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Java

Java Persistence API

Objectives

- Explain what JPA is and its role in data persistence for Java applications.
- Highlight the advantages of using JPA over traditional JDBC approaches.
- Define and illustrate core JPA concepts like entities, annotations, persistence context, entity manager and JPQL.
- Provide a clear understanding of how these components work together to manage data.
- Show how JPA simplifies development by reducing boilerplate code and allo wing focus on business logic.

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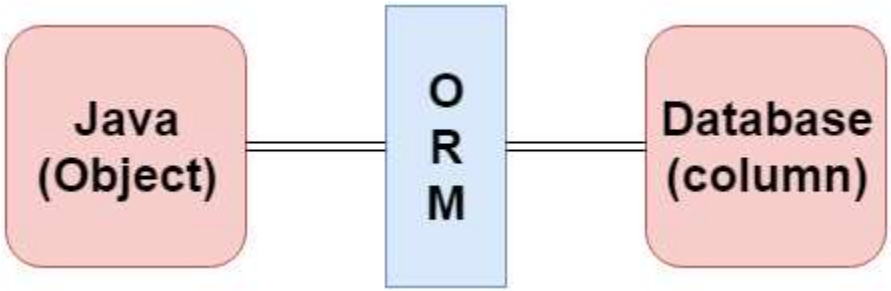
Contents

- Introduction
- Key Concepts
- Annotations
- Relationships
- Using JPA
- Demo
- Advantages and Disadvantages

Object Relational Mapping (ORM)

JPA Object Relational Mapping

- ORM makes it easier to work with databases in object-oriented applications, allowing you to focus on the business logic rather than the underlying data storage details.



Benefits of ORM

- **Increased Productivity:** You write less code because ORM handles the low-level data access tasks.
- **Improved Maintainability:** Your code is cleaner and easier to understand because it focuses on the business logic, not database details.
- **Enhanced Performance:** ORM frameworks can optimize data access and caching, potentially improving performance.
- **Database Independence:** You can switch databases without rewriting your a pplication code (to some extent)

Popular ORM Frameworks for Java

- **Hibernate:** The most widely used JPA implementation, offering a rich feature set and extensive customization options.
- **EclipseLink:** Another JPA implementation with a focus on standards complia nce and portability.
- **Spring Data JPA:** An abstraction layer on top of JPA providers, simplifying d ata access and reducing boilerplate code.
- **DataNucleus** providing easy persistence to RDBMS datastores. Comes with its own "SQL-like" JPQL query language, so you query your data in a language similar to what your datastore understands.

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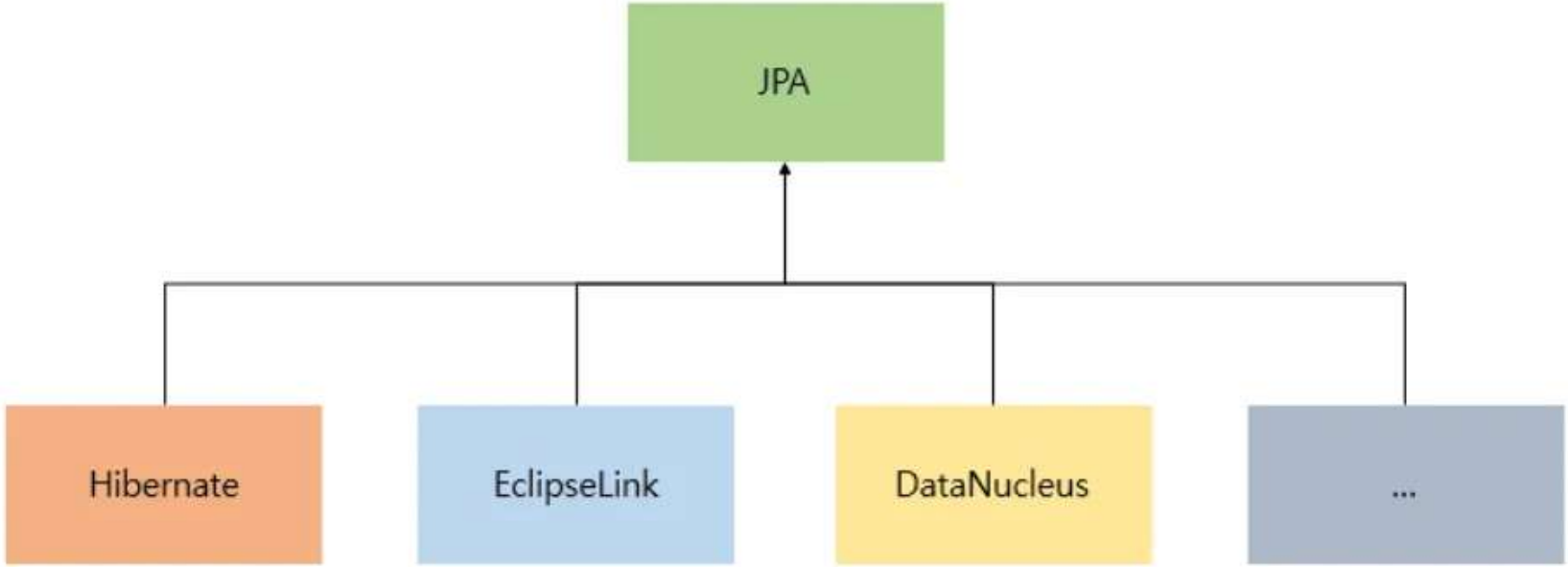
Java

