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«СИБИРСКИЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ»

Институт космических и информационных технологий  
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**ОТЧЕТ О ПРАКТИЧЕСКОЙ РАБОТЕ №3**

Работа с базами данных в Spring Framework  
Тема

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## **1 Цель работы**

Цель состоит в ознакомлении с механизмами работы с базами данных в Spring Framework.

## **2 Задачи**

Выполнение работы сводится к следующим задачам:

- а) описать класс сущности в соответствии с вариантом, который имеет как минимум три текстовых поля, два числовых и ID;
- б) создать таблицу базы данных в реляционной БД;
- с) реализовать консольное Spring приложение, которое должно позволять:
  - 1) вводить пользователю поля сущности и; добавлять её в таблицу БД;
  - 2) выводить в консоль все записи из таблицы БД;
  - 3) редактировать запись таблицы БД по ID;
  - 4) удалять запись по ID;
  - 5) осуществлять поиск по какому-то из признаков

Вариант 10. Одежда.

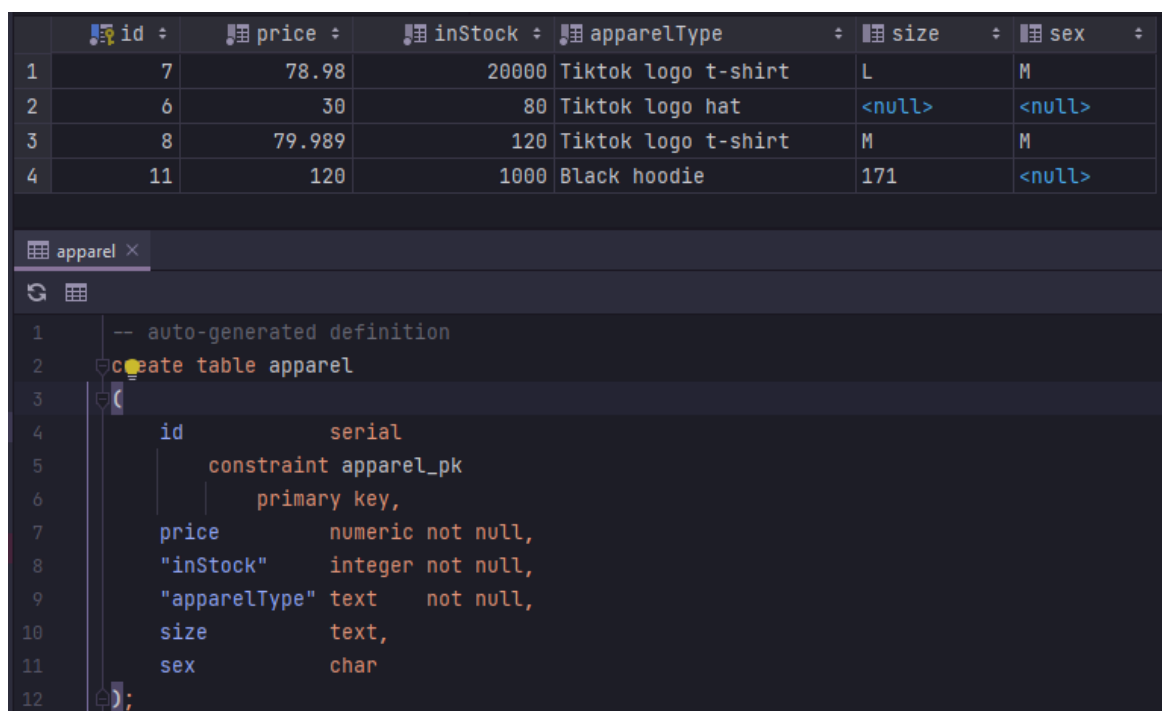
### 3 Ход работы

#### 3.1 Создание базы данных

В качестве СУБД была выбрана PostgreSQL.

В качестве характеристик предметов одежды были взяты тип, размер, цена, целевая половая принадлежность и количество одежды на складе.

На рисунке 1 приведен скриншот созданной таблицы и SQL-кода для ее создания.



