

# Hibernate Architecture, Configuration

# Objectives

- ◆ **Understand ORM:** Grasp the core concepts and benefits of object-relational mapping.
- ◆ **Map Entities:** Efficiently map Java classes to database tables and manage relationships.
- ◆ **Control Transactions:** Ensure data integrity with transactions and concurrency handling.
- ◆ **Integrate with Spring:** Leverage Spring Framework for dependency injection and simplified data access.
- ◆ **Gain Practical Experience:** Build projects and experiment with advanced features.

# Contents

- ❖ Introduction
- ❖ Key Concepts
- ❖ Annotations
- ❖ Relationships
- ❖ Using Hibernate
- ❖ Demo
- ❖ Advantages and Disadvantages

# What is Hibernate ?

- ◆ Hibernate is a powerful object-relational mapping (ORM) framework for the Java programming language.
- ◆ It acts as a bridge between the object-oriented world of Java and the relational world of databases, making it easier for developers to work with persistent data.
- ◆ Hibernate simplifies Java persistence, allowing developers to focus on the business logic of their applications rather than the intricacies of database interactions.

# Key Features of Hibernate

- ◆ **ORM:** Maps Java objects to relational database tables, simplifying data access.
- ◆ **JPA Implementation:** Adheres to the JPA standard, ensuring portability and flexibility.
- ◆ **HQL (Hibernate Query Language):** Powerful object-oriented query language for retrieving and manipulating data.
- ◆ **Lazy Loading:** Loads associated data on demand, minimizing data transfer and enhancing responsiveness.
- ◆ **Transaction Management:** Ensures data consistency and integrity through transaction support. (Begin Tran, commit, rollback)
- ◆ **Inheritance Mapping:** Handles various inheritance scenarios, mapping Java class hierarchies to database tables.

# Benefits of Using Hibernate

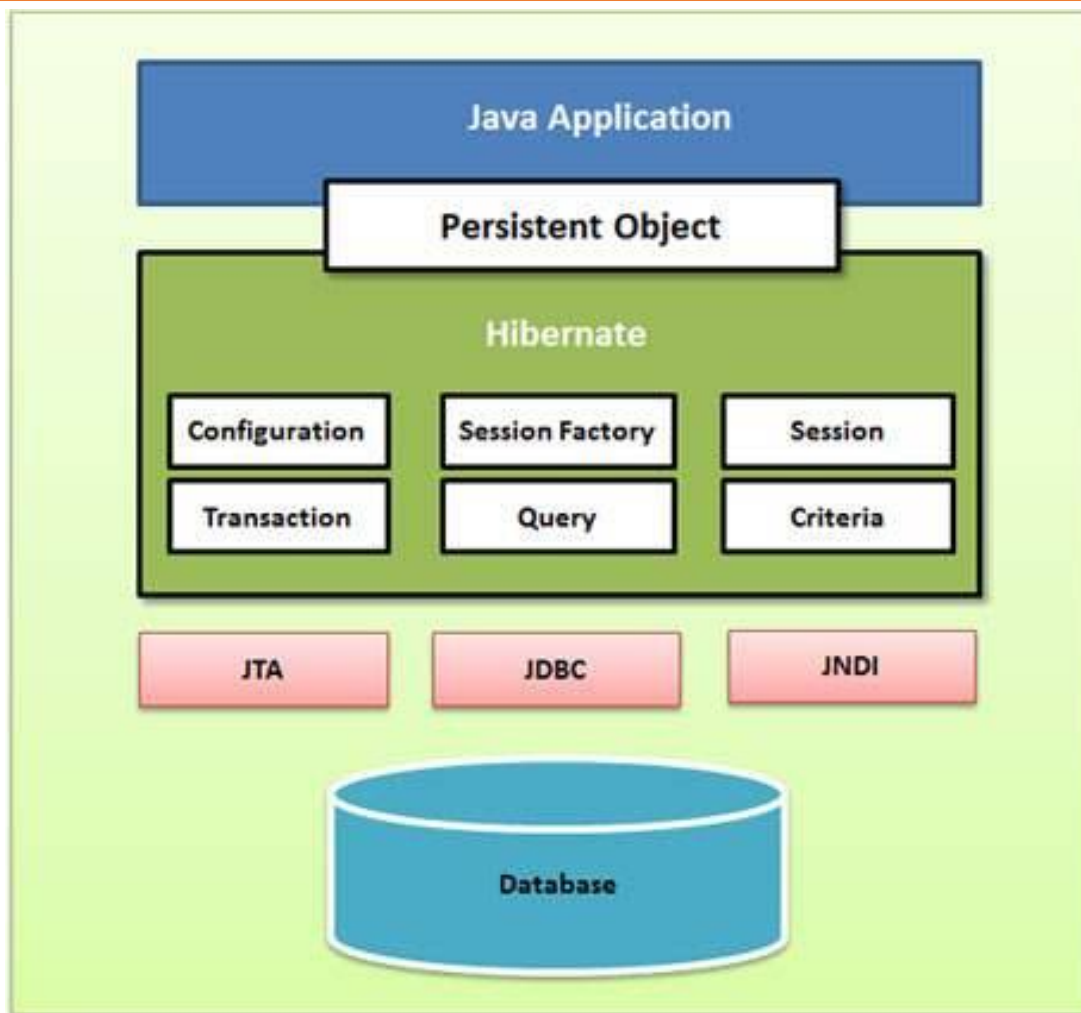
- ◆ **Faster Development:** Spend less time on database code, more time on logic features
- ◆ **Cleaner Code:** Write concise, object-oriented code instead of complex SQL.
- ◆ **Improved Maintainability:** Easier to understand, update, and refactor your codebase.
- ◆ **Database Flexibility:** Switch between different databases without major code changes.

# Benefits of Using Hibernate

- ◆ **Performance Boost:** Caching and lazy loading optimize data access for faster applications.
- ◆ **Data Integrity:** Built-in mechanisms ensure data consistency and prevent errors.
- ◆ **Industry Standard:** Widely used in the Java ecosystem, making you job-ready.
- ◆ **Spring Integration:** Works seamlessly with Spring, the leading Java framework.

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# Hibernate Architecture





# Hibernate Architecture

- ❖ **Session Factory:** Manages configuration and creates Sessions
- ❖ **Session:** Provides data access methods and interacts with persistent object
- ❖ **Persistent Objects:** Java objects representing data stored in the database.
- ❖ **Transaction Management:** Ensures data consistency and integrity.
- ❖ **Connection Provider:** Handles database connections and pooling.
- ❖ **Query API:** Supports HQL, Criteria API, and native SQL for flexible querying
- ❖ **Caching:** Optimizes performance with first-level and second-level caches.
- ❖ **Event System:** Allows customization of persistence lifecycle events.
- ❖ **Dialects:** Generates database-specific SQL for portability.

# Hibernate Architecture

## ❖ SessionFactory

- The SessionFactory is a factory of session and client of ConnectionProvider. It holds second level cache (optional) of data.
- The **org.hibernate.SessionFactory** interface provides factory method to get the object of Session.

## ❖ Session

- The session object provides an interface between the application and data stored in the database. It is a short-lived object and wraps the JDBC connection. It is factory of Transaction, Query and Criteria. It holds a first-level cache (mandatory) of data.
- The **org.hibernate.Session** interface provides methods to insert, update and delete the object. It also provides factory methods for Transaction, Query and Criteria.

# Hibernate Architecture

## ❖ Transaction

- The transaction object specifies the atomic unit of work. It is optional. The `org.hibernate.Transaction` interface provides methods for transaction management.

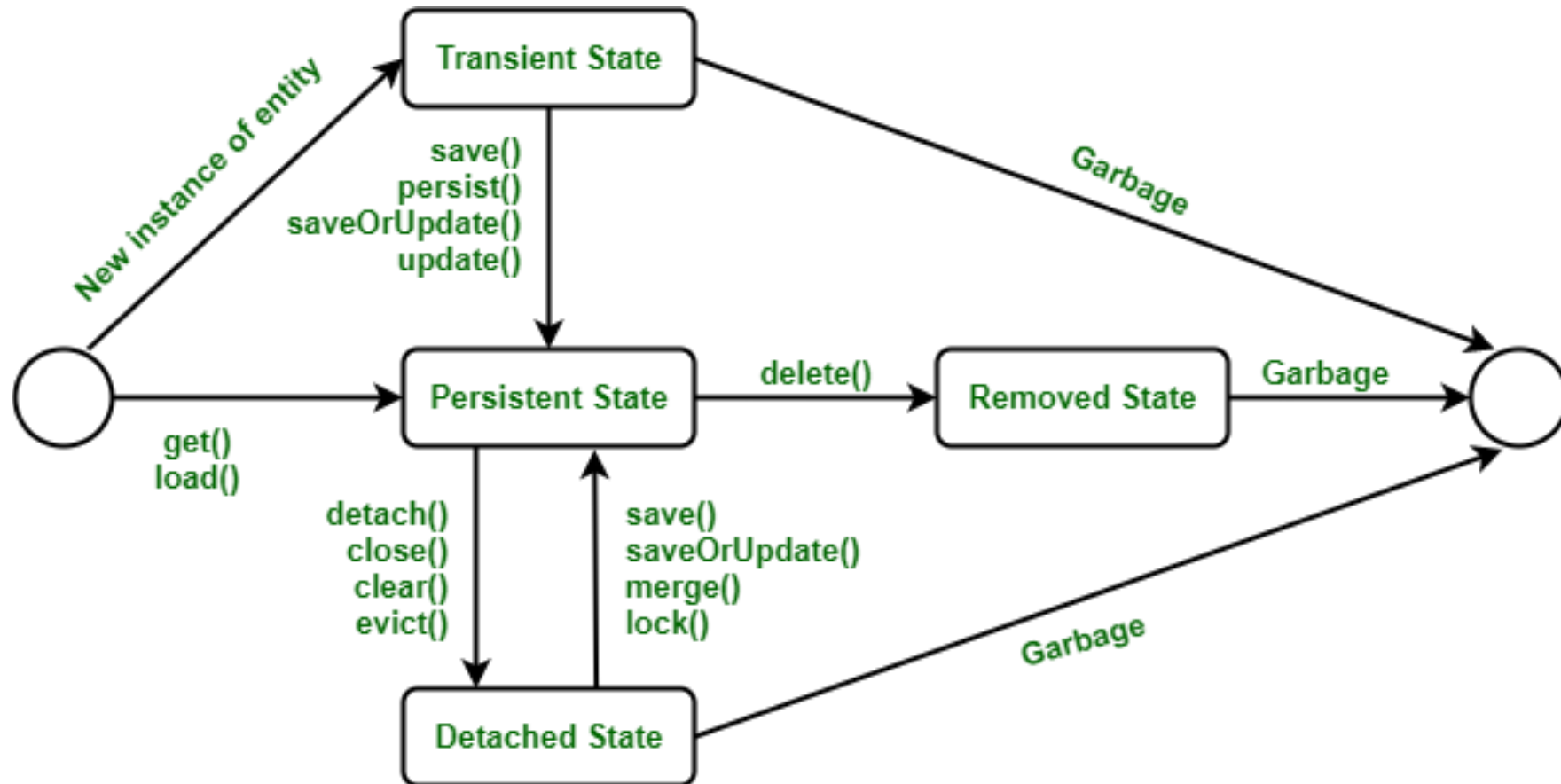
## ❖ ConnectionProvider

- It is a factory of JDBC connections. It abstracts the application from `DriverManager` or `DataSource`. It is optional.

## ❖ TransactionFactory

- It is a factory of `Transaction`. It is optional.

# Hibernate Lifecycle



# Hibernate Lifecycle

- ◆ The Hibernate lifecycle refers to the various states an entity instance goes through during its interaction with the persistence framework. Understanding this lifecycle is crucial for effectively managing data and ensuring data integrity in your applications.
- ◆ Understanding the Hibernate lifecycle is essential for writing efficient and reliable persistence code. By managing entity states and transitions effectively, you can ensure data integrity and optimize the performance of your applications.

# Hibernate Lifecycle

## 1. Transient State

- ❖ An entity instance is in a transient state when it's newly created using the new operator and not yet associated with a Hibernate session.
- ❖ Changes made to a transient instance are not tracked by Hibernate and won't be persisted to the database.

# Hibernate Lifecycle

## 2. Persistent State

- ◆ An entity instance transitions to the persistent state when it's associated with a Hibernate session. This can happen through:
  - **persist() method:** Explicitly makes an instance persistent.
  - **Cascading:** If an associated entity is persisted and cascading is enabled, the current instance becomes persistent as well.
  - **Querying:** When an entity is retrieved from the database using `find()`, `createQuery()`, or other query methods.
- ◆ Changes made to a persistent instance are tracked by Hibernate and will be synchronized with the database upon flushing or transaction commit.



# Hibernate Lifecycle

## 3. Detached State

- ◆ An entity instance becomes detached when it's no longer associated with a Hibernate session. This can occur when:
  - **Session is closed:** Closing the session detaches all persistent instances associated with it.
  - **detach() method:** Explicitly detaches an instance from the session.
  - **Serialization:** Serializing a persistent instance detaches it.
- ◆ Changes made to a detached instance are not tracked by Hibernate and won't be automatically persisted.



# Hibernate Lifecycle

## 4. Removed State

- ◆ An entity instance enters the removed state when it's marked for deletion using the `remove()` method.
- ◆ The actual deletion from the database occurs upon flushing or transaction commit.

# JPA vs Hibernate

| JPA  | Hibernate   |
|--|---|
| Java Persistence API (JP.A) defines the management of relational data in the Java applications.  | Hibernate is an Object-Relational Mapping (ORM) tool which is used to save the state of Java object into the database.  |
| It is just a specification. Various ORM tools implement it for data persistence.   | It is one of the most frequently used JPA implementation.   |
| It is defined in <b>javax.persistence</b> package.   | It is defined in <b>org.hibernate</b> package.  |
| The <b>EntityManagerFactory</b> interface is used to interact with the entity manager factory for the persistence unit. Thus, it provides an entity manager.                 | It uses <b>SessionFactory</b> interface to create Session instances.  |
| It uses <b>EntityManager</b> interface to create, read, and delete operations for instances of mapped entity classes. This interface interacts with the persistence context. | It uses <b>Session</b> interface to create, read, and delete operations for instances of mapped entity classes. It behaves as a runtime interface between a Java application and Hibernate. |
| It uses <b>Java Persistence Query Language (JPQL)</b> as an object-oriented query language to perform database operations.   | It uses <b>Hibernate Query Language (HQL)</b> as an object-oriented query language to perform database operations.  |

# Hibernate Configuration

- ❖ As Hibernate can operate in different environments, it requires a wide range of configuration parameters. These configurations contain the mapping information that provides different functionalities to Java classes. Generally, we provide database related mappings in the configuration file. Hibernate facilitates to provide the configurations either in an XML file (like hibernate.cfg.xml) or properties file (like hibernate.properties).
- ❖ An instance of Configuration class allows specifying properties and mappings to applications. This class also builds an immutable **SessionFactory**.