Java Persistence API (JPA)

JPA Versions and Key Features

JPA Version	Release Year	Key Features
JPA 1.0	2006	Core ORM functionality: entities, mappings, relationships, inheritance, JPQL, EntityManager
JPA 2.0	2009	Enums, Criteria API, embeddable collections, derived properties, validation, metamodel
JPA 2.1	2013	Entity graphs, converters, stored procedures, Java 8 date/time
JPA 2.2	2019	Streamlined bootstrap, Java 9 modules
JPA 3.0	2022	Renamed to Jakarta Persistence, Java records, Java 17 support

JPA Implementation Options



What is JPA ?

- JPA stands for Java Persistence API. It is a Java programming interface that allows developers to manage relational data in Java applications using object oriented methodologies.
- JPA is a specification for managing relational data in Java applications. It provides a set of interfaces, annotations, and an object relational mapping (ORM) framework that simplifies the process of interacting with databases.

Key Feature of JPA

- **ORM**: JPA allows you to map Java objects (entities) to relational database tables, abstracting away the differences between the object-oriented and relational models.
- **Annotations**: You can use annotations to define entities, relationships and other persistence related metadata.
- **EntityManager**: The interface provides methods for persisting, retrieving, updating, and deleting entities.
- **JPQL** is an object oriented query language that allows you to query entities and their relationships.
- **Transaction Management**: JPA supports transaction management, ensuring data integrity and consistency.

Benefits of Using JPA

- **Simplified Data Access:** JPA makes it easier to work with relational data in Ja va applications by providing a higher-level abstraction.
- **Code Portability:** JPA is a standard specification, so code written using JPA can be portable across different JPA providers.
- **Reduced Boilerplate Code:** JPA annotations and the EntityManager interface reduce the amount of code needed for data access.
- **Improved Data Integrity:** JPA's transaction management and validation features help ensure data integrity.
- **Enhanced Performance:** Caching and other optimization techniques can improve the performance of JPA applications.

Entity Annotations in JPA

- **@Entity**: This annotation marks a Java class as an entity, meaning it represents a table in the database.
- **@Table:** This annotation allows you to specify the name of the database table that an entity maps to.
- **@Transient:** This annotation marks a property that should not be persisted to the database.
- **@NamedQueries and @NamedQuery:** These annotations allow you to define named queries that can be used to retrieve entities.

Mapping Annotations in JPA

- **@Id**: This annotation marks a Java class as an entity, meaning it represents a table in the database.
- **@Column:** This annotation defines the mapping between a property of an entity and a column in the database table. You can use it to specify the column name, data type, and other attributes.
- **@Basic:** This annotation specifies that a property is a basic type and should be persisted.
- **@Enumerated:** This annotation is used to map an Enum type to a database column.

JPA Entity Manager

- The entity manager implements the API and encapsulates all of them within a single interface.
  - **Manages entity lifecycle:** Persist, find, merge, remove
  - **Controls persistence context:** Cache, flush, detach
  - **Executes queries:** JPQL, Criteria API
  - **Handles transactions:** Begin, commit, rollback
  - **Provides access to entity metadata**

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Key Operations of the Entity Manager

- **Persisting Entities:** *em.persist(entity)* makes a transient entity instance persistent
- **Finding Entities:** *em.find(entityClass,primaryKey)* retrieves an entity by its primary key.
- **Merging Entities:** *em.merge(entity)* merges a detached entity instance into the current persistence context.
- **Removing Entities:** *em.remove(entity)* removes a persistent entity instance.
- **Querying Data:** *em.createQuery(jpqlString)* creates a JPQL query to retrieve entities based on specified criteria.