The screenshot displays a database table named 'apparel' with the following data:

	id	price	inStock	apparelType	size	sex
1	7	78.98	20000	Tiktok logo t-shirt	L	M
2	6	30	80	Tiktok logo hat	<null>	<null>
3	8	79.989	120	Tiktok logo t-shirt	M	M
4	11	120	1000	Black hoodie	171	<null>

Below the table, the SQL code for creating the 'apparel' table is shown:

```
1 -- auto-generated definition
2 create table apparel
3
4     id          serial
5         constraint apparel_pk
6             primary key,
7     price       numeric not null,
8     "inStock"   integer not null,
9     "apparelType" text    not null,
10    size         text,
11    sex          char
12 ;
```

Рисунок 1 – Таблица и ее объявление

#### 3.2 Разработка приложения

Было создано Spring-приложение в соответствии с задачами. На рисунке 2 приведена файловая структура проекта.

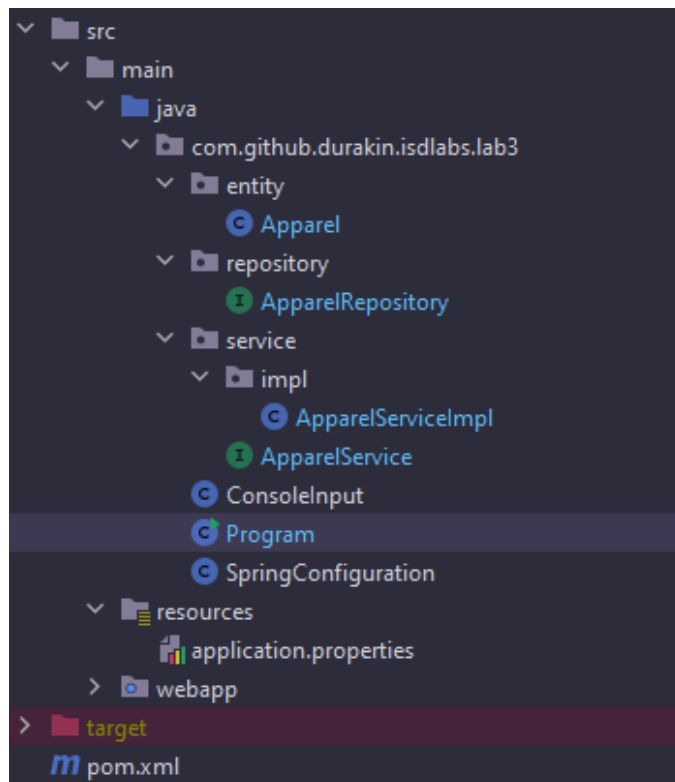


Рисунок 2 – Файловая структура проекта

На листингах далее приведен исходный код программы.

### Листинг 1 – код класса Apparel

```
package com.github.durakin.isdlabs.lab3.entity;

import javax.persistence.*;

@Entity
public class Apparel {
    @Id
    @GeneratedValue(strategy =
        GenerationType.IDENTITY)
    private Integer id;

    @Column(nullable = false)
    private Double price;

    @Column(name = "\"inStock\"", nullable = false)
    private Integer inStock;

    @Column(name = "\"apparelType\"", nullable = false)
    private String apparelType;

    @Column
    private String size;

    @Column
    private String sex;
}
```

## Продолжение листинга 1

```
public Apparel() {  
}  
  
public Apparel(Integer id, Double price, Integer inStock, String  
apparelType, String size, String sex) {  
    this.id = id;  
    this.price = price;  
    this.inStock = inStock;  
    this.apparelType = apparelType;  
    this.size = size;  
    this.sex = sex;  
}  
  
public Integer getId() {  
    return id;  
}  
  
public void setId(Integer id) {  
    this.id = id;  
}  
  
public Double getPrice() {  
    return price;  
}  
  
public void setPrice(Double price) {  
    this.price = price;  
}  
  
public Integer getInStock() {  
    return inStock;  
}  
  
public void setInStock(Integer inStock) {  
    this.inStock = inStock;  
}  
  
public String getApparelType() {  
    return apparelType;  
}  
  
public void setApparelType(String apparelType) {  
    this.apparelType = apparelType;  
}  
  
public String getSize() {  
    return size;  
}  
  
public void setSize(String size) {  
    this.size = size;  
}  
  
public String getSex() {  
    return sex;  
}  
  
public void setSex(String sex) {
```