# Properties of Hibernate Configuration

## ◆ Hibernate JDBC Properties

| Property                          | Description   |
|-----------------------------------|---|
| hibernate.connection.driver_class | It represents the JDBC driver class.  |
| hibernate.connection.url          | It represents the JDBC URL.   |
| hibernate.connection.username     | It represents the database username.  |
| hibernate.connection.password     | It represents the database password.  |
| Hibernate.connection.pool_size    | It represents the maximum number of connections available in the connection pool. |

# Properties of Hibernate Configuration

## ◆ Hibernate Datasource Properties

| Property                        | Description  |
|---------------------------------|--|
| hibernate.connection.datasource | It represents datasource JNDI name which is used by Hibernate for database properties. |
| hibernate.jndi.url              | It is optional. It represents the URL of the JNDI provider.                            |
| hibernate.jndi.class            | It is optional. It represents the class of the JNDI InitialContextFactory.             |

# Properties of Hibernate Configuration

| Property                       | Description   |
|--------------------------------|---|
| hibernate.dialect              | It represents the type of database used in hibernate to generate SQL statements for a particular relational database. |
| hibernate.show_sql             | It is used to display the executed SQL statements to console.   |
| hibernate.format_sql           | It is used to print the SQL in the log and console.   |
| hibernate.default_catalog      | It qualifies unqualified table names with the given catalog in generated SQL.   |
| hibernate.default_schema       | It qualifies unqualified table names with the given schema in generated SQL.  |
| hibernate.session_factory_name | The SessionFactory interface automatically bound to this name in JNDI after it has been created.                      |

# Properties of Hibernate Configuration

| Property                          | Description   |
|-----------------------------------|---|
| hibernate.default_entity_mode     | It sets a default mode for entity representation for all sessions opened from this SessionFactory         |
| hibernate.order_updates           | It orders SQL updates on the basis of the updated primary key.  |
| hibernate.use_identifier_rollback | If enabled, the generated identifier properties will be reset to default values when objects are deleted. |
| hibernate.generate_statistics     | If enabled, the Hibernate will collect statistics useful for performance tuning.                          |
| hibernate.use_sql_comments        | If enabled, the Hibernate generate comments inside the SQL. It is used to make debugging easier.          |



# Hibernate Cache Properties

| Property                               | Description  |
|--|--|
| hibernate.cache.provider_class         | It represents the classname of a custom CacheProvider.   |
| hibernate.cache.use_minimal_puts       | It is used to optimize the second-level cache. It minimizes writes, at the cost of more frequent reads.        |
| hibernate.cache.use_query_cache        | It is used to enable the query cache.  |
| hibernate.cache.use_second_level_cache | It is used to disable the second-level cache, which is enabled by default for classes which specify a mapping. |
| hibernate.cache.query_cache_factory    | It represents the classname of a custom QueryCache interface.  |
| hibernate.cache.region_prefix          | It specifies the prefix which is used for second-level cache region names.                                     |
| hibernate.cache.use_structured_entries | It facilitates Hibernate to store data in the second-level cache in a more human-friendly format.              |



# Properties of Hibernate Configuration

## ◆ Hibernate Transaction Properties

| Property   | Description  |
|--|--|
| <code>hibernate.transaction.factory_class</code>           | It represents the classname of a TransactionFactory which is used with Hibernate Transaction API.                  |
| <code>hibernate.transaction.manager_lookup_class</code>    | It represents the classname of a TransactionManagerLookup. It is required when JVM-level caching is enabled.       |
| <code>hibernate.transaction.flush_before_completion</code> | If it is enabled, the session will be automatically flushed during the before completion phase of the transaction. |
| <code>hibernate.transaction.auto_close_session</code>      | If it is enabled, the session will be automatically closed during the after completion phase of the transaction.   |

# Properties of Hibernate Configuration

## ◆ Other Hibernate Properties

| Property                                | Description  |
|---|--|
| hibernate.connection.provider_class     | It represents the classname of a custom ConnectionProvider which provides JDBC connections to Hibernate. |
| hibernate.connection.isolation          | It is used to set the JDBC transaction isolation level.  |
| hibernate.connection.autocommit         | It enables auto-commit for JDBC pooled connections. However, it is not recommended.                      |
| hibernate.connection.release_mode       | It specifies when Hibernate should release JDBC connections.   |
| hibernate.current_session_context_class | It provides a custom strategy for the scoping of the "current" Session.                                  |
| hibernate.hbm2ddl.auto                  | It automatically generates a schema in the database with the creation of SessionFactory.                 |

# Annotations in Hibernate

# Commonly Used Annotations

- ❖ **@Entity:** Marks a class as a persistent entity, indicating that it represents data stored in a database table.
- ❖ **@Table:** Specifies the name of the database table to which the entity is mapped.
- ❖ **@Id:** Identifies the primary key property of the entity.
- ❖ **@GeneratedValue:** Configures the strategy for generating identifier values (e.g., AUTO, SEQUENCE, IDENTITY).
- ❖ **@Column:** Provides details about the mapping of a property to a database column, such as the column name, data type, and nullability.

# Commonly Used Annotations

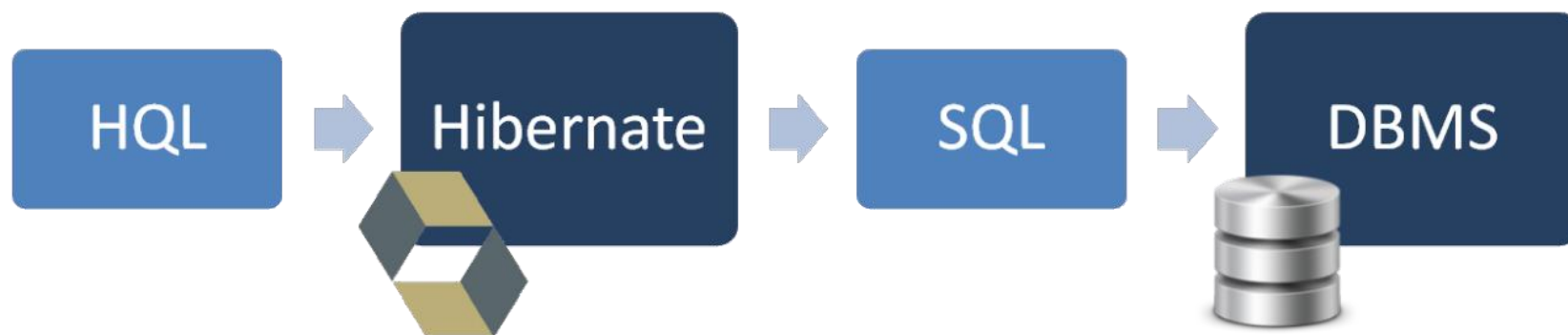
- ❖ **@Basic**: Marks a property as a basic type (e.g., String, int, Date).
- ❖ **@Transient**: Excludes a property from persistence.
- ❖ **@Embedded**: Map embeddable components as value types.
- ❖ **@Temporal**: Specifies the temporal precision of a date/time property.
- ❖ **@Enumerated**: Configures the mapping of an enum type.
- ❖ **@Lob**: Marks a property as a large object (BLOB or CLOB).
- ❖ **@Version**: Enables optimistic locking with a version property.
- ❖ **@CreationTimestamp, @UpdateTimestamp**: Automatically set timestamps for creation and update events.

# Relationships Annotations in Hibernate

- ❖ **@ManyToOne:** This annotation defines a many-to-one relationship between two entities.
- ❖ **@OneToMany:** This annotation defines a one-to-many relationship between two entities.
- ❖ **@OneToOne:** This annotation defines a one-to-one relationship between two entities.
- ❖ **@ManyToMany:** This annotation defines a many-to-many relationship between two entities.

# Hibernate Query Language (HQL)

- ❖ Hibernate Query Language (HQL) is same as SQL (Structured Query Language) but it doesn't depends on the table of the database. Instead of table name, we use class name in HQL. So it is database independent query language.



# Advantage of HQL

- ◆ Database independent
- ◆ Supports polymorphic queries
- ◆ Easy to learn for Java Programmer



# Query Interface

- ◆ It is an object oriented representation of Hibernate Query. The object of Query can be obtained by calling the `createQuery()` method Session interface.
  - **`public int executeUpdate()`** is used to execute the update or delete query.
  - **`public List list()`** returns the result of the relation as a list.
  - **`public Query setFirstResult(int rowno)`** specifies the row number from where record will be retrieved.

# Query Interface

- ◆ **public Query setMaxResult(int rowno)** specifies the no. of records to be retrieved from the relation (table).
- ◆ **public Query setParameter(int position, Object value)** it sets the value to the JDBC style query parameter.
- ◆ **public Query setParameter(String name, Object value)** it sets the value to a named query parameter.

# Example of HQL paging

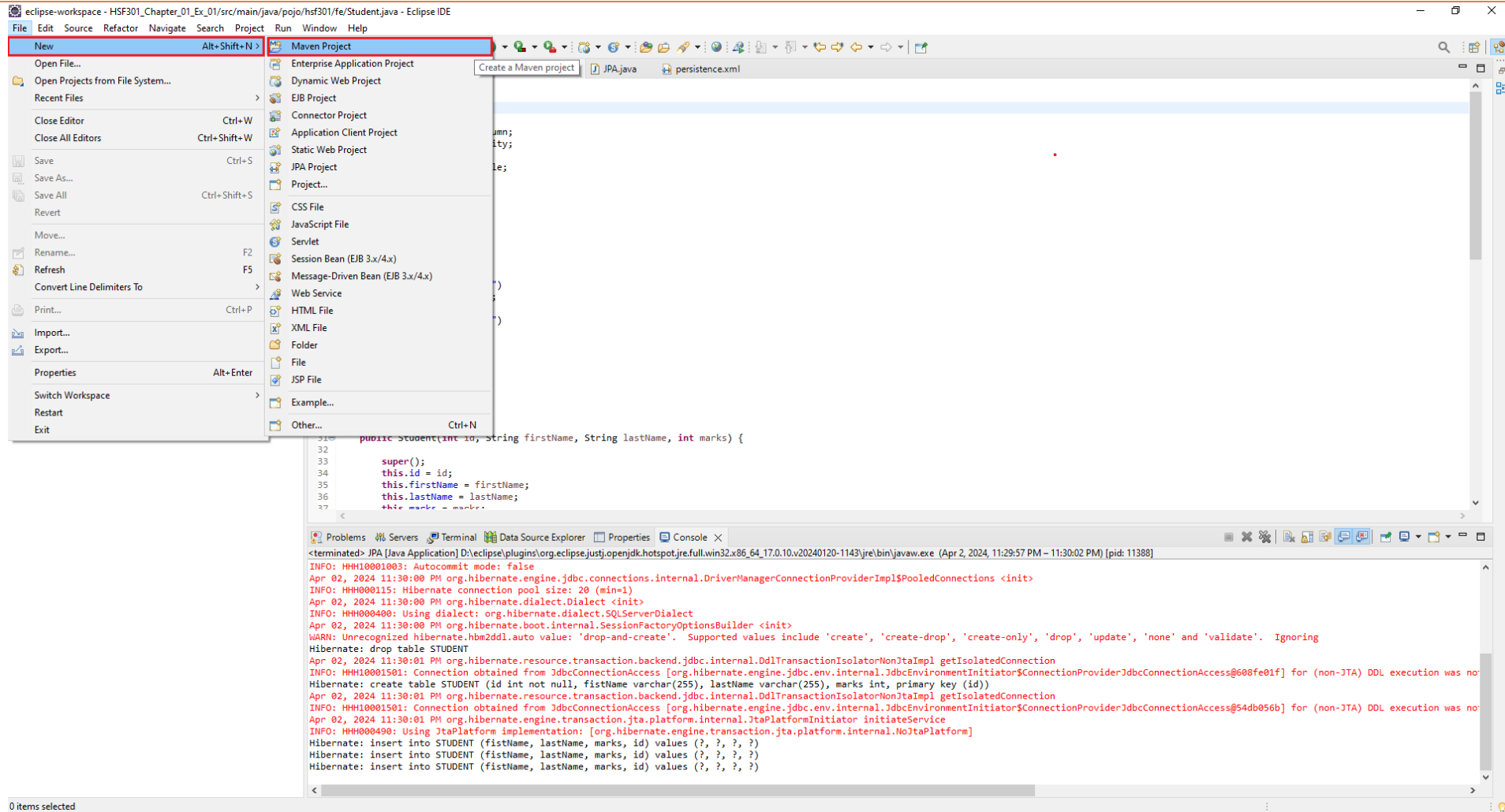
- ◆ Query query=session.createQuery("from Student");
- ◆ query.setFirstResult(5);
- ◆ query.setMaxResult(10);
- ◆ List list=query.list();//will return the records from 5 to 10th number

# Example of HQL update query

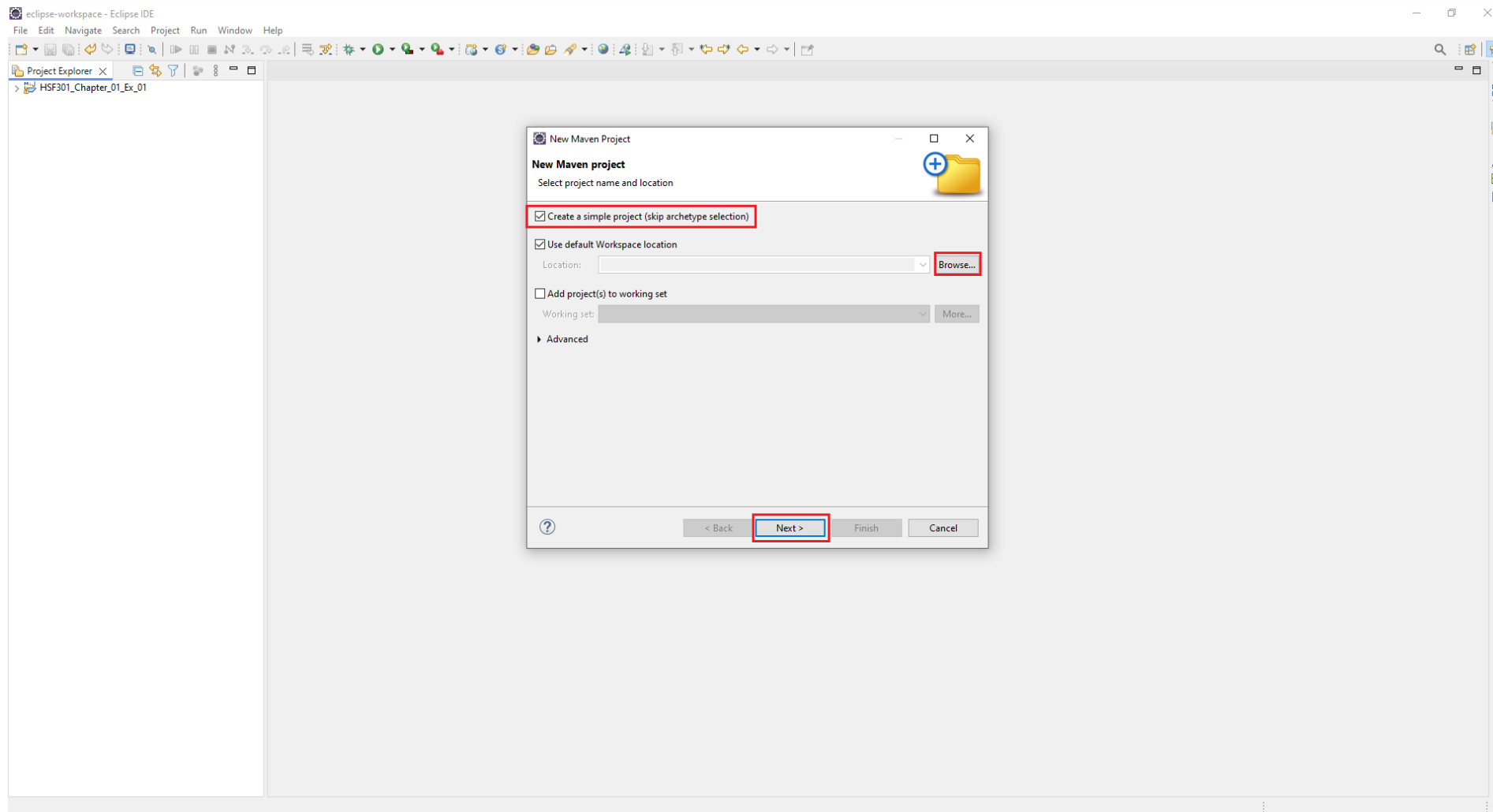
1. *Transaction tx=session.beginTransaction();*
2. *Query q=session.createQuery("update Student set lastName=:n where id=:i");*
3. *q.setParameter("n","Sang");*
4. *q.setParameter("i",1);*
5. ***int** status=q.executeUpdate();*
6. *System.out.println(status);*
7. *tx.commit();*