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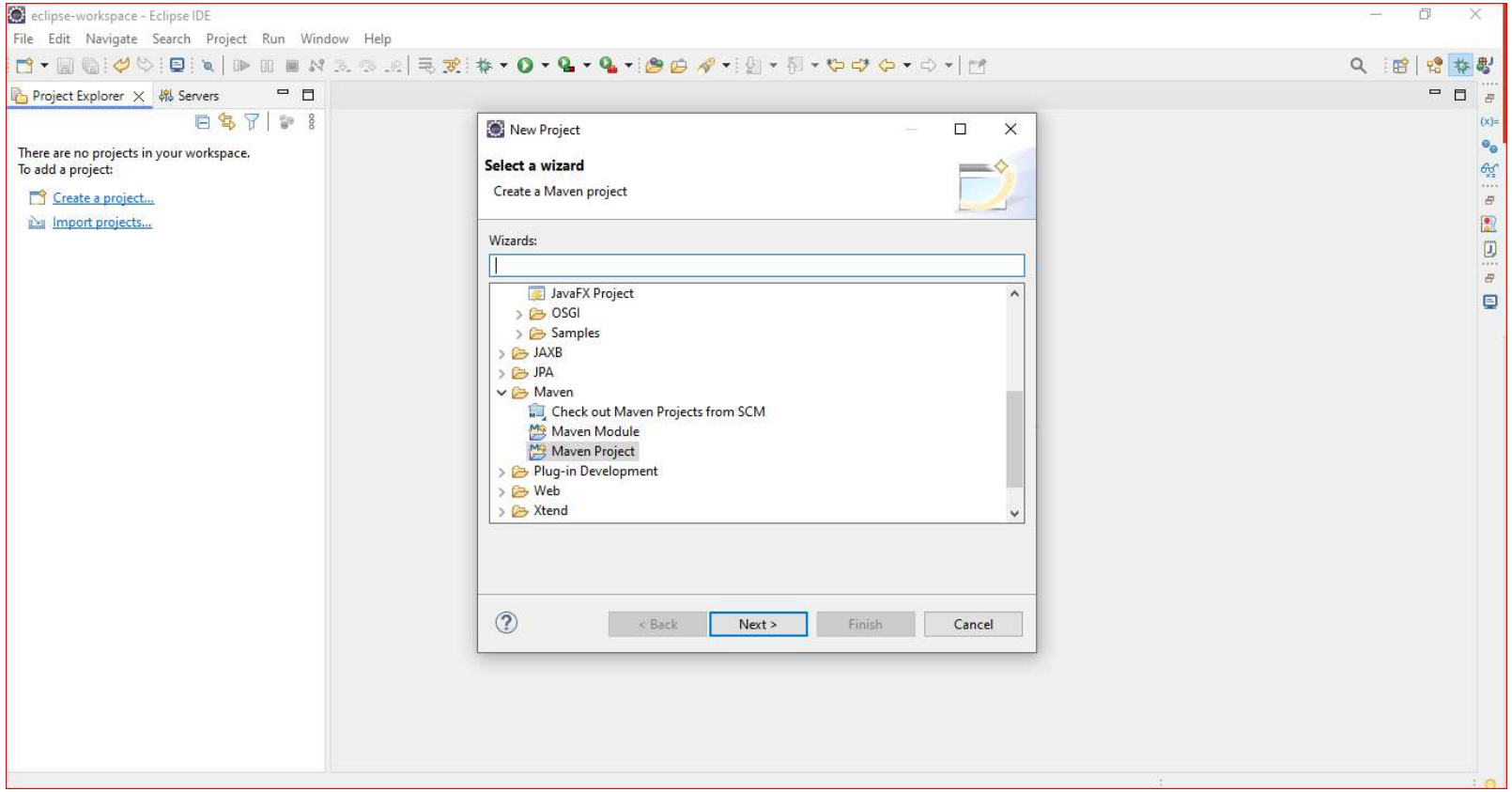
Java