## Окончание листинга 1

```
        this.sex = sex;
    }

    @Override
    public String toString() {
        return "id " + id +
            "\nType " + apparelType +
            "\nSex " + sex +
            "\nSize " + size +
            "\nPrice " + String.format("%.2f", price) +
            "\nLeft in stock " + inStock +
            '\n';
    }
}
```

## Листинг 2 – Код интерфейса ApparelRepository

```
package com.github.durakin.isdlabs.lab3.repository;

import com.github.durakin.isdlabs.lab3.entity.Apparel;
import org.springframework.data.jpa.repository.JpaRepository;
import org.springframework.stereotype.Repository;

import java.util.List;

@Repository
public interface ApparelRepository extends JpaRepository<Apparel, Integer> {
    List<Apparel> findDistinctByPriceLessThan(Double price);
}
```

## Листинг 3 – Код интерфейса ApparelService

```
package com.github.durakin.isdlabs.lab3.service;

import com.github.durakin.isdlabs.lab3.entity.Apparel;

import java.util.List;

public interface ApparelService {
    Integer add(Apparel apparel);
    boolean delete(Integer id);
    Apparel findById(Integer id);
    boolean update(Integer id, Integer newInStock, Double newPrice);
    List<Apparel> findByMaxPrice(Double maxPrice);
    List<Apparel> findAll();
}
```

## Листинг 4 – Код класса ApparelServiceImpl

```
package com.github.durakin.isdlabs.lab3.service.impl;

import com.github.durakin.isdlabs.lab3.entity.Apparel;
import com.github.durakin.isdlabs.lab3.repository.ApparelRepository;
import com.github.durakin.isdlabs.lab3.service.ApparelService;
import org.springframework.beans.factory.annotation.Autowired;
```

## Окончание листинга 4

```
import org.springframework.data.domain.Sort;
import org.springframework.stereotype.Service;

import java.util.List;

@Service
public class ApparelServiceImpl implements ApparelService {
    @Autowired
    private ApparelRepository apparelRepository;

    @Override
    public Integer add(Apparel apparel) {
        this.apparelRepository.save(apparel);
        return apparel.getId();
    }

    @Override
    public boolean delete(Integer id) {
        if (!checkId(id)) {
            return false;
        }
        this.apparelRepository.deleteById(id);
        return true;
    }

    @Override
    public boolean update(Integer id, Integer newInStock, Double newPrice) {
        var oldApparel = this.findById(id);
        if (oldApparel == null) return false;
        if (newPrice != null) {
            oldApparel.setPrice(newPrice);
        }
        if (newInStock != null) {
            oldApparel.setInStock(newInStock);
        }
        this.apparelRepository.save(oldApparel);
        return true;
    }

    @Override
    public List<Apparel> findByMaxPrice(Double maxPrice) {
        return this.apparelRepository.findDistinctByPriceLessThan(maxPrice);
    }

    @Override
    public List<Apparel> findAll() {
        return this.apparelRepository.findAll(Sort.by("id"));
    }

    @Override
    public Apparel findById(Integer id) {
        return this.apparelRepository.findById(id).orElse(null);
    }

    private boolean checkId(Integer id) {
        return id != null && this.apparelRepository.existsById(id);
    }
}
```