# Demo Hibernate (One To Many)

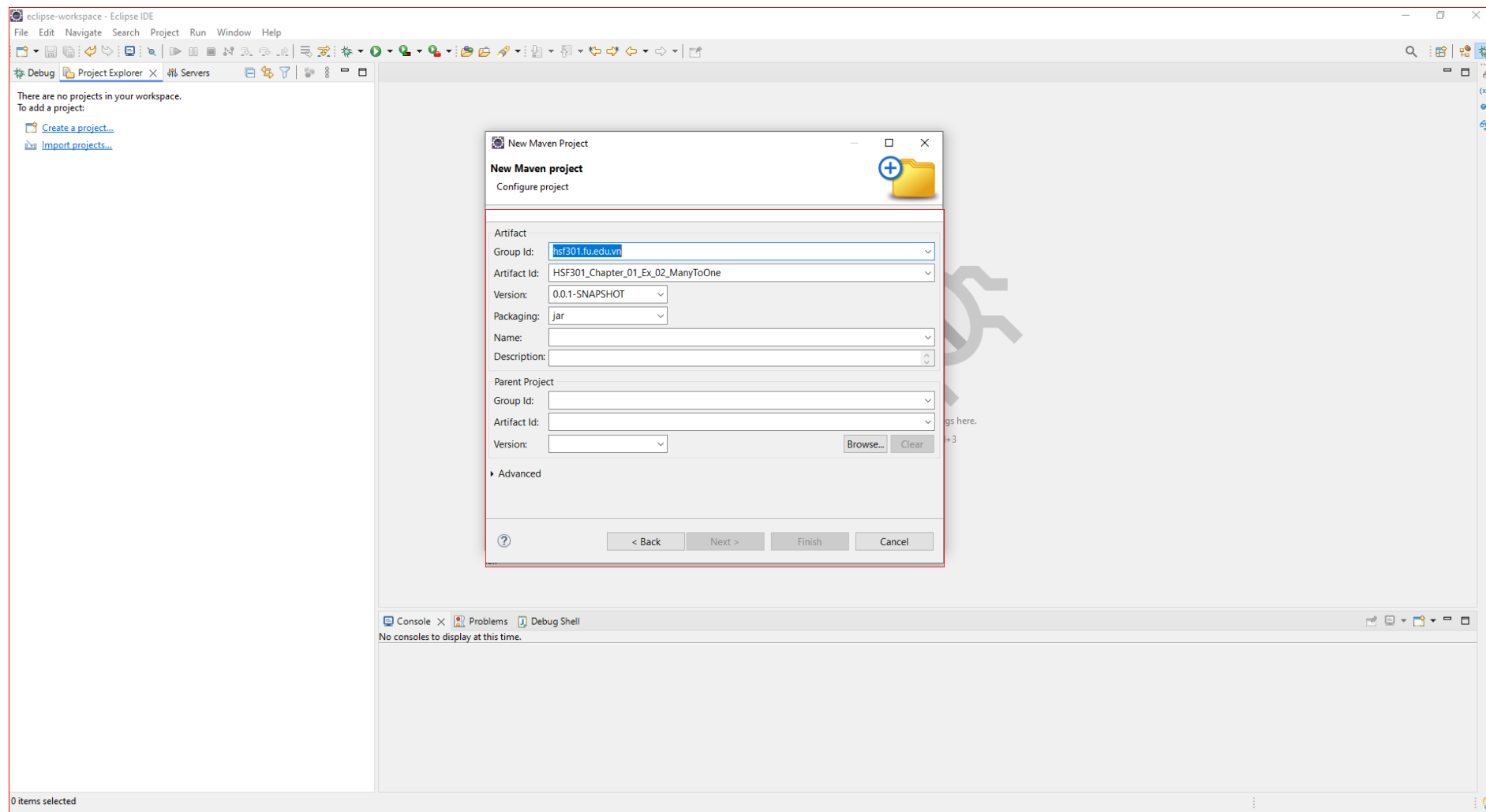
# 1. Open Eclipse, File | New | Maven Project



## 2. Check Create a simple project -> Browse Project -> Next

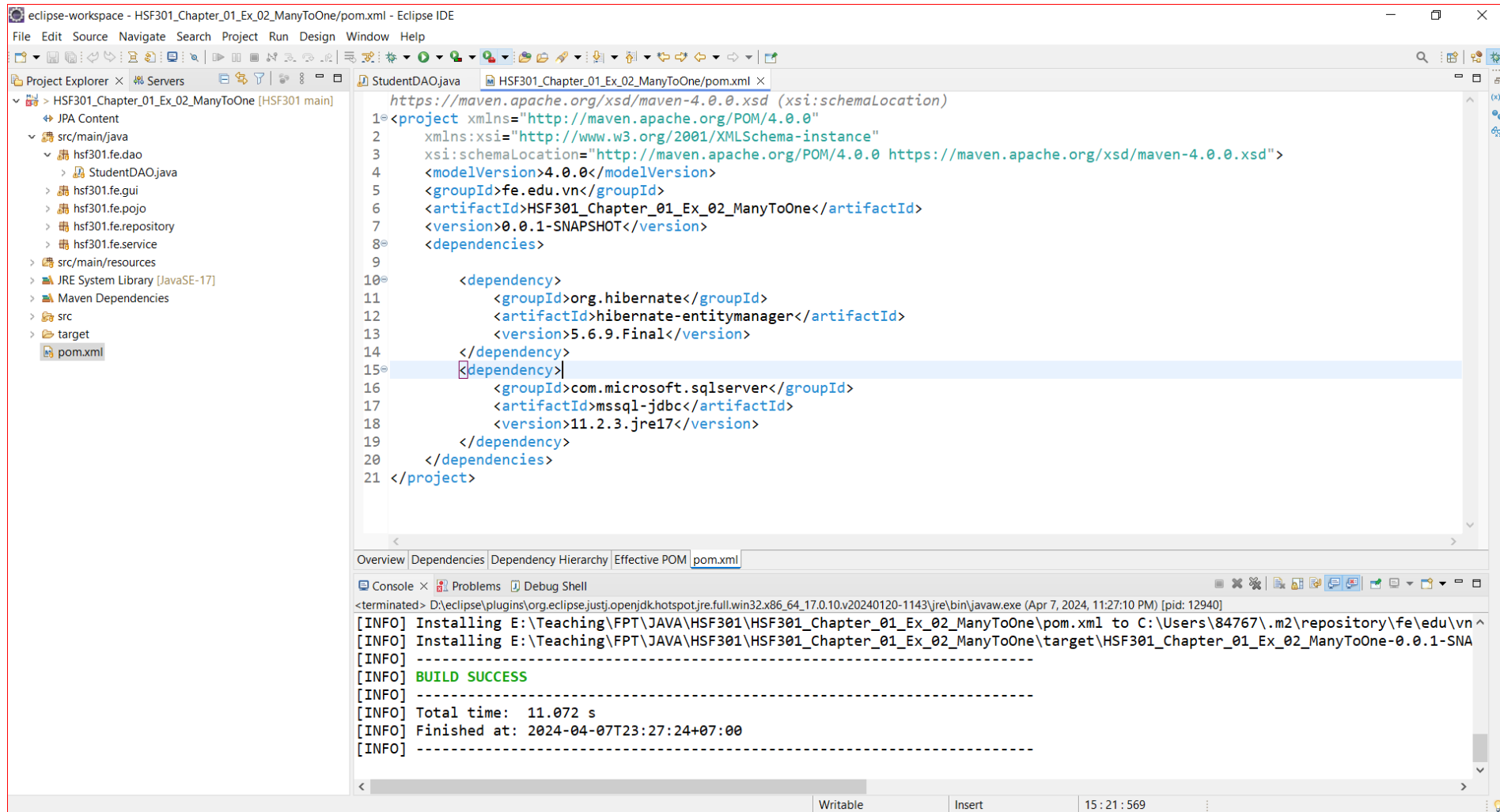


### 3. Fill the information Project -> Click Finish





## 4. Structure of Maven Project



The screenshot displays the Eclipse IDE interface for a Maven project named 'HSF301\_Chapter\_01\_Ex\_02\_ManyToOne'. The Project Explorer on the left shows the project structure, including the 'pom.xml' file. The main editor window displays the content of 'pom.xml', which is a Maven POM file. The file includes the following XML elements:

```
<?xml version="1.0" encoding="UTF-8" ?>
<project xmlns="http://maven.apache.org/POM/4.0.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 https://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <groupId>fe.edu.vn</groupId>
  <artifactId>HSF301_Chapter_01_Ex_02_ManyToOne</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <dependencies>
    <dependency>
      <groupId>org.hibernate</groupId>
      <artifactId>hibernate-entitymanager</artifactId>
      <version>5.6.9.Final</version>
    </dependency>
    <dependency>
      <groupId>com.microsoft.sqlserver</groupId>
      <artifactId>mssql-jdbc</artifactId>
      <version>11.2.3.jre17</version>
    </dependency>
  </dependencies>
</project>
```

The console output at the bottom shows the build process, indicating a successful build:

```
[INFO] Installing E:\Teaching\FPT\JAVA\HSF301\HSF301_Chapter_01_Ex_02_ManyToOne\pom.xml to C:\Users\84767\.m2\repository\fe\edu\vn ^
[INFO] Installing E:\Teaching\FPT\JAVA\HSF301\HSF301_Chapter_01_Ex_02_ManyToOne\target\HSF301_Chapter_01_Ex_02_ManyToOne-0.0.1-SNA
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 11.072 s
[INFO] Finished at: 2024-04-07T23:27:24+07:00
[INFO] -----
```

## 5. Create hibernate.cfg.xml

```

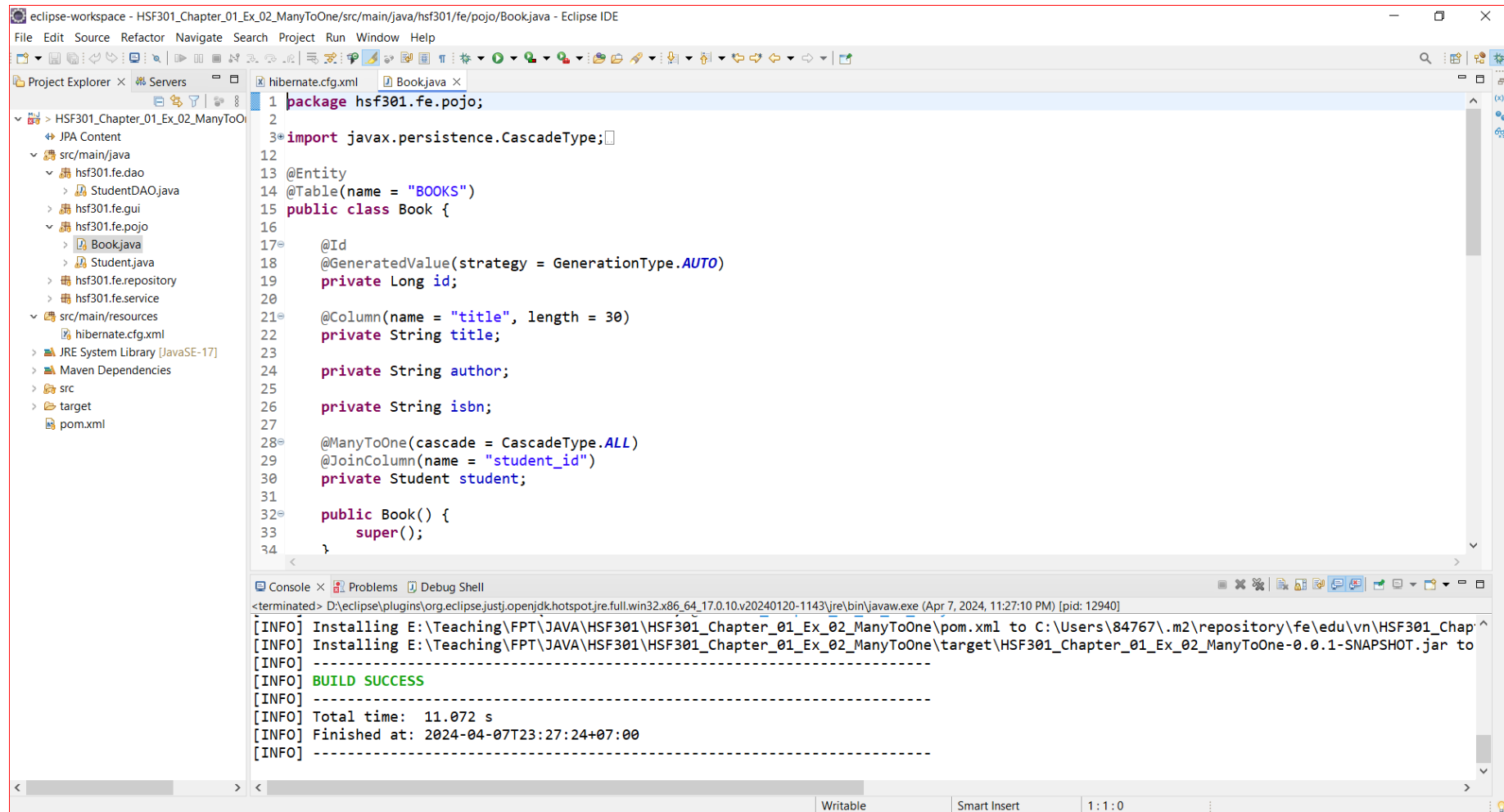
eclipse-workspace - HSF301_Chapter_01_Ex_02_ManyToOne/src/main/resources/hibernate.cfg.xml - Eclipse IDE
File Edit Source Source Navigate Search Project Run Window Help
Project Explorer Servers
HSF301_Chapter_01_Ex_02_ManyToOne
  JPA Content
  src/main/java
    hsf301.fe.dao
      StudentDAO.java
    hsf301.fe.gui
    hsf301.fe.pojo
    hsf301.fe.repository
    hsf301.fe.service
  src/main/resources
    hibernate.cfg.xml
  JRE System Library [JavaSE-17]
  Maven Dependencies
  src
  target
  pom.xml

hibernate.cfg.xml
http://www.hibernate.org/dtd/hibernate-configuration-3.0.dtd (doctype)
1 <?xml version = "1.0" encoding = "utf-8"?>
2 <!DOCTYPE hibernate-configuration SYSTEM
3 "http://www.hibernate.org/dtd/hibernate-configuration-3.0.dtd">
4 <hibernate-configuration>
5   <session-factory>
6     <property name="hbm2ddl.auto">update</property>
7     <property name="dialect">org.hibernate.dialect.SQLServerDialect</property>
8     <property name="connection.url">jdbc:sqlserver://localhost:1433;DatabaseName=tutorial;encrypt=true;trustServerCertificate=true</p
9     <property name="connection.username">sa</property>
10    <property name="connection.password">Aesx5099@@</property>
11    <property name="connection.driver_class">com.microsoft.sqlserver.jdbc.SQLServerDriver</property>
12
13    <mapping class="hsf301.fe.pojo.Student" />
14    <mapping class="hsf301.fe.pojo.Book" />
15
16  </session-factory>
17
18 </hibernate-configuration>

Design Source
Console Problems Debug Shell
<terminated> D:\eclipse\plugins\org.eclipse.justi.openjdk.hotspot.jre.full.win32.x86_64_17.0.10.v20240120-1143\jre\bin\javaw.exe (Apr 7, 2024, 11:27:10 PM) [pid: 12940]
[INFO] Installing E:\Teaching\FPT\JAVA\HSF301\HSF301_Chapter_01_Ex_02_ManyToOne\pom.xml to C:\Users\84767\.m2\repository\fe\edu\vn\HSF301_Chap^
[INFO] Installing E:\Teaching\FPT\JAVA\HSF301\HSF301_Chapter_01_Ex_02_ManyToOne\target\HSF301_Chapter_01_Ex_02_ManyToOne-0.0.1-SNAPSHOT.jar to
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 11.072 s
[INFO] Finished at: 2024-04-07T23:27:24+07:00
[INFO] -----

```

## 6. Create Books in Pojo



The screenshot shows the Eclipse IDE with the following components:

- Project Explorer:** Displays the project structure for 'HSF301\_Chapter\_01\_Ex\_02\_ManyToOne'. The 'src/main/java' directory contains sub-packages: 'hsf301.fe.dao' (with 'StudentDAO.java'), 'hsf301.fe.gui', 'hsf301.fe.pojo' (containing 'Book.java'), 'hsf301.fe.repository', and 'hsf301.fe.service'. The 'src/main/resources' directory contains 'hibernate.cfg.xml'. Other folders include 'JRE System Library [JavaSE-17]', 'Maven Dependencies', 'src', 'target', and 'pom.xml'.
- Editor:** Shows the 'Book.java' file with the following code:

```
1 package hsf301.fe.pojo;
2
3 import javax.persistence.CascadeType;
4
5 @Entity
6 @Table(name = "BOOKS")
7 public class Book {
8
9     @Id
10    @GeneratedValue(strategy = GenerationType.AUTO)
11    private Long id;
12
13    @Column(name = "title", length = 30)
14    private String title;
15
16    private String author;
17
18    private String isbn;
19
20    @ManyToOne(cascade = CascadeType.ALL)
21    @JoinColumn(name = "student_id")
22    private Student student;
23
24    public Book() {
25        super();
26    }
27 }
```
- Console:** Displays the output of the Maven build process:

```
<terminated> D:\eclipse\plugins\org.eclipse.justi.openjdk.hotspot.jre.full.win32.x86_64_17.0.10.v20240120-1143\jre\bin\javaw.exe (Apr 7, 2024, 11:27:10 PM) [pid: 12940]
[INFO] Installing E:\Teaching\FPT\JAVA\HSF301\HSF301_Chapter_01_Ex_02_ManyToOne\pom.xml to C:\Users\84767\.m2\repository\fe\edu\vn\HSF301_Chap^
[INFO] Installing E:\Teaching\FPT\JAVA\HSF301\HSF301_Chapter_01_Ex_02_ManyToOne\target\HSF301_Chapter_01_Ex_02_ManyToOne-0.0.1-SNAPSHOT.jar to
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 11.072 s
[INFO] Finished at: 2024-04-07T23:27:24+07:00
[INFO] -----
```

# 7. Create Students in Pojo

The screenshot shows the Eclipse IDE with the following components:

- Project Explorer:** Displays the project structure for 'HSF301\_Chapter\_01\_Ex\_02\_ManyToOne'. The 'src/main/java' directory is expanded, showing sub-packages like 'hsf301.fe.dao', 'hsf301.fe.gui', 'hsf301.fe.pojo', and 'hsf301.fe.repository'. The 'hsf301.fe.pojo' package is selected, showing 'Book.java' and 'Student.java'.
- Editor:** Displays the code for 'Student.java'. The code is as follows:
 

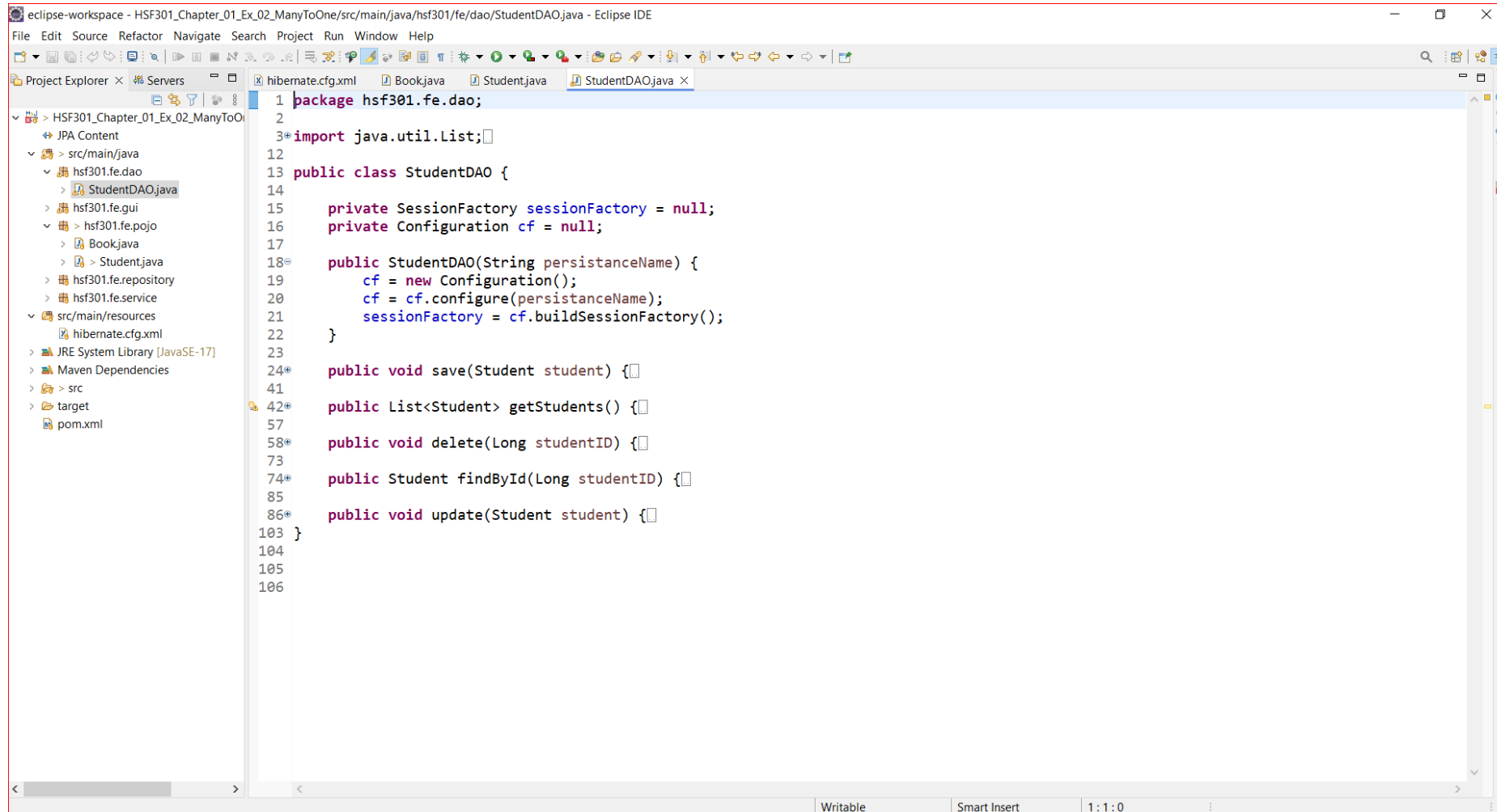
```

1 package hsf301.fe.pojo;
2
3 import java.util.HashSet;
4
15 @Entity
16 @Table(name = "STUDENTS")
17 public class Student {
18
19
20     @Id
21     @GeneratedValue(strategy = GenerationType.AUTO)
22     @Column(name = "id")
23     private int id;
24
25     @Column(name = "firstName", nullable = false, unique = true)
26     private String firstName;
27
28     @Column(name = "lastName")
29     private String lastName;
30
31     @Column(name = "marks")
32     private int marks;
33
34     @OneToMany(cascade = CascadeType.ALL)
35     @JoinColumn(name = "student_id")
36     private Set<Book> books ;
37
      
```
- Console:** Displays the output of the Maven build process. The output shows the installation of the project's pom.xml and the resulting jar file, followed by a successful build message.
 

```

<terminated> D:\eclipse\plugins\org.eclipse.justi.openjdk.hotspot.jre.full.win32.x86_64.17.0.10.v20240120-1143\jre\bin\javaw.exe (Apr 7, 2024, 11:27:10 PM) [pid: 12940]
[INFO] Installing E:\Teaching\FPT\JAVA\HSF301\HSF301_Chapter_01_Ex_02_ManyToOne\pom.xml to C:\Users\84767\.m2\repository\fe\edu\vn\HSF301_Chap
[INFO] Installing E:\Teaching\FPT\JAVA\HSF301\HSF301_Chapter_01_Ex_02_ManyToOne\target\HSF301_Chapter_01_Ex_02_ManyToOne-0.0.1-SNAPSHOT.jar to
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 11.072 s
[INFO] Finished at: 2024-04-07T23:27:24+07:00
[INFO] -----
      
```

## 8. Create StudentDAO



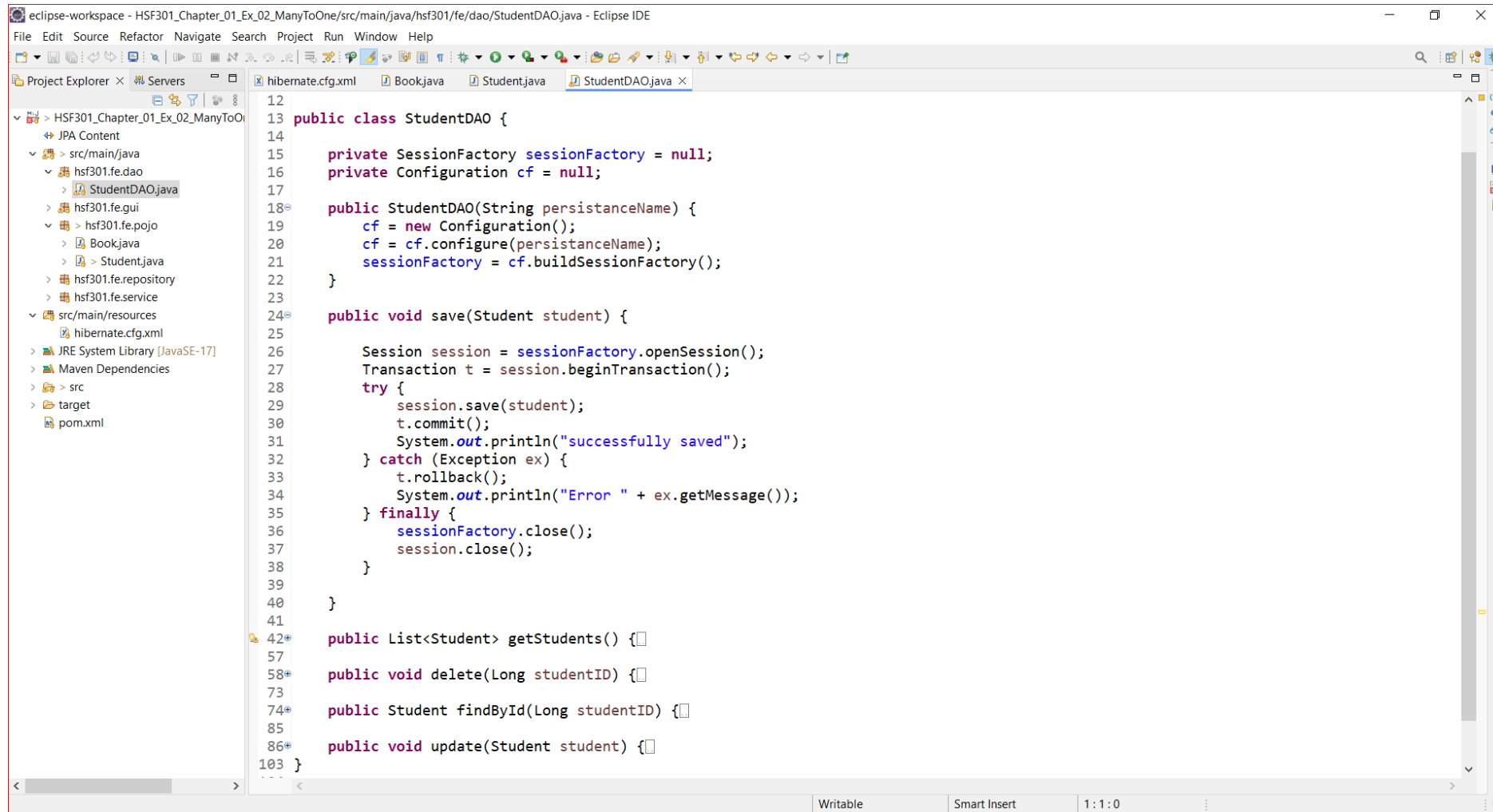
The screenshot shows the Eclipse IDE with the following components:

- Project Explorer:** Displays the project structure. The package `hsf301.fe.dao` is expanded, showing the file `StudentDAO.java`.
- Editors:** The `StudentDAO.java` file is open in the editor. The code is as follows:
 

```

1 package hsf301.fe.dao;
2
3 import java.util.List;
4
12
13 public class StudentDAO {
14
15     private SessionFactory sessionFactory = null;
16     private Configuration cf = null;
17
18     public StudentDAO(String persistenceName) {
19         cf = new Configuration();
20         cf = cf.configure(persistenceName);
21         sessionFactory = cf.buildSessionFactory();
22     }
23
24     public void save(Student student) {}
25
42     public List<Student> getStudents() {}
43
57
58     public void delete(Long studentID) {}
59
73
74     public Student findById(Long studentID) {}
75
85
86     public void update(Student student) {}
87
103 }
104
105
106
      
```
- Bottom Bar:** Shows the status bar with "Writable", "Smart Insert", and "1:1:0".

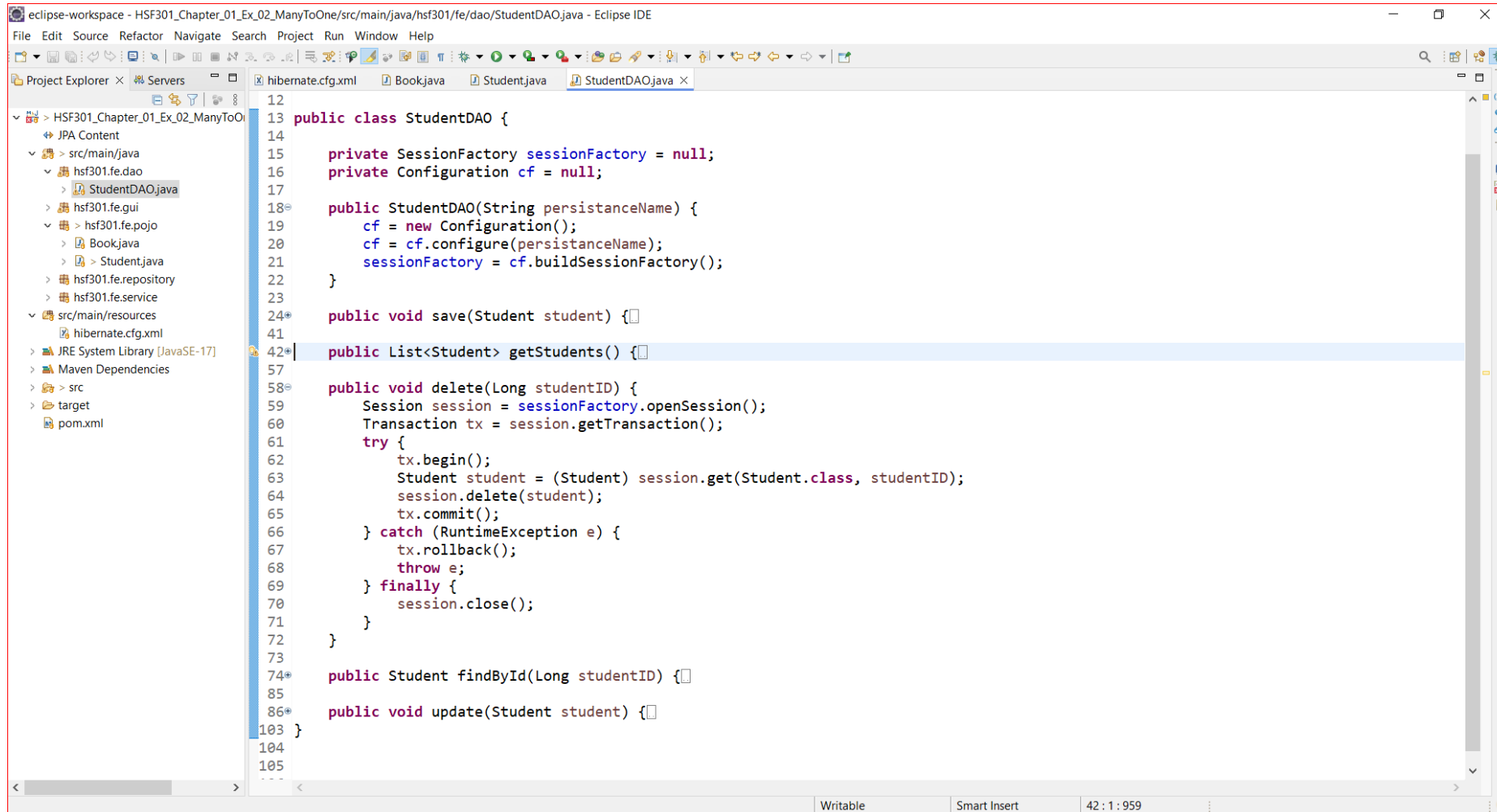
## 9. Save Student in StudentDAO



```
12
13 public class StudentDAO {
14
15     private SessionFactory sessionFactory = null;
16     private Configuration cf = null;
17
18     public StudentDAO(String persistenceName) {
19         cf = new Configuration();
20         cf = cf.configure(persistenceName);
21         sessionFactory = cf.buildSessionFactory();
22     }
23
24     public void save(Student student) {
25
26         Session session = sessionFactory.openSession();
27         Transaction t = session.beginTransaction();
28         try {
29             session.save(student);
30             t.commit();
31             System.out.println("successfully saved");
32         } catch (Exception ex) {
33             t.rollback();
34             System.out.println("Error " + ex.getMessage());
35         } finally {
36             sessionFactory.close();
37             session.close();
38         }
39     }
40
41
42     public List<Student> getStudents() {}
43
44
45     public void delete(Long studentID) {}
46
47
48     public Student findById(Long studentID) {}
49
50
51     public void update(Student student) {}
52 }
```