Demo Simple CRUD with JPA

1. Open Eclipse, File | New | Maven Project



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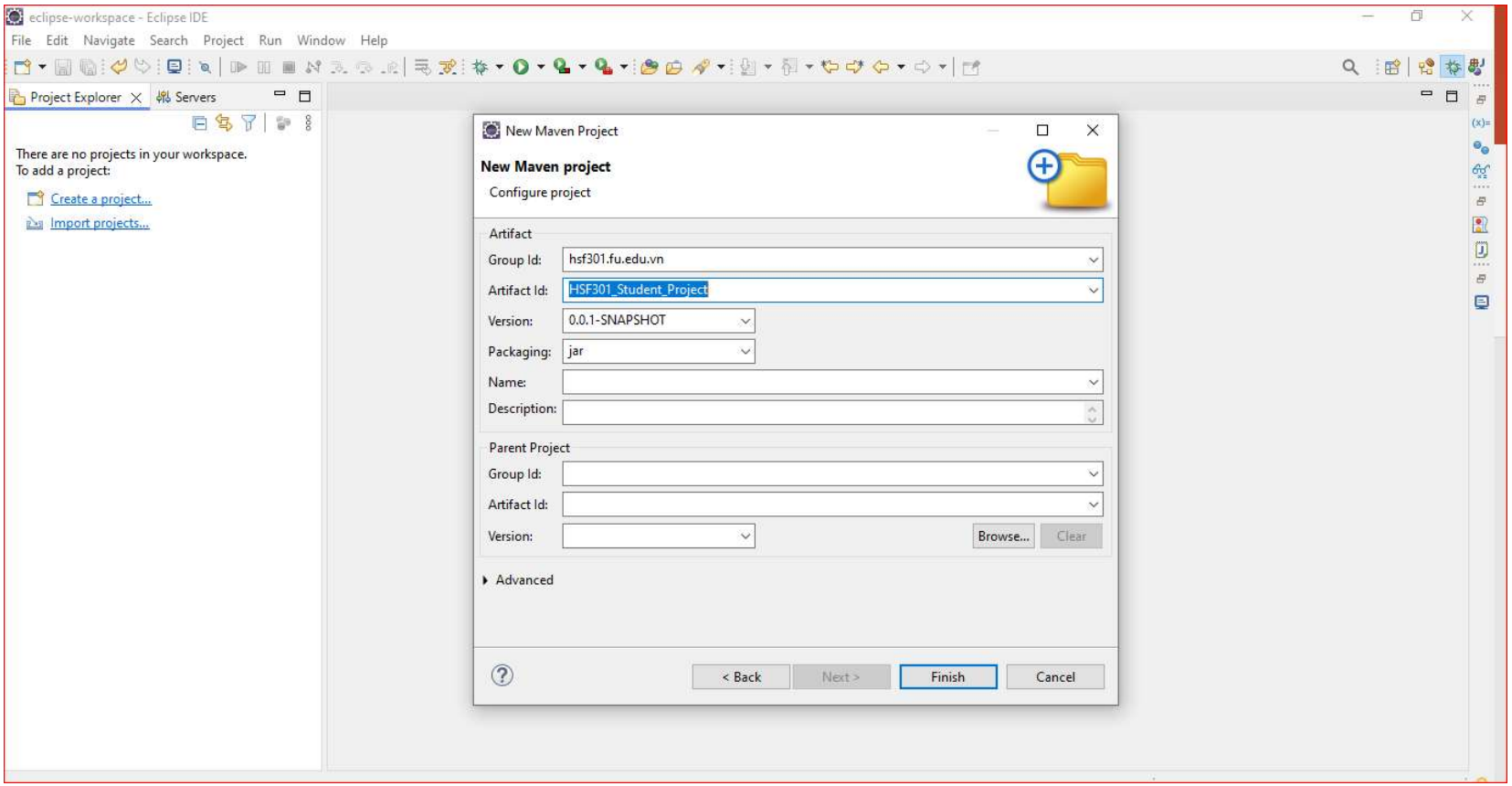