## Листинг 5 – Код конфигурации Spring

```
package com.github.durakin.isdlabs.lab3;

import lombok.RequiredArgsConstructor;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.context.annotation.Bean;
import org.springframework.context.annotation.ComponentScan;
import org.springframework.context.annotation.Configuration;
import org.springframework.context.annotation.PropertySource;
import org.springframework.core.env.Environment;
import org.springframework.data.jpa.repository.config.EnableJpaRepositories;
import org.springframework.jdbc.datasource.DriverManagerDataSource;
import org.springframework.orm.jpa.JpaTransactionManager;
import org.springframework.orm.jpa.LocalContainerEntityManagerFactoryBean;
import org.springframework.orm.jpa.vendor.HibernateJpaVendorAdapter;
import org.springframework.transaction.PlatformTransactionManager;

import javax.persistence.EntityManagerFactory;
import javax.sql.DataSource;
import java.util.Objects;
import java.util.Properties;

@Configuration
@ComponentScan("com.github.durakin.isdlabs.lab3")
@PropertySource("classpath:application.properties")
@EnableJpaRepositories
@RequiredArgsConstructor
public class SpringConfiguration {
    private final Environment env;

    @Bean
    public DataSource dataSource() {
        DriverManagerDataSource dataSource = new DriverManagerDataSource();

        dataSource.setDriverClassName(Objects.requireNonNull(env.getProperty("spring.datasource.driverClassName")));
        dataSource.setUrl(env.getProperty("spring.datasource.url"));
        dataSource.setUsername(env.getProperty("spring.datasource.username"));
        dataSource.setPassword(env.getProperty("spring.datasource.password"));
        return dataSource;
    }

    @Bean
    public Properties jpaProperties() {
        return new Properties();
    }

    @Bean
    @Autowired
    public EntityManagerFactory entityManagerFactory(DataSource dataSource,
        Properties jpaProperties) {
        HibernateJpaVendorAdapter vendorAdapter = new
        HibernateJpaVendorAdapter();
        LocalContainerEntityManagerFactoryBean factory = new
        LocalContainerEntityManagerFactoryBean();
        factory.setJpaVendorAdapter(vendorAdapter);
        factory.setPackagesToScan("com.github.durakin.isdlabs.lab3");
        factory.setDataSource(dataSource);
        factory.setJpaProperties(jpaProperties);
    }
}
```



## Окончание листинга 5

```
        factory.afterPropertiesSet();
        return factory.getObject();
    }

    @Bean
    @Autowired
    public PlatformTransactionManager transactionManager(EntityManagerFactory
entityManagerFactory) {
        JpaTransactionManager txManager = new JpaTransactionManager();
        txManager.setEntityManagerFactory(entityManagerFactory);
        return txManager;
    }
}
```

## Листинг 6 – Код класса ConsoleInput

```
package com.github.durakin.isdlabs.lab3;

import java.io.BufferedReader;
import java.util.function.Function;

public class ConsoleInput {

    public static Integer CheckedIntInput(String message, BufferedReader reader,
Function<Integer, Boolean> checker) {
        while (true) {
            try {
                System.out.print(message);
                var number = Integer.parseInt(reader.readLine());
                if (!checker.apply(number)) {
                    throw new Exception("Out of required range");
                }
                return number;
            } catch (Exception e) {
                System.err.println(e.getMessage());
            }
        }
    }

    public static Integer CheckedIntInput(String message, BufferedReader reader)
{
        return CheckedIntInput(message, reader, (integer) -> true);
    }

    public static Double CheckedDoubleInput(String message, BufferedReader
reader, Function<Double, Boolean> checker) {
```

## Окончание листинга 6

```
        while (true) {
            try {
                System.out.print(message);
                var number = Double.parseDouble(reader.readLine());
                if (!checker.apply(number)) {
                    throw new Exception("Out of required range");
                }
                return number;
            } catch (Exception e) {
                System.err.println(e.getMessage());
            }
        }
    }

    public static Double CheckedDoubleInput(String message, BufferedReader
reader) {
        return CheckedDoubleInput(message, reader, (aDouble -> true));
    }

    public static String CheckedStringInput(String message, BufferedReader
reader, Function<String, Boolean> checker) {
        while (true) {
            try {
                System.out.print(message);
                var string = reader.readLine();
                if (!checker.apply(string)) {
                    throw new Exception("String is empty");
                }
                return string;
            } catch (Exception e) {
                System.err.println(e.getMessage());
            }
        }
    }

    public static String CheckedStringInput(String message, BufferedReader
reader) {
        return CheckedStringInput(message, reader, (string) -> string != null &&
!string.isBlank());
    }
}
```