# 10. Get All Student in StudentDAO



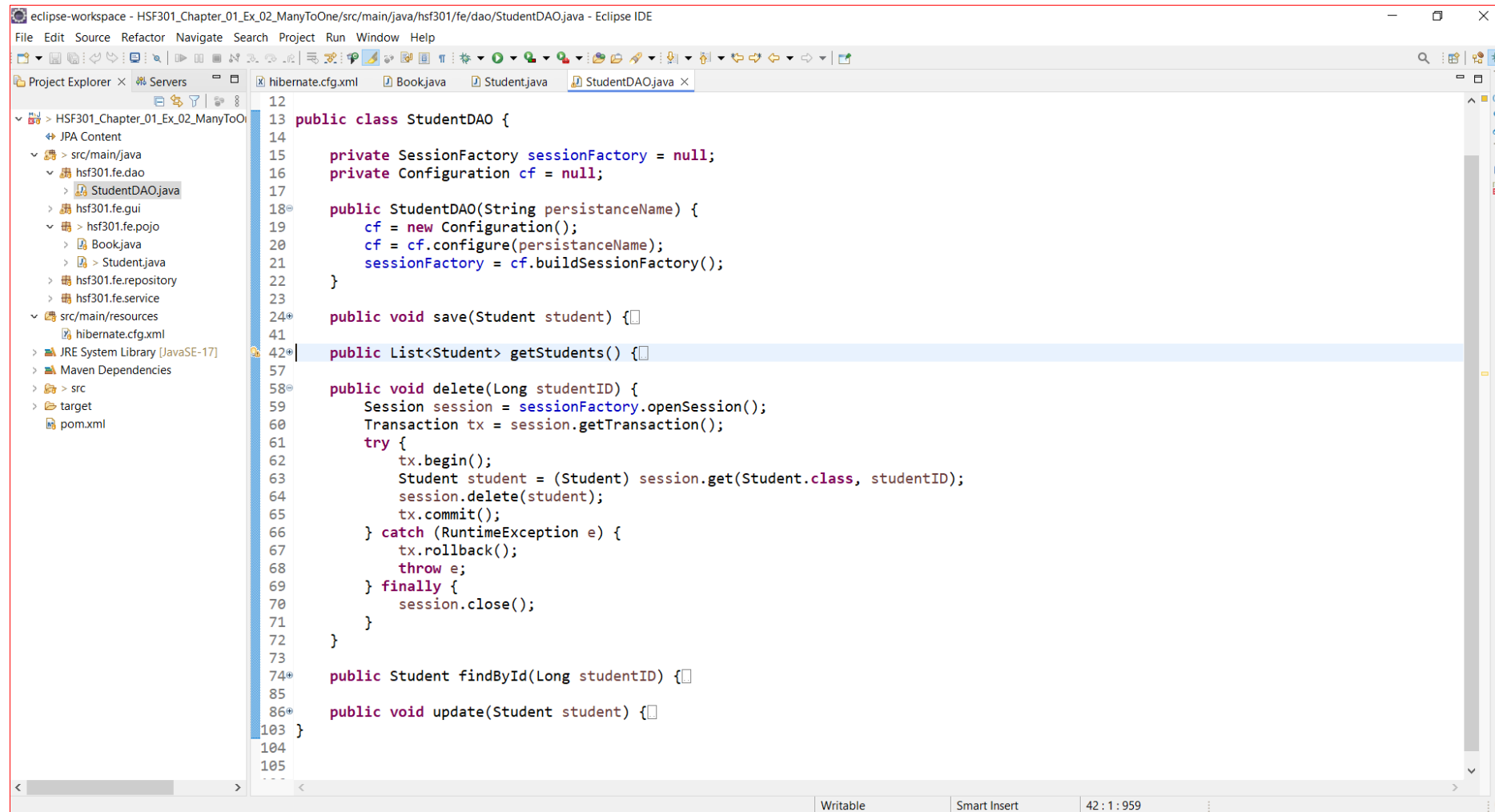
```
eclipse-workspace - HSF301_Chapter_01_Ex_02_ManyToOne/src/main/java/hsf301/fe/dao/StudentDAO.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help

Project Explorer Servers
  HSF301_Chapter_01_Ex_02_ManyToOne
    JPA Content
    src/main/java
      hsf301.fe.dao
        StudentDAO.java
      hsf301.fe.gui
      hsf301.fe.pojo
        Book.java
        Student.java
      hsf301.fe.repository
      hsf301.fe.service
    src/main/resources
      hibernate.cfg.xml
    JRE System Library [JavaSE-17]
    Maven Dependencies
    src
    target
    pom.xml

12
13 public class StudentDAO {
14
15     private SessionFactory sessionFactory = null;
16     private Configuration cf = null;
17
18     public StudentDAO(String persistenceName) {
19         cf = new Configuration();
20         cf = cf.configure(persistenceName);
21         sessionFactory = cf.buildSessionFactory();
22     }
23
24     public void save(Student student) {}
25
26     public List<Student> getStudents() {}
27
28     public void delete(Long studentID) {
29         Session session = sessionFactory.openSession();
30         Transaction tx = session.getTransaction();
31         try {
32             tx.begin();
33             Student student = (Student) session.get(Student.class, studentID);
34             session.delete(student);
35             tx.commit();
36         } catch (RuntimeException e) {
37             tx.rollback();
38             throw e;
39         } finally {
40             session.close();
41         }
42     }
43
44     public Student findById(Long studentID) {}
45
46     public void update(Student student) {}
47 }
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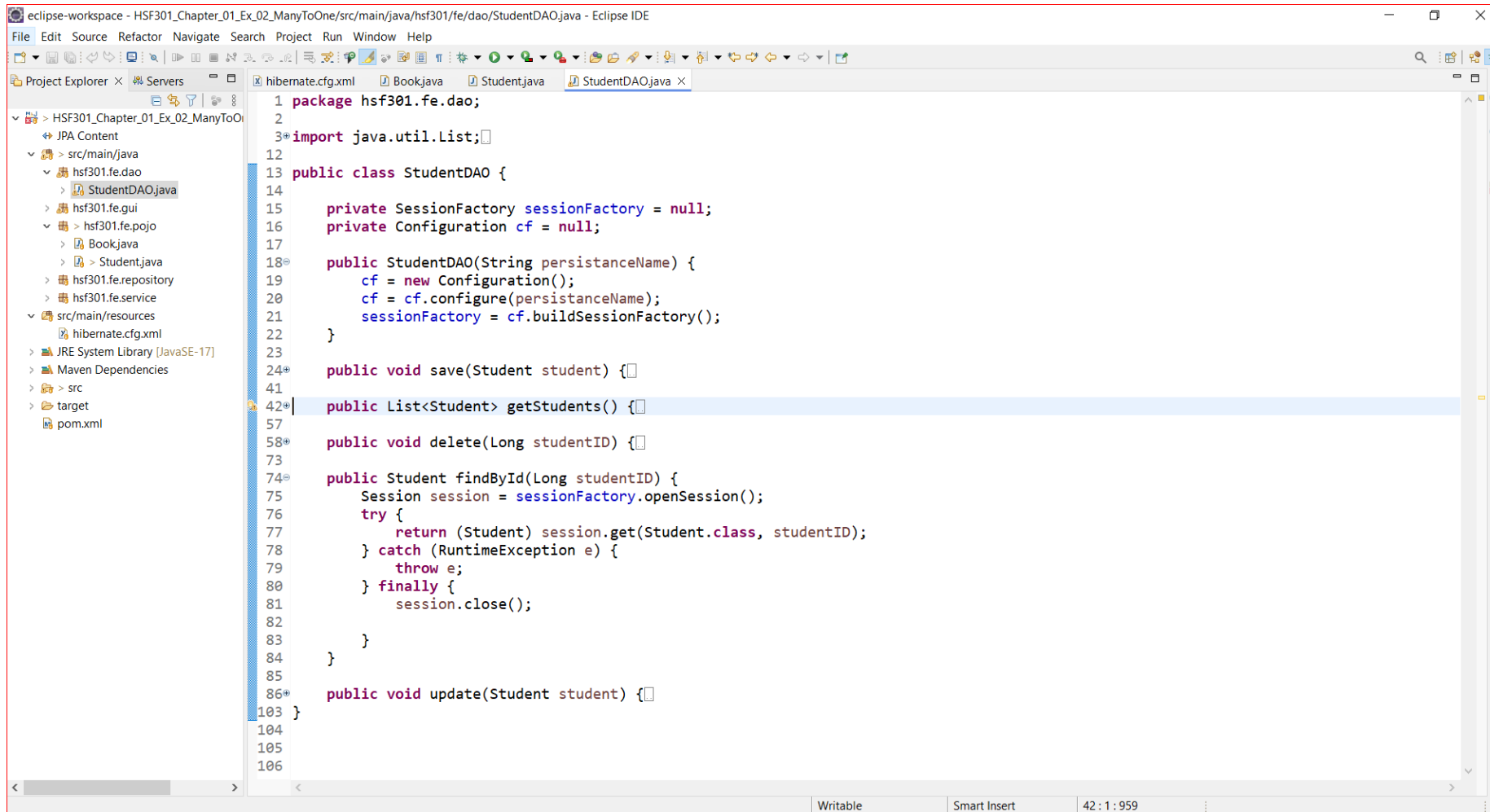
# 11. Delete Student in StudentDAO



```
12
13 public class StudentDAO {
14
15     private SessionFactory sessionFactory = null;
16     private Configuration cf = null;
17
18     public StudentDAO(String persistenceName) {
19         cf = new Configuration();
20         cf = cf.configure(persistenceName);
21         sessionFactory = cf.buildSessionFactory();
22     }
23
24     public void save(Student student) {}
25
26     public List<Student> getStudents() {}
27
28     public void delete(Long studentID) {
29         Session session = sessionFactory.openSession();
30         Transaction tx = session.getTransaction();
31         try {
32             tx.begin();
33             Student student = (Student) session.get(Student.class, studentID);
34             session.delete(student);
35             tx.commit();
36         } catch (RuntimeException e) {
37             tx.rollback();
38             throw e;
39         } finally {
40             session.close();
41         }
42     }
43
44     public Student findById(Long studentID) {}
45
46     public void update(Student student) {}
47 }
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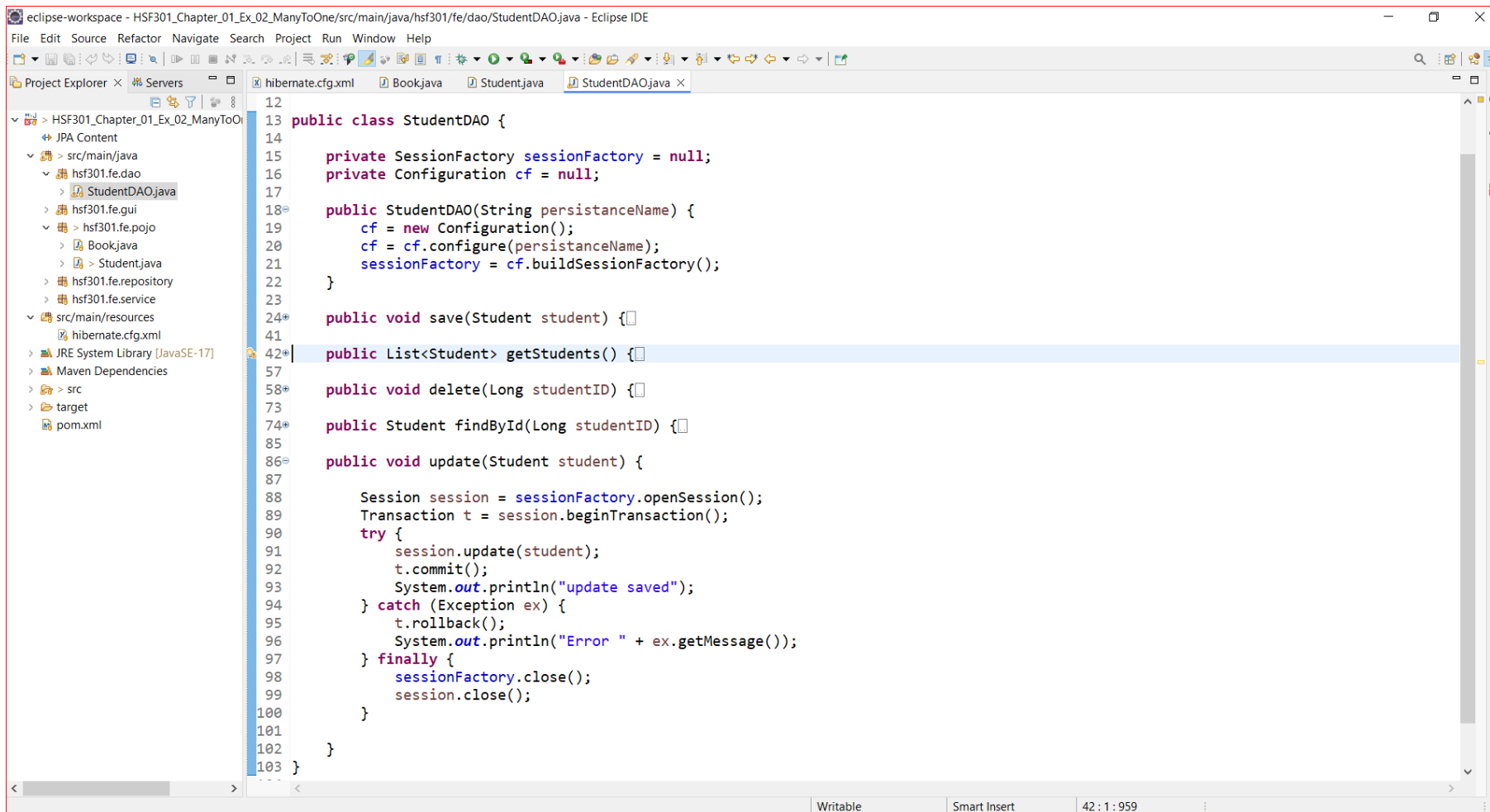


## 12. Find A Student in StudentDAO



```
1 package hsf301.fe.dao;
2
3 import java.util.List;
4
5 public class StudentDAO {
6     private SessionFactory sessionFactory = null;
7     private Configuration cf = null;
8
9     public StudentDAO(String persistenceName) {
10         cf = new Configuration();
11         cf = cf.configure(persistenceName);
12         sessionFactory = cf.buildSessionFactory();
13     }
14
15     public void save(Student student) {}
16
17     public List<Student> getStudents() {}
18
19     public void delete(Long studentID) {}
20
21     public Student findById(Long studentID) {
22         Session session = sessionFactory.openSession();
23         try {
24             return (Student) session.get(Student.class, studentID);
25         } catch (RuntimeException e) {
26             throw e;
27         } finally {
28             session.close();
29         }
30     }
31
32     public void update(Student student) {}
33 }
```

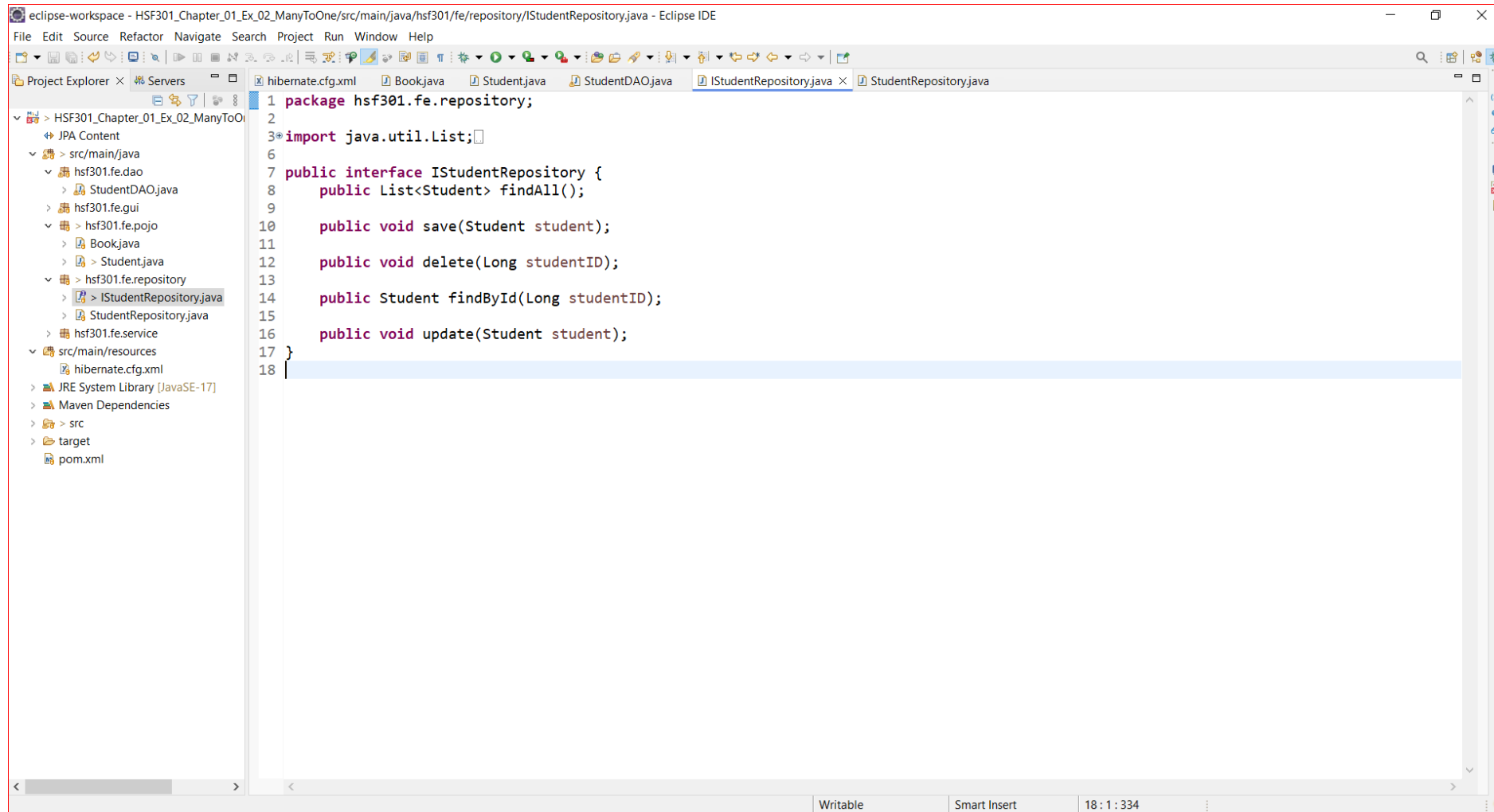
# 13. Update a Student in StudentDAO



```
eclipse-workspace - HSF301_Chapter_01_Ex_02_ManyToOne/src/main/java/hsf301/fe/dao/StudentDAO.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
hibernate.cfg.xml Bookjava Studentjava StudentDAO.java
Project Explorer Servers
HSF301_Chapter_01_Ex_02_ManyToOne
  JPA Content
  src/main/java
    hsf301.fe.dao
      StudentDAO.java
    hsf301.fe.gui
    hsf301.fe.pojo
      Bookjava
      Studentjava
    hsf301.fe.repository
    hsf301.fe.service
  src/main/resources
    hibernate.cfg.xml
  JRE System Library [JavaSE-17]
  Maven Dependencies
  src
  target
  pom.xml

12
13 public class StudentDAO {
14
15     private SessionFactory sessionFactory = null;
16     private Configuration cf = null;
17
18     public StudentDAO(String persistenceName) {
19         cf = new Configuration();
20         cf = cf.configure(persistenceName);
21         sessionFactory = cf.buildSessionFactory();
22     }
23
24     public void save(Student student) {}
41
42     public List<Student> getStudents() {}
57
58     public void delete(Long studentID) {}
73
74     public Student findById(Long studentID) {}
85
86     public void update(Student student) {
87
88         Session session = sessionFactory.openSession();
89         Transaction t = session.beginTransaction();
90         try {
91             session.update(student);
92             t.commit();
93             System.out.println("update saved");
94         } catch (Exception ex) {
95             t.rollback();
96             System.out.println("Error " + ex.getMessage());
97         } finally {
98             sessionFactory.close();
99             session.close();
100         }
101     }
102 }
103 }
```