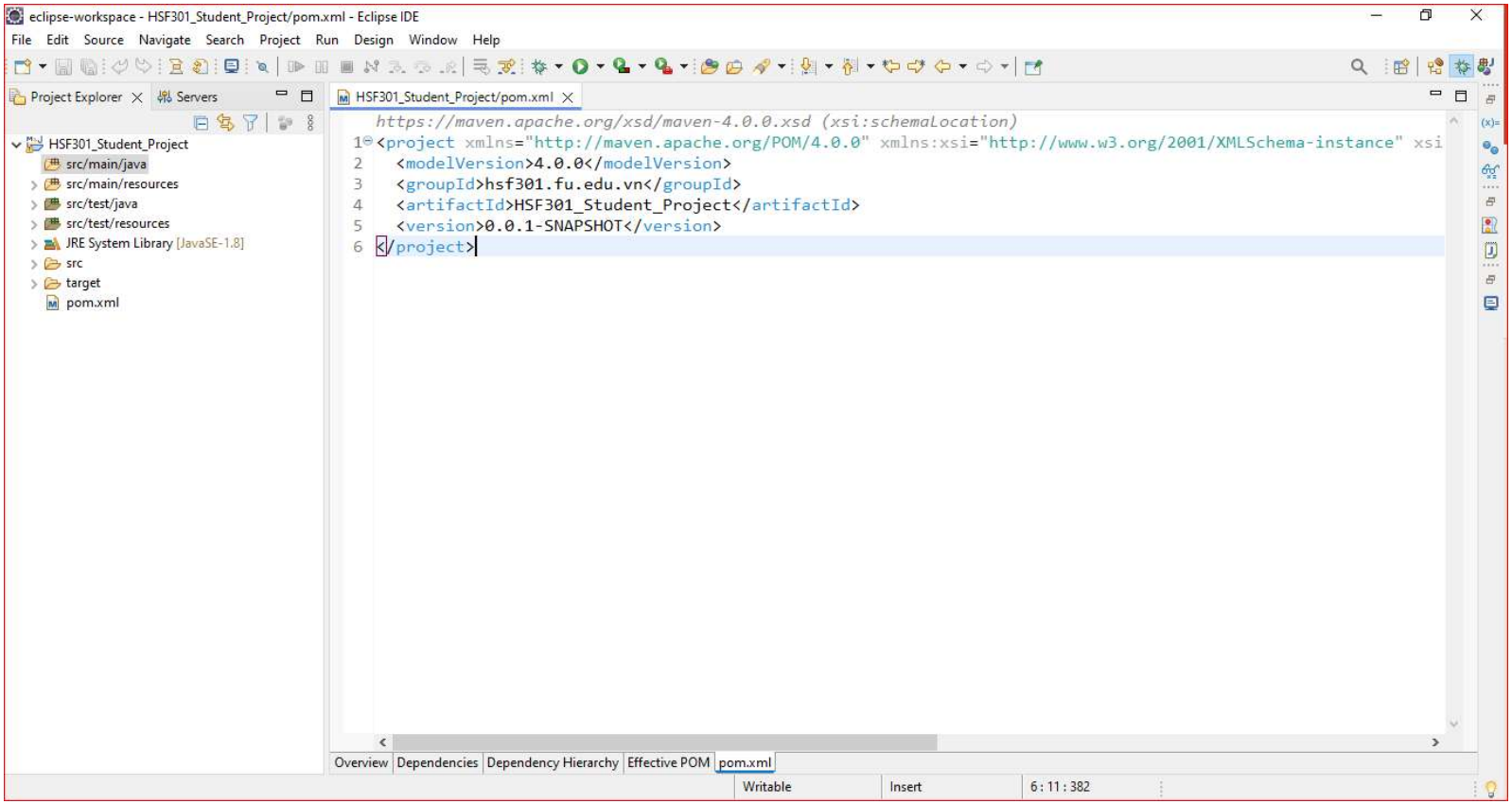
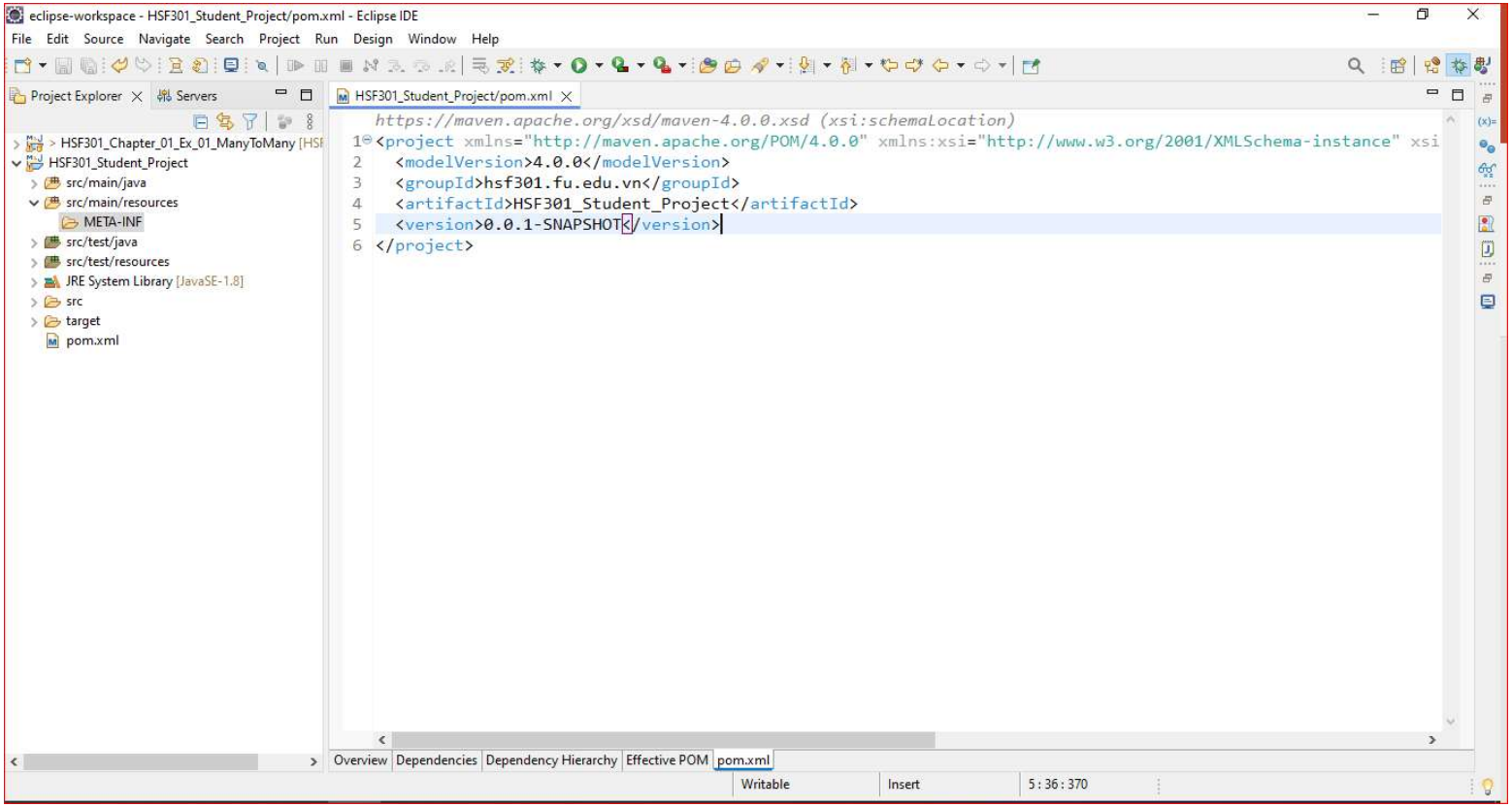
2. Check Create a simple project -> Browse Project -> Next



