manufacturer_data: dict):
    db_manufacturer = db.query(Manufacturer).filter(Manufacturer.id ==
manufacturer_id).first()
    if db_manufacturer:
```

```
        for key, value in manufacturer_data.items():
            setattr(db_manufacturer, key, value)
        db.commit()
        db.refresh(db_manufacturer)
    return db_manufacturer

def delete_manufacturer(db: Session, manufacturer_id: int):
    db_manufacturer = db.query(Manufacturer).filter(Manufacturer.id ==
manufacturer_id).first()
    if db_manufacturer:
        db.delete(db_manufacturer)
        db.commit()
    return db_manufacturer

# CRUD для Build
def create_build(db: Session, build_data: dict):
    db_build = Build(**build_data)
    db.add(db_build)
    db.commit()
    db.refresh(db_build)
    return db_build

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

def get_build(db: Session, build_id: int):
    return db.query(Build).filter(Build.id == build_id).first()

def update_build(db: Session, build_id: int, build_data: dict):
    db_build = db.query(Build).filter(Build.id == build_id).first()
    if db_build:
        for key, value in build_data.items():
            setattr(db_build, key, value)
        db.commit()
        db.refresh(db_build)
    return db_build

def delete_build(db: Session, build_id: int):
    db_build = db.query(Build).filter(Build.id == build_id).first()
    if db_build:
        db.delete(db_build)
        db.commit()
    return db_build

def add_component_to_build(db: Session, build_id: int, component_id: int):
    build = db.query(Build).filter(Build.id == build_id).first()
    component = db.query(Component).filter(Component.id == component_id).first()
    if build and component:
        build.components.append(component)
        db.commit()
        db.refresh(build)
    return build

def remove_component_from_build(db: Session, build_id: int, component_id: int):
    build = db.query(Build).filter(Build.id == build_id).first()
    component = db.query(Component).filter(Component.id == component_id).first()
    if build and component:
        build.components.remove(component)
        db.commit()
```

```
        db.refresh(build)
    return build
```

const.py:

```
from dataclasses import dataclass

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

database.py:

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

engine = create_engine(Const.DATABASE_URL, connect_args={"check_same_thread": False})
SessionLocal = sessionmaker(autocommit=False, autoflush=False, bind=engine)

Base = declarative_base()

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 Build и Component
build_component = Table(
    'build_component', Base.metadata,
    Column('build_id', Integer, ForeignKey('builds.id')),
    Column('component_id', Integer, ForeignKey('components.id'))
)

class Category(Base):
    __tablename__ = "categories"
    id = Column(Integer, primary_key=True, index=True)
    name = Column(String(50), nullable=False, unique=True)
    components = relationship("Component", back_populates="category")

class Manufacturer(Base):
    __tablename__ = "manufacturers"
    id = Column(Integer, primary_key=True, index=True)
    name = Column(String(100), nullable=False, unique=True)
    website = Column(String(200))
    components = relationship("Component", back_populates="manufacturer")

class Component(Base):
    __tablename__ = "components"
    id = Column(Integer, primary_key=True, index=True)
```

```
    name = Column(String(100), nullable=False)
    description = Column(String(250))
    price = Column(Float, nullable=False)
    category_id = Column(Integer, ForeignKey("categories.id"))
    manufacturer_id = Column(Integer, ForeignKey("manufacturers.id"))
    category = relationship("Category", back_populates="components")
    manufacturer = relationship("Manufacturer", back_populates="components")
    builds = relationship("Build", secondary=build_component,
back_populates="components")