# 14. Create IStudentRepository



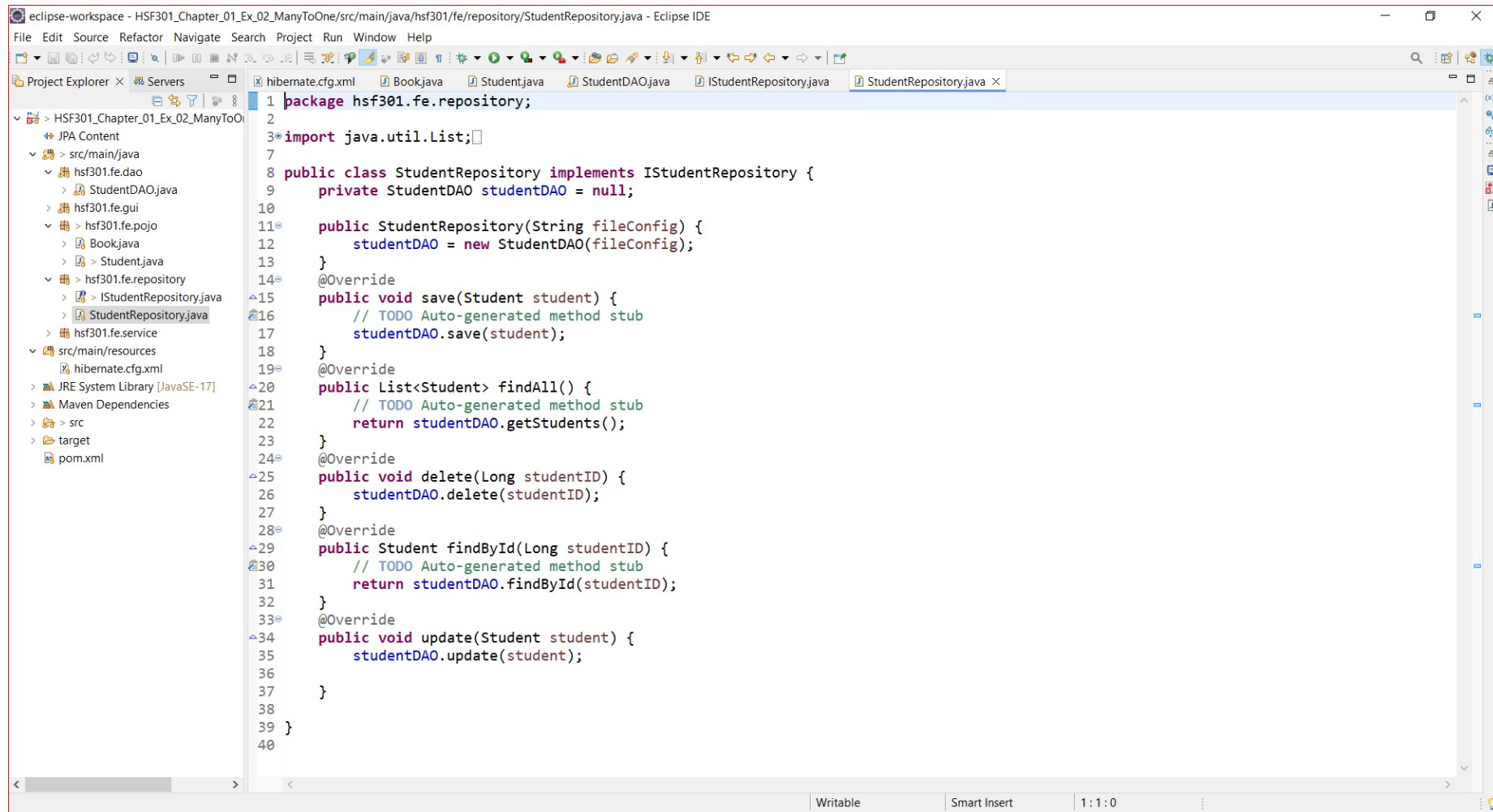
The screenshot shows the Eclipse IDE interface. The Project Explorer on the left displays the project structure, with the file `IStudentRepository.java` selected under the `hsf301.fe.repository` package. The main editor window shows the code for `IStudentRepository.java`, which defines a package, an import, and an interface with five methods.

```

1 package hsf301.fe.repository;
2
3 import java.util.List;
4
5
6
7 public interface IStudentRepository {
8     public List<Student> findAll();
9
10    public void save(Student student);
11
12    public void delete(Long studentID);
13
14    public Student findById(Long studentID);
15
16    public void update(Student student);
17 }
18

```

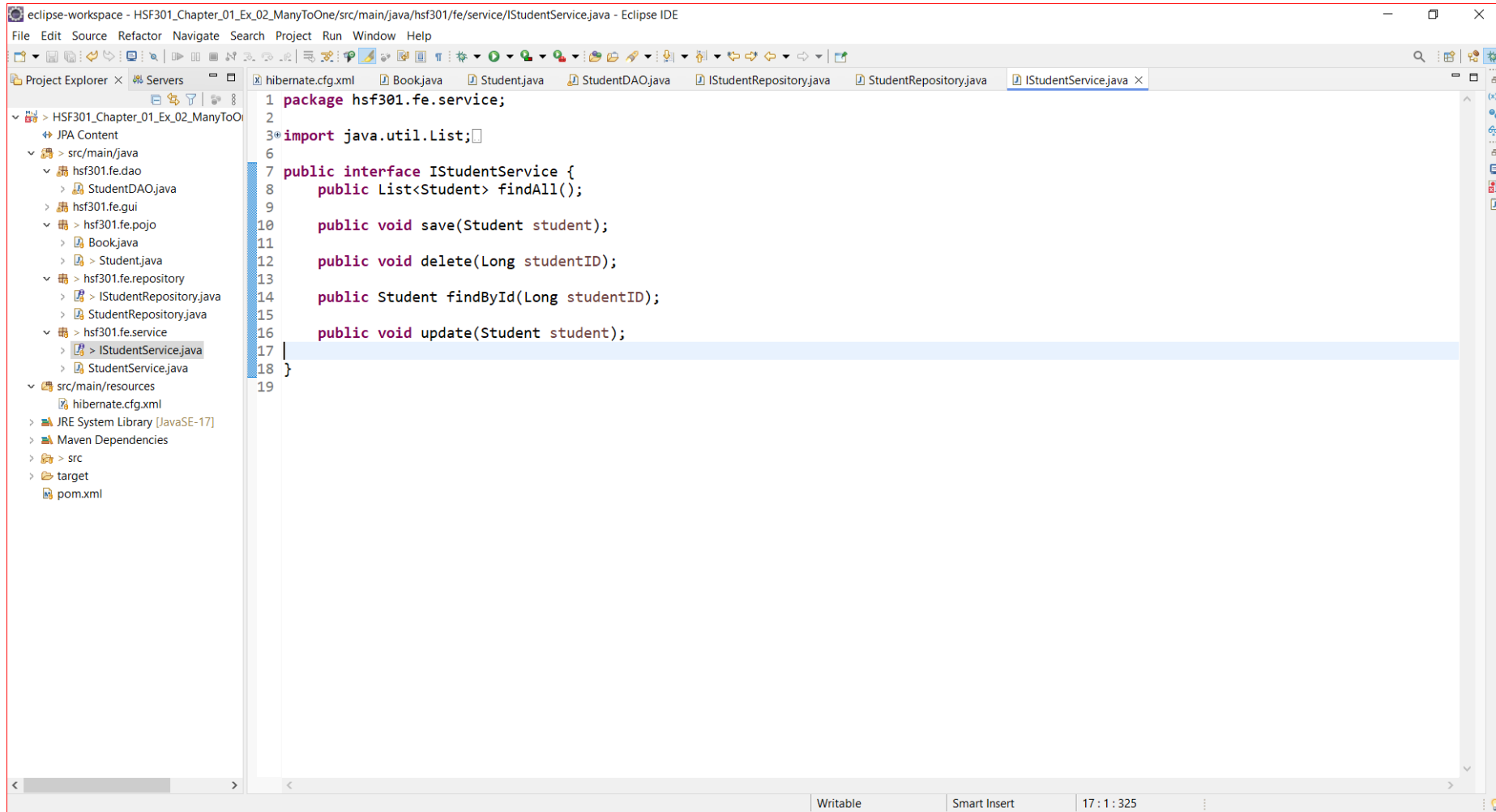
# 15. Create StudentRepository



The screenshot shows the Eclipse IDE interface. The Project Explorer on the left displays the project structure, with the file `StudentRepository.java` selected under the `hsf301.fe.repository` package. The main editor window shows the code for `StudentRepository.java`, which implements the `IStudentRepository` interface. The code includes imports for `java.util.List` and `StudentDAO`, and defines methods for `save`, `findAll`, `delete`, and `findById`. The `save` method is annotated with `@Override` and includes a TODO comment. The `findAll` method is also annotated with `@Override` and includes a TODO comment. The `delete` method is annotated with `@Override` and includes a TODO comment. The `findById` method is annotated with `@Override` and includes a TODO comment. The `update` method is annotated with `@Override` and includes a TODO comment. The code is as follows:

```
1 package hsf301.fe.repository;
2
3 import java.util.List;
4
5 public class StudentRepository implements IStudentRepository {
6     private StudentDAO studentDAO = null;
7
8     public StudentRepository(String fileConfig) {
9         studentDAO = new StudentDAO(fileConfig);
10    }
11
12    @Override
13    public void save(Student student) {
14        // TODO Auto-generated method stub
15        studentDAO.save(student);
16    }
17
18    @Override
19    public List<Student> findAll() {
20        // TODO Auto-generated method stub
21        return studentDAO.getStudents();
22    }
23
24    @Override
25    public void delete(Long studentID) {
26        studentDAO.delete(studentID);
27    }
28
29    @Override
30    public Student findById(Long studentID) {
31        // TODO Auto-generated method stub
32        return studentDAO.findById(studentID);
33    }
34
35    @Override
36    public void update(Student student) {
37        studentDAO.update(student);
38    }
39 }
40
```

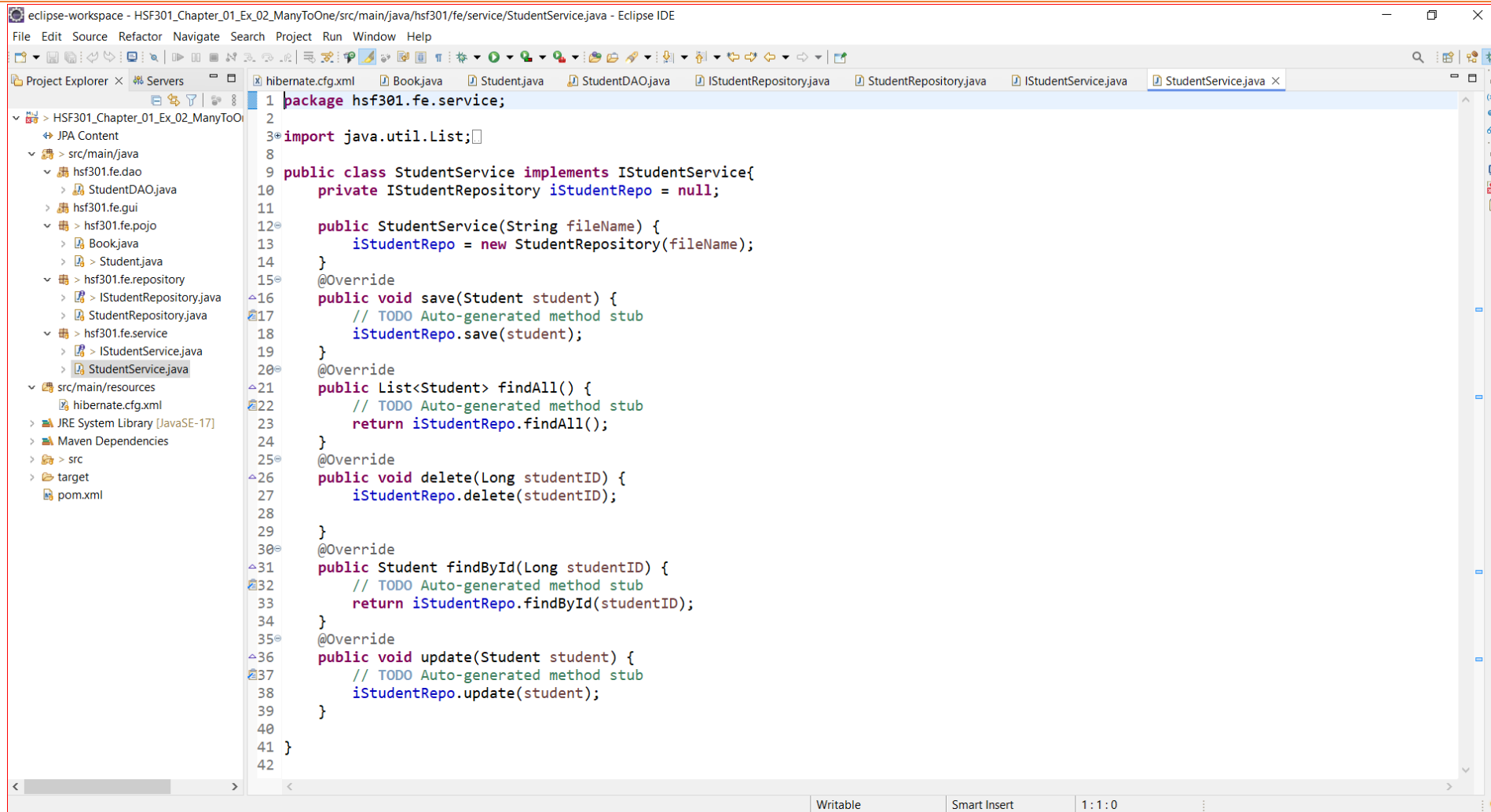
## 16. Create IStudentService



The screenshot shows the Eclipse IDE interface. The Project Explorer on the left displays the project structure, with the file `IStudentService.java` selected under the `hsf301.fe.service` package. The main editor window shows the code for `IStudentService.java`. The code defines a package `hsf301.fe.service`, imports `java.util.List`, and declares an interface `IStudentService` with five methods: `findAll()`, `save()`, `delete()`, `findById()`, and `update()`.

```
1 package hsf301.fe.service;
2
3 import java.util.List;
4
5
6
7 public interface IStudentService {
8     public List<Student> findAll();
9
10    public void save(Student student);
11
12    public void delete(Long studentID);
13
14    public Student findById(Long studentID);
15
16    public void update(Student student);
17 }
18
19
```