## Листинг 7 – Код класса Program

```
package com.github.durakin.isdlabs.lab3;

import com.github.durakin.isdlabs.lab3.entity.Apparel;
import com.github.durakin.isdlabs.lab3.service.ApparelService;
import org.springframework.context.annotation.AnnotationConfigApplicationContext;

import java.io.BufferedReader;
import java.io.InputStreamReader;

public class Program {

    public static void main(String[] args) {
        AnnotationConfigApplicationContext context = new
        AnnotationConfigApplicationContext(SpringConfiguration.class);

        var reader = new BufferedReader(new InputStreamReader(System.in));
        var service = context.getBean("apparelServiceImpl",
        ApparelService.class);

        boolean lastMenuIteration = false;
        while (!lastMenuIteration) {
            System.out.println("" +
                "1. Print info about all apparels" + '\n' +
                "2. Print info about single apparel by ID" + '\n' +
                "3. Print apparels with price lower than requested" + '\n' +
                "4. Delete element by index" + '\n' +
                "5. Edit element" + '\n' +
                "6. Add element" + '\n' +
                "7. Quit" + '\n'
            );

            var cmdNumber = ConsoleInput.CheckedIntInput("Enter required command
number (1-7) ", reader,
                (input) -> 1 <= input && input <= 7);

            switch (cmdNumber) {
                case 1 -> {
                    var data = service.findAll();
                    for (var i : data) {
                        System.out.println(i);
                    }
                }
            }
        }
    }
}
```

## Продолжение листинга 7

```
        case 2 -> {
            var data =
service.findById(ConsoleInput.CheckedIntInput("Enter required apparel ID ",
reader));

            System.out.println(data != null ? data : "Element not found
");
        }
        case 3 -> {
            var data =
service.findByMaxPrice(ConsoleInput.CheckedDoubleInput("Enter required price ",
reader));

            System.out.println("Found " + data.size() + " elements");
            for (var i : data) {
                System.out.println(i);
            }
        }
        case 4 -> {
            var result =
service.delete(ConsoleInput.CheckedIntInput("Enter id of the element to delete
", reader));

            System.out.println(result ? "Successfully deleted " :
"Element not found ");
        }
        case 5 -> {
            var id = ConsoleInput.CheckedIntInput("Enter id of the
element to edit ", reader);
            var element = service.findById(id);
            if (element == null) {
                System.out.println("Element not found");
                break;
            }
            Double newPrice = null;
            Integer newInStock = null;
            var lastSubMenuIteration = false;
            while (!lastSubMenuIteration) {
                System.out.println("Element\n" + element);
                System.out.println((newPrice == null ? "" : "New price
will be " + newPrice + '\n') + (newInStock == null ? "" : "New number in stock
will be " + newInStock + '\n'));
                System.out.println("1. Edit price\n" +
                    "2. Edit number in stock\n" +
                    "3. Finish editing\n" +
                    "4. Cancel editing\n"
                );
                var subCmdNumber = ConsoleInput.CheckedIntInput("Enter
required command number (1-4) ", reader,
                    (input) -> 1 <= input && input <= 4);
```

## Продолжение листинга 7

```
        switch (subCmdNumber) {
            case 1 -> newPrice =
ConsoleInput.CheckedDoubleInput("Enter new apparel's price", reader);
            case 2 -> newInStock =
ConsoleInput.CheckedIntInput("Enter new number of apparels in stock", reader);
            case 3 -> lastSubMenuIteration = true;
            case 4 -> {
                newInStock = null;
                newPrice = null;
            }
        }
    }

    System.out.println(service.update(id, newInStock, newPrice)
? "Updated" : "Something went wrong");

}

case 6 -> {
    var apparel = new Apparel();

apparel.setApparelType(ConsoleInput.CheckedStringInput("Enter apparel's type ",
reader));

    var sex = ConsoleInput.CheckedStringInput("Enter apparel's
sex (M, F or Uni) ", reader, Program::ApparelsSexChecker);
    apparel.setSex(sex.length() == 1 ? sex : null);

    var size = ConsoleInput.CheckedStringInput("Enter apparel's
size (- for non-sized items) ", reader);
    apparel.setSize(!size.equals("-") ? size : null);

    var inStock = ConsoleInput.CheckedIntInput("Enter number of
items in stock ", reader, (integer -> integer > 0));
    apparel.setInStock(inStock);

    var price = ConsoleInput.CheckedDoubleInput("Enter price of
the item ", reader, (aDouble -> aDouble >= 0));
    apparel.setPrice(price);
    var id = service.add(apparel);
    System.out.println("Apparel added " + service.findById(id));
}

case 7 -> lastMenuIteration = true;

}

}

System.out.println();
context.close();
System.exit(0);
```