3. The New Project



4. Create folder META-INF in src/main/resources



5. Edit the pom.xml

eclipse-workspace - HSF301_Student_Project/pom.xml - Eclipse IDE

File Edit Source Navigate Search Project Run Design Window Help

Project Explorer | Servers

- HSF301_Chapter_01_Ex_01_ManyToMany [HSF301 main]
- HSF301_Student_Project
  - src/main/java
  - src/main/resources
    - META-INF
  - src/test/java
  - src/test/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

HSF301_Student_Project/pom.xml

```
  https://maven.apache.org/xsd/maven-4.0.0.xsd (xsi:schemaLocation)
1 <project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instan
2   <modelVersion>4.0.0</modelVersion>
3   <groupId>hsf301.fu.edu.vn</groupId>
4   <artifactId>HSF301_Student_Project</artifactId>
5   <version>0.0.1-SNAPSHOT</version>
6   <dependencies>
7     <dependency>
8         <groupId>org.eclipse.persistence</groupId>
9         <artifactId>javax.persistence</artifactId>
10        <version>2.2.0</version>
11    </dependency>
12    <dependency>
13        <groupId>org.hibernate</groupId>
14        <artifactId>hibernate-entitymanager</artifactId>
15        <version>5.6.9.Final</version>
16    </dependency>
17    <dependency>
18      <groupId>com.microsoft.sqlserver</groupId>
19      <artifactId>mssql-jdbc</artifactId>
20      <version>11.2.3.jre17</version>
21    </dependency>
22  </dependencies>
23 </project>
```