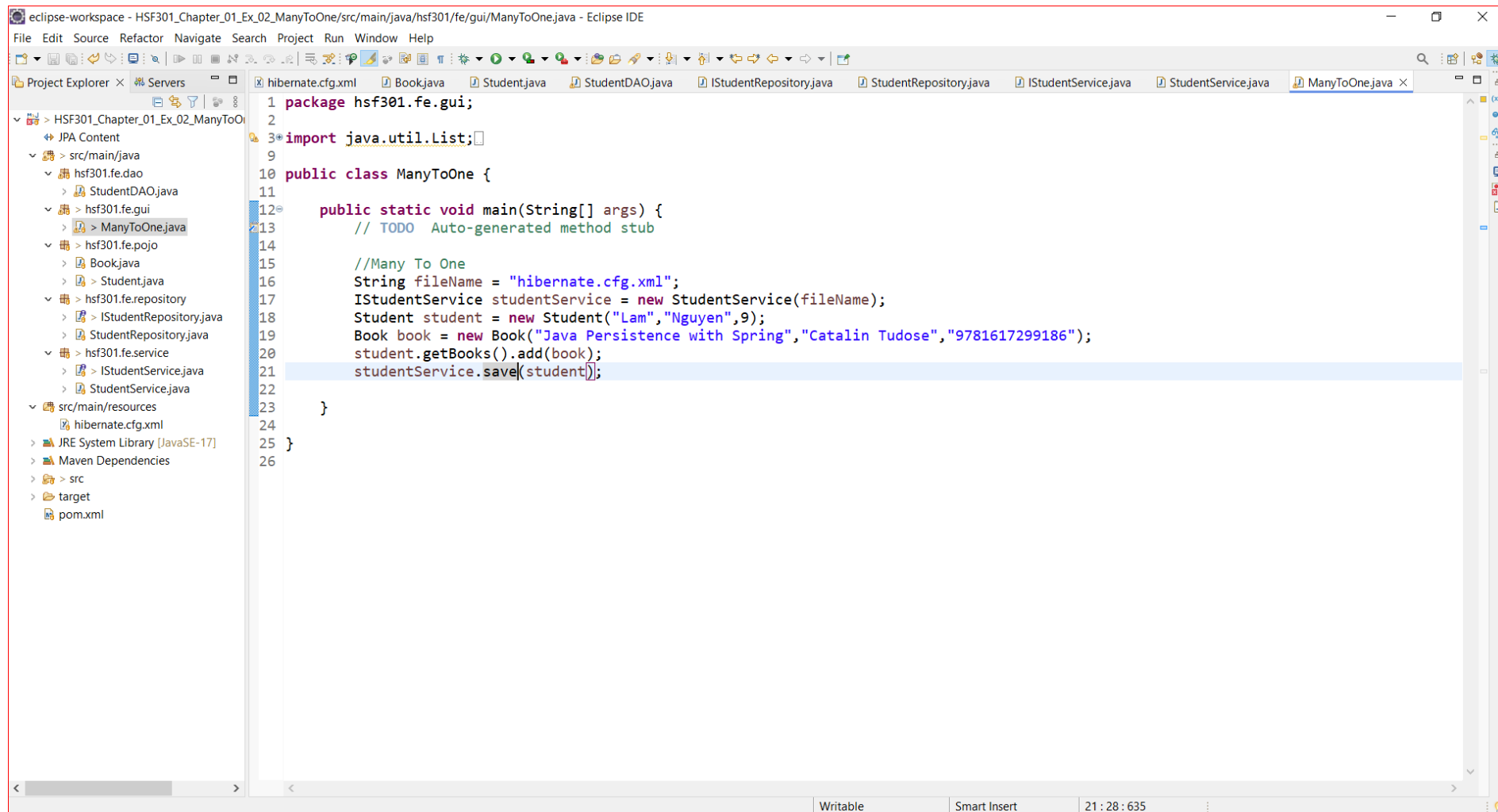
# 17. Create StudentService



```
1 package hsf301.fe.service;
2
3 import java.util.List;
4
5
6
7
8
9 public class StudentService implements IStudentService{
10     private IStudentRepository iStudentRepo = null;
11
12     public StudentService(String fileName) {
13         iStudentRepo = new StudentRepository(fileName);
14     }
15     @Override
16     public void save(Student student) {
17         // TODO Auto-generated method stub
18         iStudentRepo.save(student);
19     }
20     @Override
21     public List<Student> findAll() {
22         // TODO Auto-generated method stub
23         return iStudentRepo.findAll();
24     }
25     @Override
26     public void delete(Long studentID) {
27         iStudentRepo.delete(studentID);
28     }
29
30     @Override
31     public Student findById(Long studentID) {
32         // TODO Auto-generated method stub
33         return iStudentRepo.findById(studentID);
34     }
35     @Override
36     public void update(Student student) {
37         // TODO Auto-generated method stub
38         iStudentRepo.update(student);
39     }
40 }
41
42
```



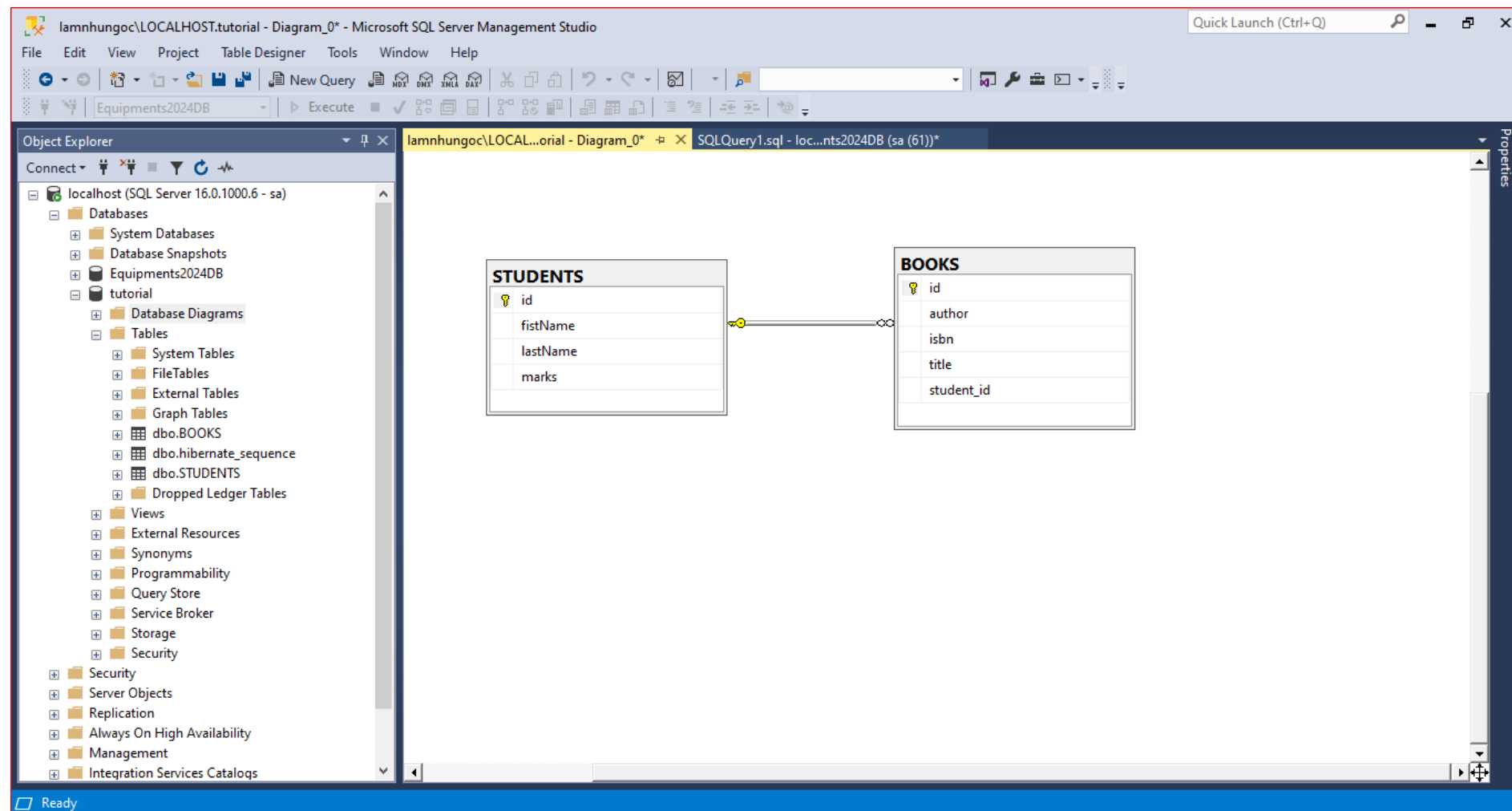
# 18. Create Main function



The screenshot shows the Eclipse IDE interface. The Project Explorer on the left displays the project structure, with the file `ManyToOne.java` selected under the `hsf301.fe.gui` package. The main editor window shows the code for `ManyToOne.java`. The code defines a package, imports `java.util.List`, and creates a `ManyToOne` class with a `main` method. The `main` method initializes a `StudentService`, creates a `Student` object, adds a `Book` to its list of books, and saves the student.

```
1 package hsf301.fe.gui;
2
3 import java.util.List;
4
5
6
7
8
9
10 public class ManyToOne {
11
12     public static void main(String[] args) {
13         // TODO Auto-generated method stub
14
15         //Many To One
16         String fileName = "hibernate.cfg.xml";
17         IStudentService studentService = new StudentService(fileName);
18         Student student = new Student("Lam", "Nguyen", 9);
19         Book book = new Book("Java Persistence with Spring", "Catalin Tudose", "9781617299186");
20         student.getBooks().add(book);
21         studentService.save(student);
22     }
23 }
24
25
26
```

# 19. Result





# 20. Result

SQLQuery1.sql - localhost.tutorial (sa (53)) - Microsoft SQL Server Management Studio

File Edit View Query Project Tools Window Help

tutorial

Execute

100 %

Results

Messages

localhost (SQL Server 16.0.1000.6 - sa)

Databases

System Databases

Database Snapshots

Equipments2024DB

tutorial

Database Diagrams

Tables

System Tables

FileTables

External Tables

Graph Tables

dbo.BOOKS

dbo.hibernate\_sequence

dbo.STUDENTS

Dropped Ledger Tables

Views

External Resources

Synonyms

Programmability

Query Store

Service Broker

Storage

Security

Security

Server Objects

Replication

Always On High Availability

Management

Integration Services Catalogs

SQLQuery1.sql - loca...st.tutorial (sa (53))

SELECT TOP (1000) [id]  
,[author]  
,[isbn]  
,[title]  
,[student\_id]  
FROM [tutorial].[dbo].[BOOKS]

id

author

isbn

title

student\_id

1

Catalin Tudose

9781617299186

Java Persistence with Spring

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Query executed successfully.

SQLQuery2.sql - localhost.tutorial (sa (62)) - Microsoft SQL Server Management Studio

File Edit View Query Project Tools Window Help

tutorial

Execute

100 %

Results

Messages

localhost (SQL Server 16.0.1000.6 - sa)

Databases

System Databases

Database Snapshots

Equipments2024DB

tutorial

Database Diagrams

Tables

System Tables

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External Tables

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dbo.BOOKS

dbo.hibernate\_sequence

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Dropped Ledger Tables

Views

External Resources

Synonyms

Programmability

Query Store

Service Broker

Storage

Security

Security

Server Objects

Replication

Always On High Availability

Management

Integration Services Catalogs

SQLQuery2.sql - loca...st.tutorial (sa (62))

SQLQuery1.sql - loca...st.tutorial (sa (53))

SELECT TOP (1000) [id]  
,[firstName]  
,[lastName]  
,[marks]  
FROM [tutorial].[dbo].[STUDENTS]

id

firstName

lastName

marks

1

Lam

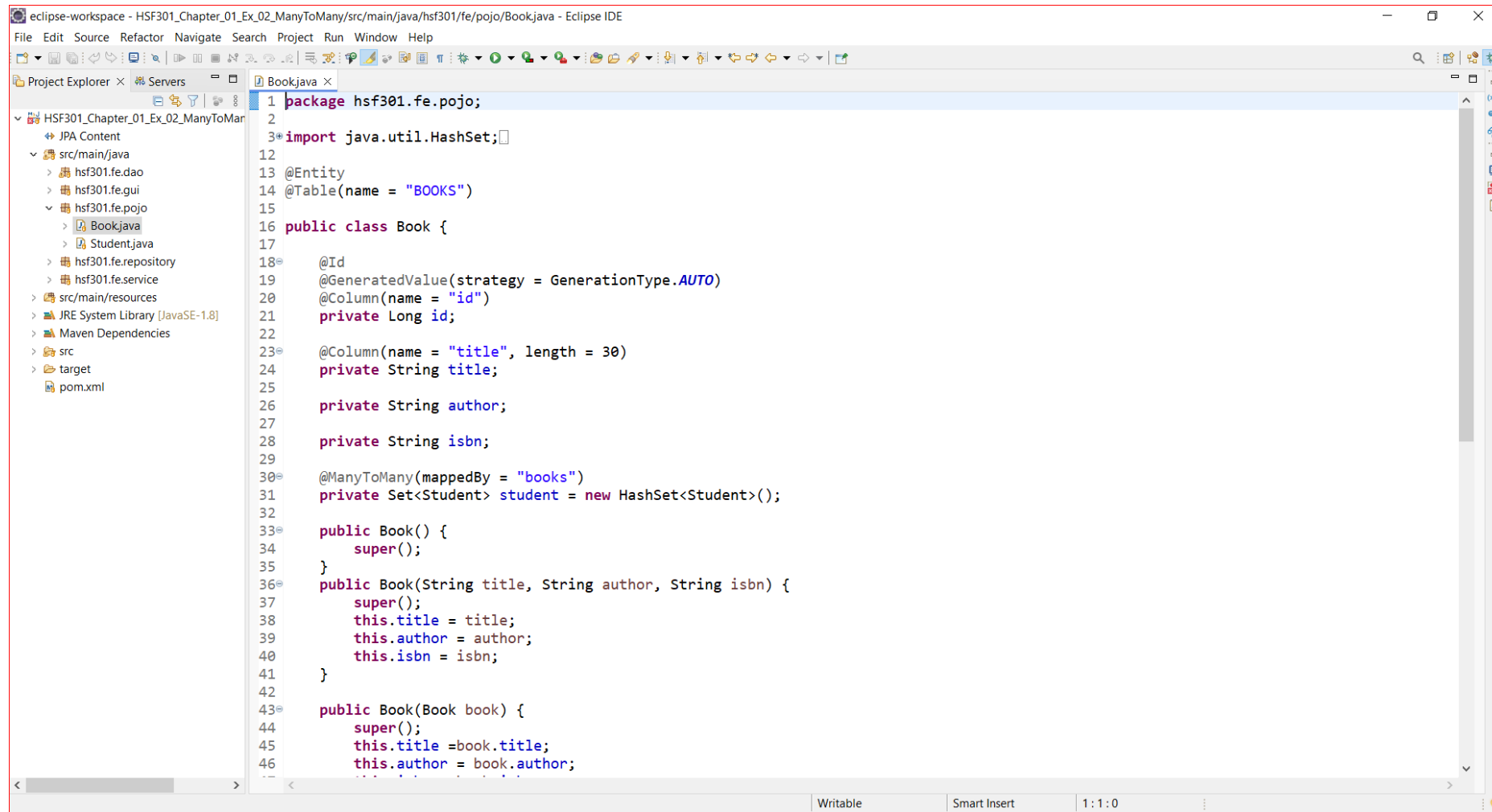
Nguyen

9

Query executed successfully.