class Build(Base):
    __tablename__ = "builds"
    id = Column(Integer, primary_key=True, index=True)
    name = Column(String(100), nullable=False)
    description = Column(String(250))
    total_price = Column(Float)
    components = relationship("Component", secondary=build_component,
back_populates="builds")
```

test.http:

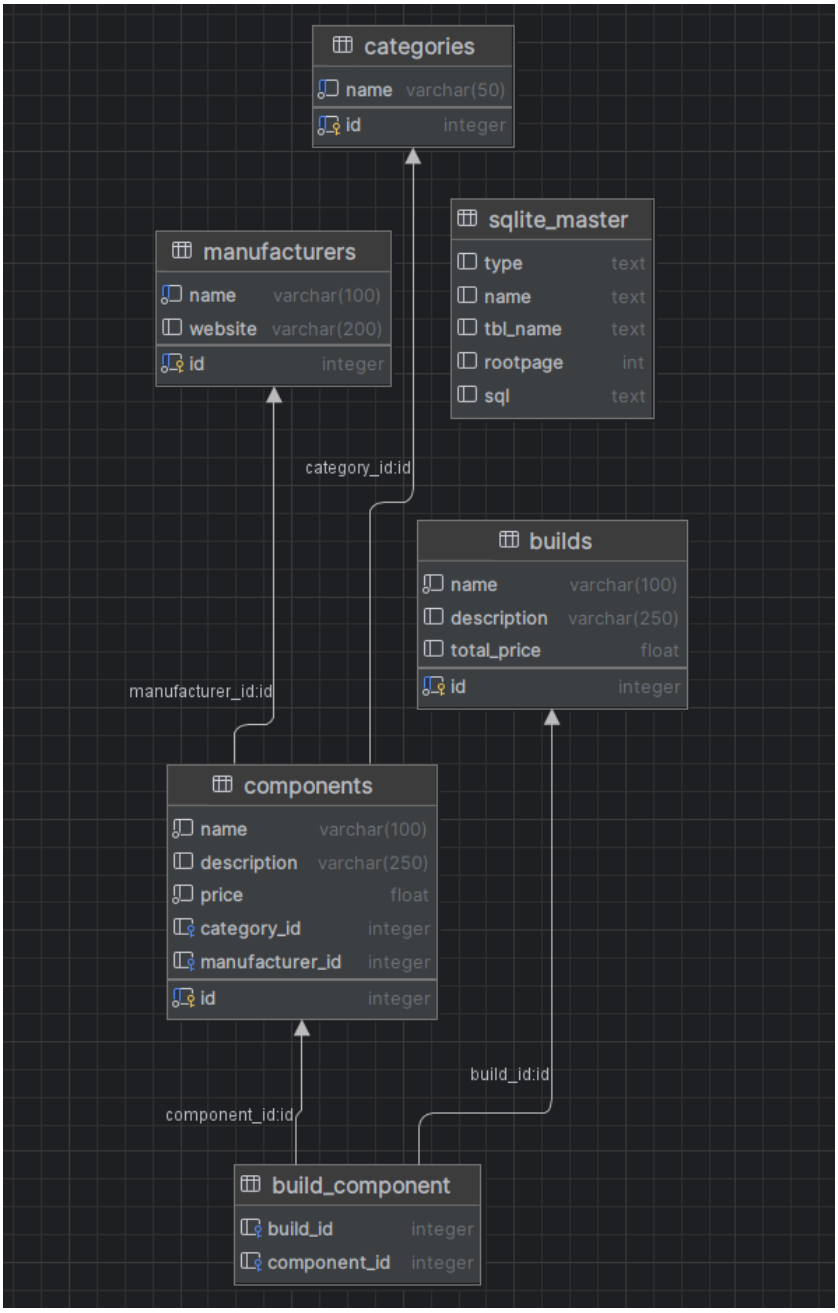
```
# Test your FastAPI endpoints for Computer Build System

# Components
POST http://127.0.0.1:8000/components/
Accept: application/json
Content-Type: application/json

{
    "name": "Intel Core i9-13900K",
    "description": "24-ядерный процессор",
    "price": 600.0,
    "category_id": 1,
    "manufacturer_id": 1
}

###

GET http://127.0.0.1:8000/components/
Accept: application/json

###

GET http://127.0.0.1:8000/components/1
Accept: application/json

###

PUT http://127.0.0.1:8000/components/1
Accept: application/json
Content-Type: application/json

{
    "name": "Intel Core i9-13900KS",
    "price": 650.0
}
```

```
###

DELETE http://127.0.0.1:8000/components/1
Accept: application/json

###

# Categories
POST http://127.0.0.1:8000/categories/
Accept: application/json
Content-Type: application/json

{
    "name": "Блоки питания"
}

###

GET http://127.0.0.1:8000/categories/
Accept: application/json

###

GET http://127.0.0.1:8000/categories/1
Accept: application/json

###

PUT http://127.0.0.1:8000/categories/1
Accept: application/json
Content-Type: application/json