## Окончание листинга 7

```
    }  
  
    private static boolean ApparelsSexChecker(String string) {  
        return string.equals("M") || string.equals("F") || string.equals("Uni");  
    }  
  
}
```

### 3.3 Демонстрация работы приложения

Далее на рисунках приведены примеры работы программы.

```
1. Print info about all apparels
2. Print info about single apparel by ID
3. Print apparels with price lower than requested
4. Delete element by index
5. Edit element
6. Add element
7. Quit

Enter required command number (1-7) 1

id 6
Type Tiktok logo hat
Sex null
Size null
Price 30.00
Left in stock 80

id 7
Type Tiktok logo t-shirt
Sex M
Size L
Price 78.98
Left in stock 20000

id 8
Type Tiktok logo t-shirt
Sex M
Size M
Price 79.99
Left in stock 120

id 11
Type Black hoodie
Sex null
Size 171
Price 120.00
Left in stock 1000
```

Рисунок 3 – Вывод всех записей в таблице

```
1. Print info about all apparels
2. Print info about single apparel by ID
3. Print apparels with price lower than requested
4. Delete element by index
5. Edit element
6. Add element
7. Quit

Enter required command number (1-7) 2
Enter required apparel ID 12
Element not found
1. Print info about all apparels
2. Print info about single apparel by ID
3. Print apparels with price lower than requested
4. Delete element by index
5. Edit element
6. Add element
7. Quit

Enter required command number (1-7) 2
Enter required apparel ID 8
id 8
Type Tiktok logo t-shirt
Sex M
Size M
Price 79.99
Left in stock 120
```

Рисунок 4 – Вывод записи по ID



```
1. Print info about all apparels
2. Print info about single apparel by ID
3. Print apparels with price lower than requested
4. Delete element by index
5. Edit element
6. Add element
7. Quit

Enter required command number (1-7) 3
Enter required price 80
Found 3 elements
id 8
Type Tiktok logo t-shirt
Sex M
Size M
Price 79.99
Left in stock 120

id 6
Type Tiktok logo hat
Sex null
Size null
Price 30.00
Left in stock 80

id 7
Type Tiktok logo t-shirt
Sex M
Size L
Price 78.98
Left in stock 20000
```

Рисунок 5 – Вывод записей по условию (дешевле заданной цены)

```
Enter id of the element to edit 7
Element
id 7
Type Tiktok logo t-shirt
Sex M
Size L
Price 78.98
Left in stock 20000

1. Edit price
2. Edit number in stock
3. Finish editing
4. Cancel editing

Enter required command number (1-4) 2
Enter new number of apparels in stock8000
Element
id 7
Type Tiktok logo t-shirt
Sex M
Size L
Price 78.98
Left in stock 20000

New number in stock will be 8000

1. Edit price
2. Edit number in stock
3. Finish editing
4. Cancel editing

Enter required command number (1-4) 3
Updated
```

Рисунок 6 – Редактирование записи по ID

```
1. Print info about all apparels
2. Print info about single apparel by ID
3. Print apparels with price lower than requested
4. Delete element by index
5. Edit element
6. Add element
7. Quit

Enter required command number (1-7) 2
Enter required apparel ID 7
id 7
Type Tiktok logo t-shirt
Sex M
Size L
Price 78.98
Left in stock 8000

1. Print info about all apparels
2. Print info about single apparel by ID
3. Print apparels with price lower than requested
4. Delete element by index
5. Edit element
6. Add element
7. Quit

Enter required command number (1-7) 4
Enter id of the element to delete 7
Successfully deleted
```

Рисунок 7 – Удаление записи по ID

```
1. Print info about all apparels
2. Print info about single apparel by ID
3. Print apparels with price lower than requested
4. Delete element by index
5. Edit element
6. Add element
7. Quit

Enter required command number (1-7) 6
Enter apparel's type Gosha Rubchinsky Kalsony
Enter apparel's sex (M, F or Uni) Uni
Enter apparel's size (- for non-sized items) 40-44
Enter number of items in stock 20
Enter price of the item 40000
Apparel added id 13
Type Gosha Rubchinsky Kalsony
Sex null
Size 40-44
Price 40000.00
Left in stock 20
```

Рисунок 8 – Добавление записи в таблицу