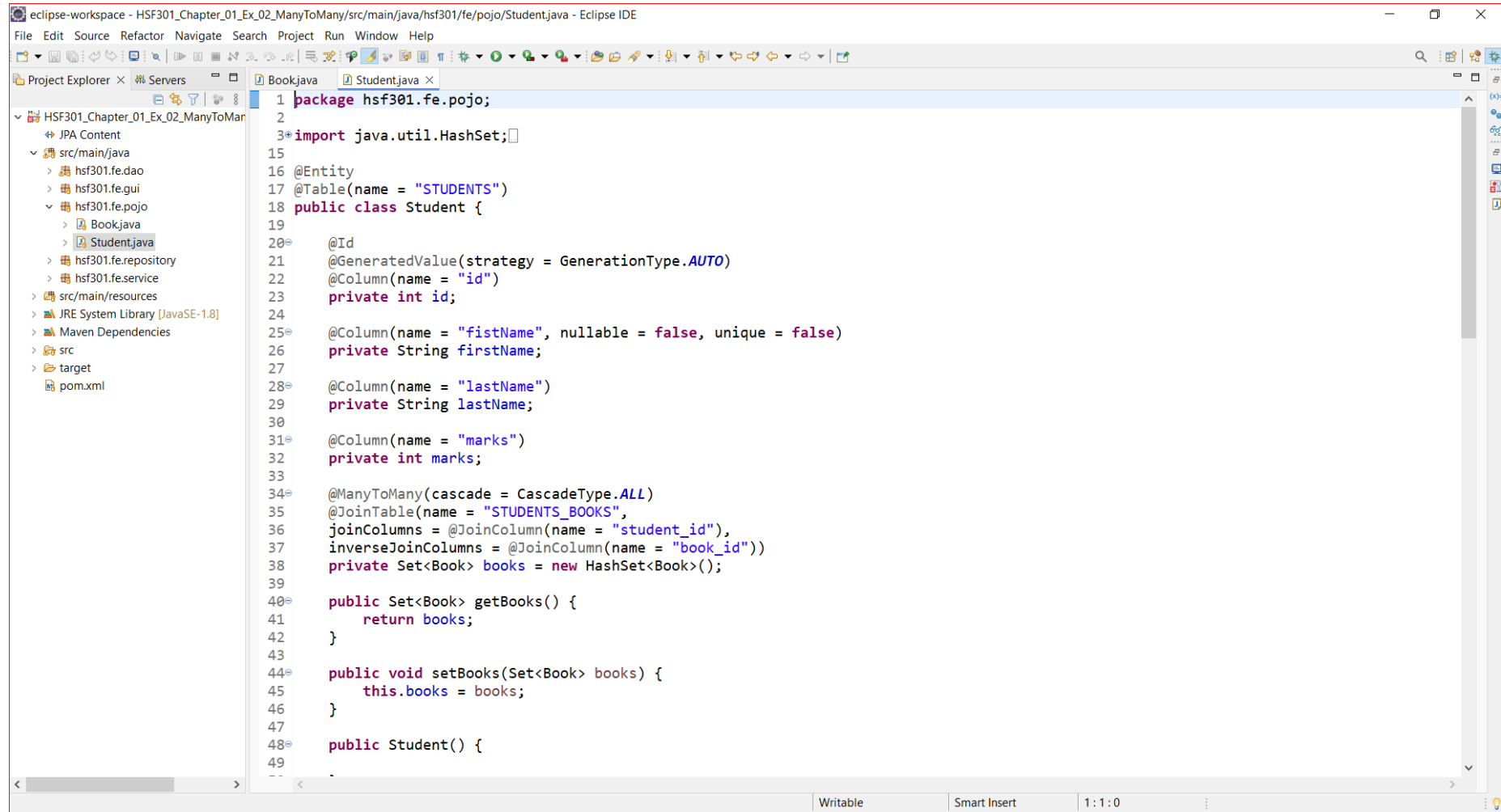
# Demo JPA (Many To Many)

# 1. Create Books in Pojo's Package



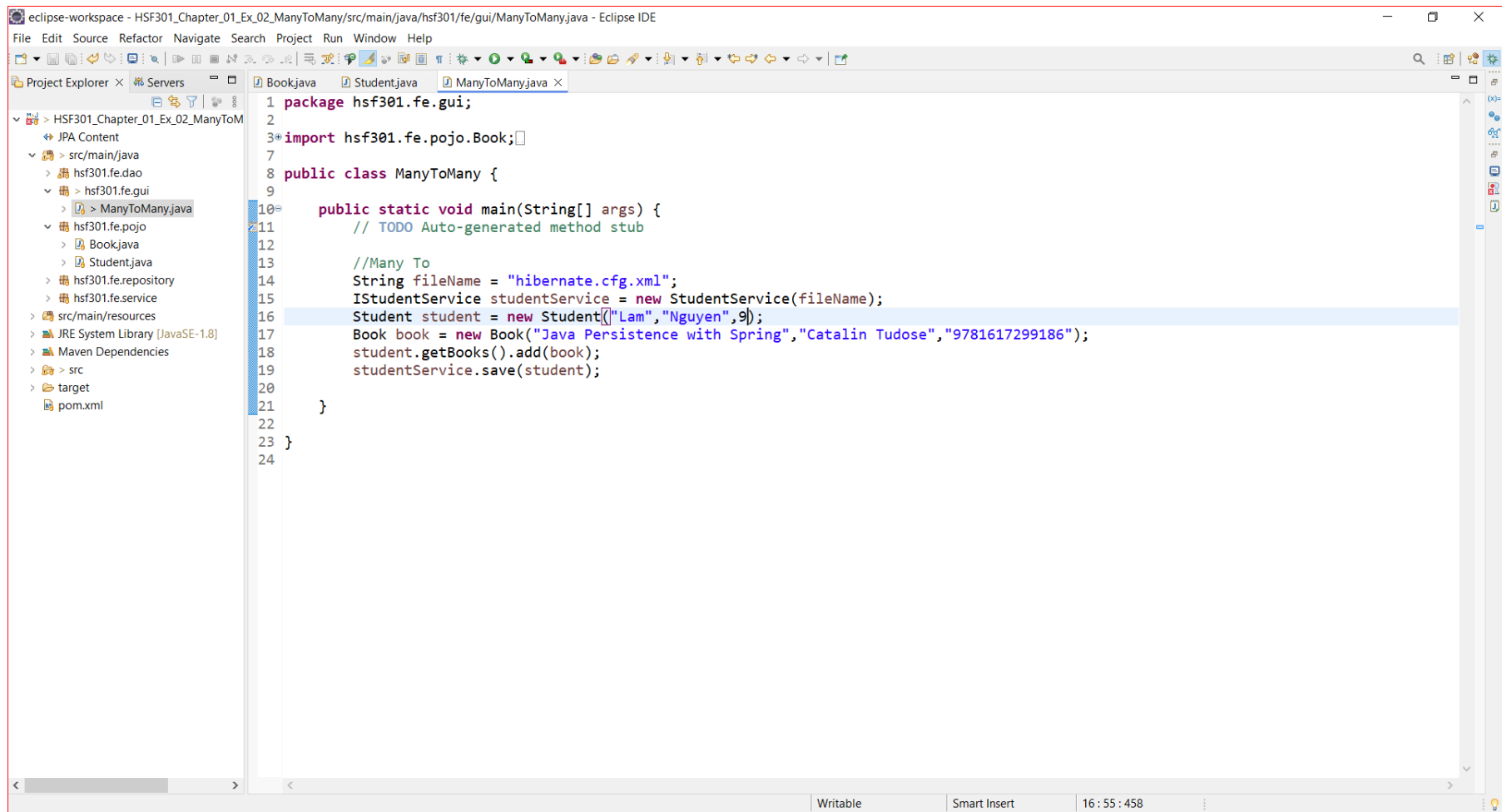
```
1 package hsf301.fe.pojo;
2
3 import java.util.HashSet;
4
5
6
7
8
9
10
11
12 @Entity
13 @Table(name = "BOOKS")
14
15
16 public class Book {
17
18     @Id
19     @GeneratedValue(strategy = GenerationType.AUTO)
20     @Column(name = "id")
21     private Long id;
22
23     @Column(name = "title", length = 30)
24     private String title;
25
26     private String author;
27
28     private String isbn;
29
30     @ManyToMany(mappedBy = "books")
31     private Set<Student> student = new HashSet<Student>();
32
33     public Book() {
34         super();
35     }
36
37     public Book(String title, String author, String isbn) {
38         super();
39         this.title = title;
40         this.author = author;
41         this.isbn = isbn;
42     }
43
44     public Book(Book book) {
45         super();
46         this.title = book.title;
47         this.author = book.author;
```

## 2. Create Students in Pojo's Package



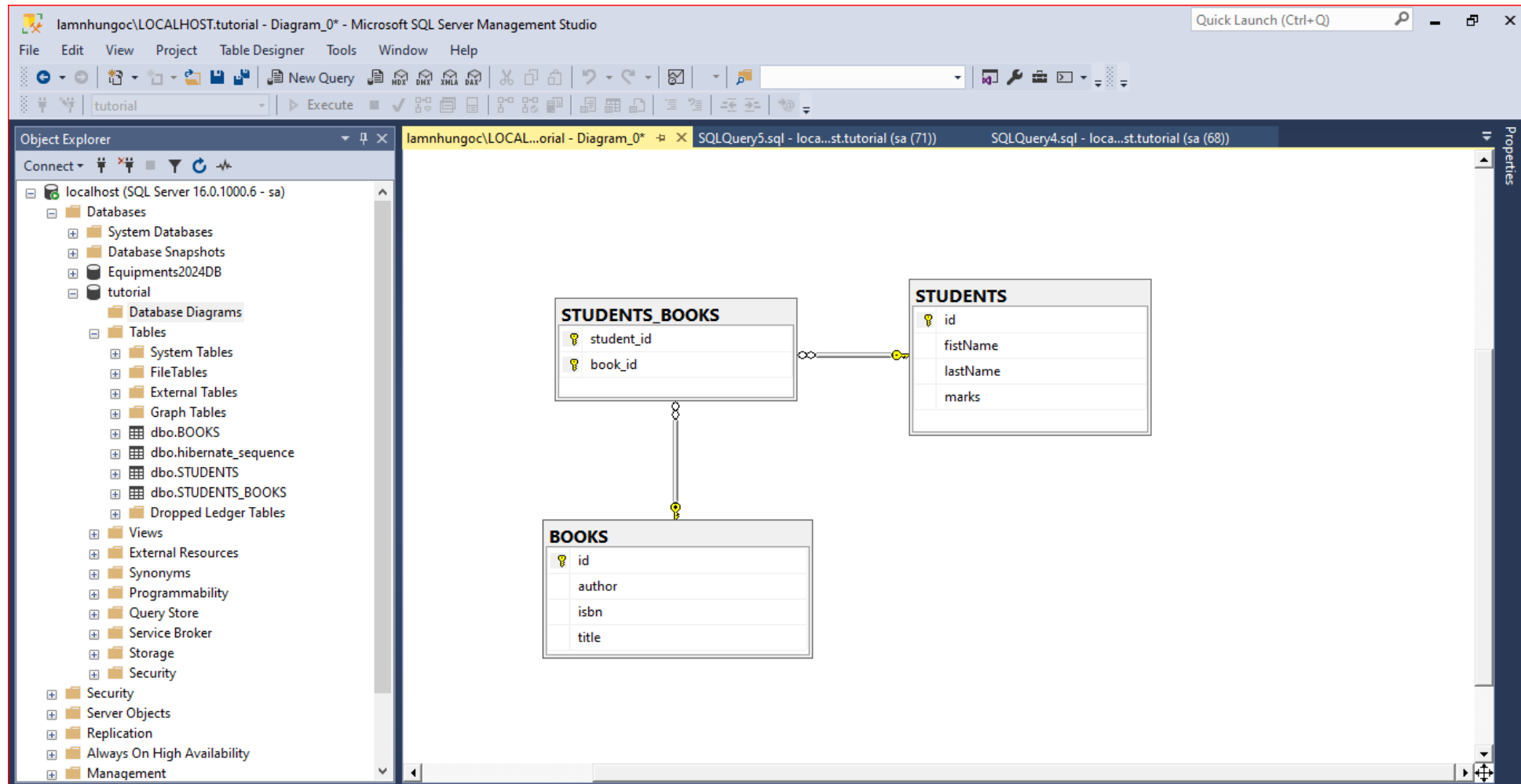
```
1 package hsf301.fe.pojo;
2
3 import java.util.HashSet;
4
5
6
7
8
9
10
11
12
13
14
15
16 @Entity
17 @Table(name = "STUDENTS")
18 public class Student {
19
20     @Id
21     @GeneratedValue(strategy = GenerationType.AUTO)
22     @Column(name = "id")
23     private int id;
24
25     @Column(name = "firstName", nullable = false, unique = false)
26     private String firstName;
27
28     @Column(name = "lastName")
29     private String lastName;
30
31     @Column(name = "marks")
32     private int marks;
33
34     @ManyToMany(cascade = CascadeType.ALL)
35     @JoinTable(name = "STUDENTS_BOOKS",
36         joinColumns = @JoinColumn(name = "student_id"),
37         inverseJoinColumns = @JoinColumn(name = "book_id"))
38     private Set<Book> books = new HashSet<Book>();
39
40     public Set<Book> getBooks() {
41         return books;
42     }
43
44     public void setBooks(Set<Book> books) {
45         this.books = books;
46     }
47
48     public Student() {
49
50     }
51 }
```

# 3. Run Program



```
1 package hsf301.fe.gui;
2
3 import hsf301.fe.pojo.Book;
4
5 public class ManyToMany {
6
7     public static void main(String[] args) {
8         // TODO Auto-generated method stub
9
10        //Many To
11        String fileName = "hibernate.cfg.xml";
12        IStudentService studentService = new StudentService(fileName);
13        Student student = new Student("Lam", "Nguyen", 9);
14        Book book = new Book("Java Persistence with Spring", "Catalin Tudose", "9781617299186");
15        student.getBooks().add(book);
16        studentService.save(student);
17    }
18 }
19
20
21
22
23
24
```

## 4. Result



# 5. Result

SQLQuery1.sql - localhost:tutorial (sa (53)) - Microsoft SQL Server Management Studio

localhost (SQL Server 16.0.1000.6 - sa)

Databases

System Databases

Database Snapshots

Equipments2024DB

tutorial

Database Diagrams

Tables

System Tables

FileTables

External Tables

Graph Tables

dbo.BOOKS

dbo.hibernate\_sequence

dbo.STUDENTS

dbo.STUDENTS\_BOOKS

Dropped Ledger Tables

Views

External Resources

Synonyms

Programmability

Query Store

Service Broker

Storage

Security

Security

Server Objects

Replication

Always On High Availability

Management

Integration Services Catalogs

```

SELECT TOP (1000) [id]
      ,[author]
      ,[isbn]
      ,[title]
      ,[student_id]
FROM [tutorial].[dbo].[BOOKS]

```

100 %

Results Messages

|   | id | author         | isbn          | title                        | student_id |
|---|----|----------------|---------------|------------------------------|------------|
| 1 | 2  | Catalin Tudose | 9781617299186 | Java Persistence with Spring | 1          |

Query executed successfully.

localhost (16.0 RTM) | sa (53) | tutorial | 00:00:00 | 1 rows

SQLQuery8.sql - localhost:tutorial (sa (72)) - Microsoft SQL Server Management Studio

localhost (SQL Server 16.0.1000.6 - sa)

Databases

System Databases

Database Snapshots

Equipments2024DB

tutorial

Database Diagrams

Tables

System Tables

FileTables

External Tables

Graph Tables

dbo.BOOKS

dbo.hibernate\_sequence

dbo.STUDENTS

dbo.STUDENTS\_BOOKS

Dropped Ledger Tables

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Security

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Management

Integration Services Catalogs

```

SELECT TOP (1000) [student_id]
      ,[book_id]
FROM [tutorial].[dbo].[STUDENTS_BOOKS]

```

100 %

Results Messages

|   | student_id | book_id |
|---|------------|---------|
| 1 | 1          | 2       |

Query executed successfully.

localhost (16.0 RTM) | sa (72) | tutorial | 00:00:00 | 1 rows

SQLQuery7.sql - localhost:tutorial (sa (64)) - Microsoft SQL Server Management Studio

localhost (SQL Server 16.0.1000.6 - sa)

Databases

System Databases

Database Snapshots

Equipments2024DB

tutorial

Database Diagrams

Tables

System Tables

FileTables

External Tables

Graph Tables

dbo.BOOKS

dbo.hibernate\_sequence

dbo.STUDENTS

dbo.STUDENTS\_BOOKS

Dropped Ledger Tables

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Security

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Replication

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Management

Integration Services Catalogs

```

FROM [tutorial].[dbo].[STUDENTS]

```

100 %

Results Messages

|   | id | firstName | lastName | marks |
|---|----|-----------|----------|-------|
| 1 | 1  | Lam       | Nguyen   | 9     |

Query executed successfully.

localhost (16.0 RTM) | sa (62) | tutorial | 00:00:00 | 1 rows



# Summary

- ❖ Concepts were introduced:
  - ❖ Overview about Hibernate
  - ❖ Architecture Overview new features of Hibernate
  - ❖ Explain and demo using Eclipse IDE to create Hibernate Console
  - ❖ Create and Run cross-platform Console application with Java connect to MSSQL with Repository Pattern