{
    "name": "Процессоры (CPU)"
}

###

DELETE http://127.0.0.1:8000/categories/1
Accept: application/json

###

# Manufacturers
POST http://127.0.0.1:8000/manufacturers/
Accept: application/json
Content-Type: application/json

{
    "name": "ASUS",
    "website": "https://www.asus.com"
}

###

GET http://127.0.0.1:8000/manufacturers/
Accept: application/json

###
```

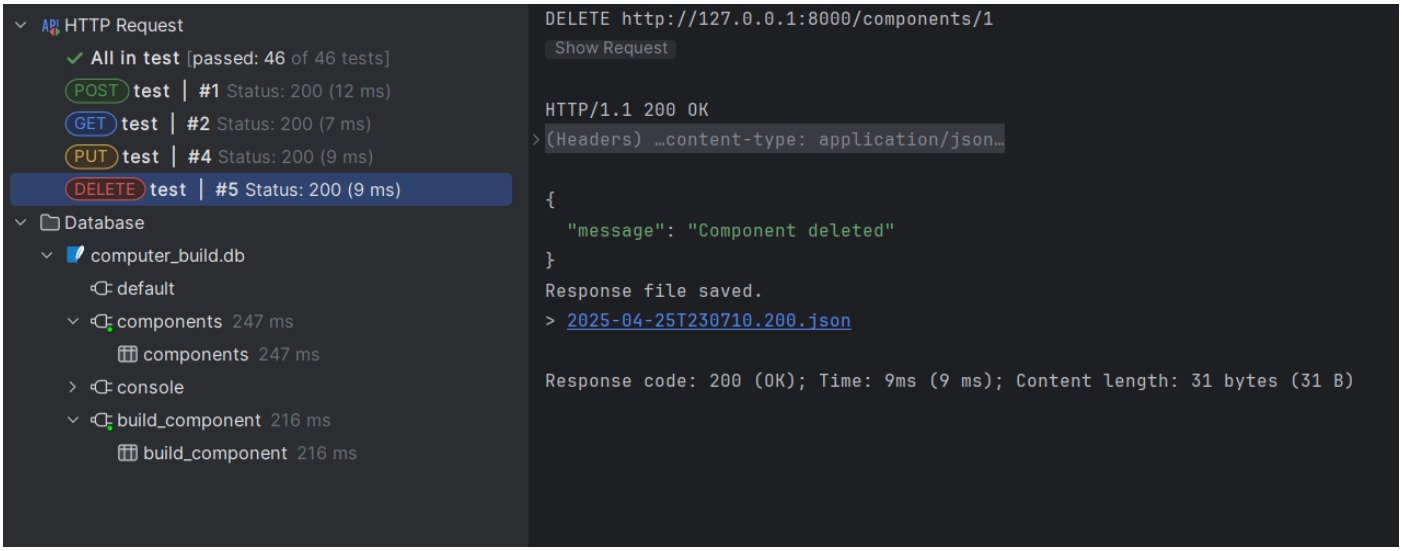
```
GET http://127.0.0.1:8000/manufacturers/1
Accept: application/json

###

PUT http://127.0.0.1:8000/manufacturers/1
Accept: application/json
Content-Type: application/json

{
    "name": "ASUS ROG",
    "website": "https://rog.asus.com"
}

###

DELETE http://127.0.0.1:8000/manufacturers/1
Accept: application/json

###

# Builds
POST http://127.0.0.1:8000/builds/
Accept: application/json
Content-Type: application/json

{
    "name": "Стримерский ПК",
    "description": "Мощный ПК для стриминга",
    "total_price": 2500.0
}

###

GET http://127.0.0.1:8000/builds/
Accept: application/json

###

GET http://127.0.0.1:8000/builds/1
Accept: application/json

###

PUT http://127.0.0.1:8000/builds/1
Accept: application/json
Content-Type: application/json

{
    "name": "Профессиональный стримерский ПК",
    "total_price": 2700.0
}

###

DELETE http://127.0.0.1:8000/builds/1
Accept: application/json
```

```
###

# Build Components Management
POST http://127.0.0.1:8000/builds/1/components/2
Accept: application/json
Content-Type: application/json

###

DELETE http://127.0.0.1:8000/builds/1/components/2
Accept: application/json

###

# Get Build with Components
GET http://127.0.0.1:8000/builds/1
Accept: application/json
```

Результаты работы программы:



```
  @app.on_event("startup")
INFO:     Started server process [22092]
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.