Overview | Dependencies | Dependency Hierarchy | Effective POM | pom.xml

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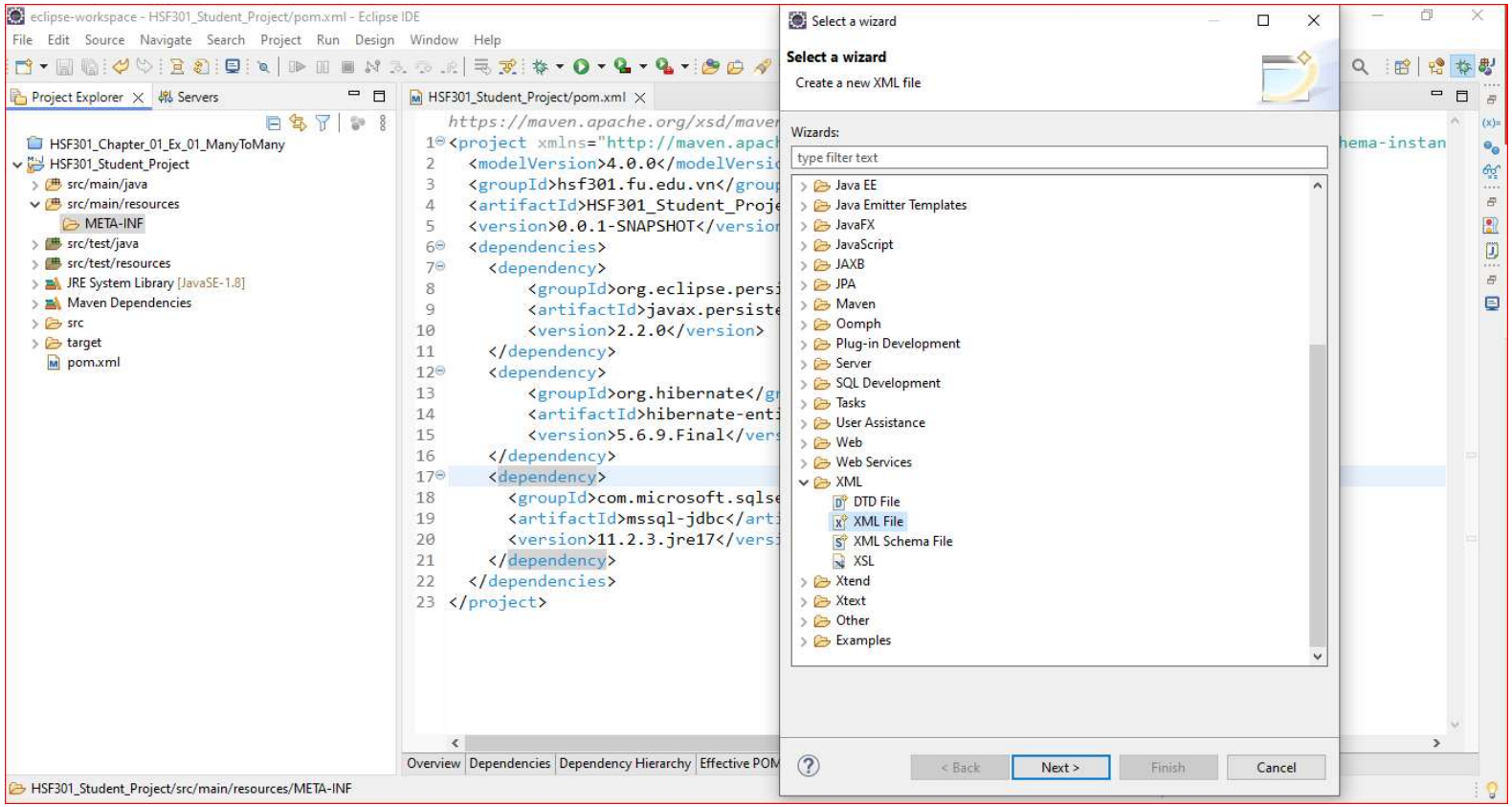
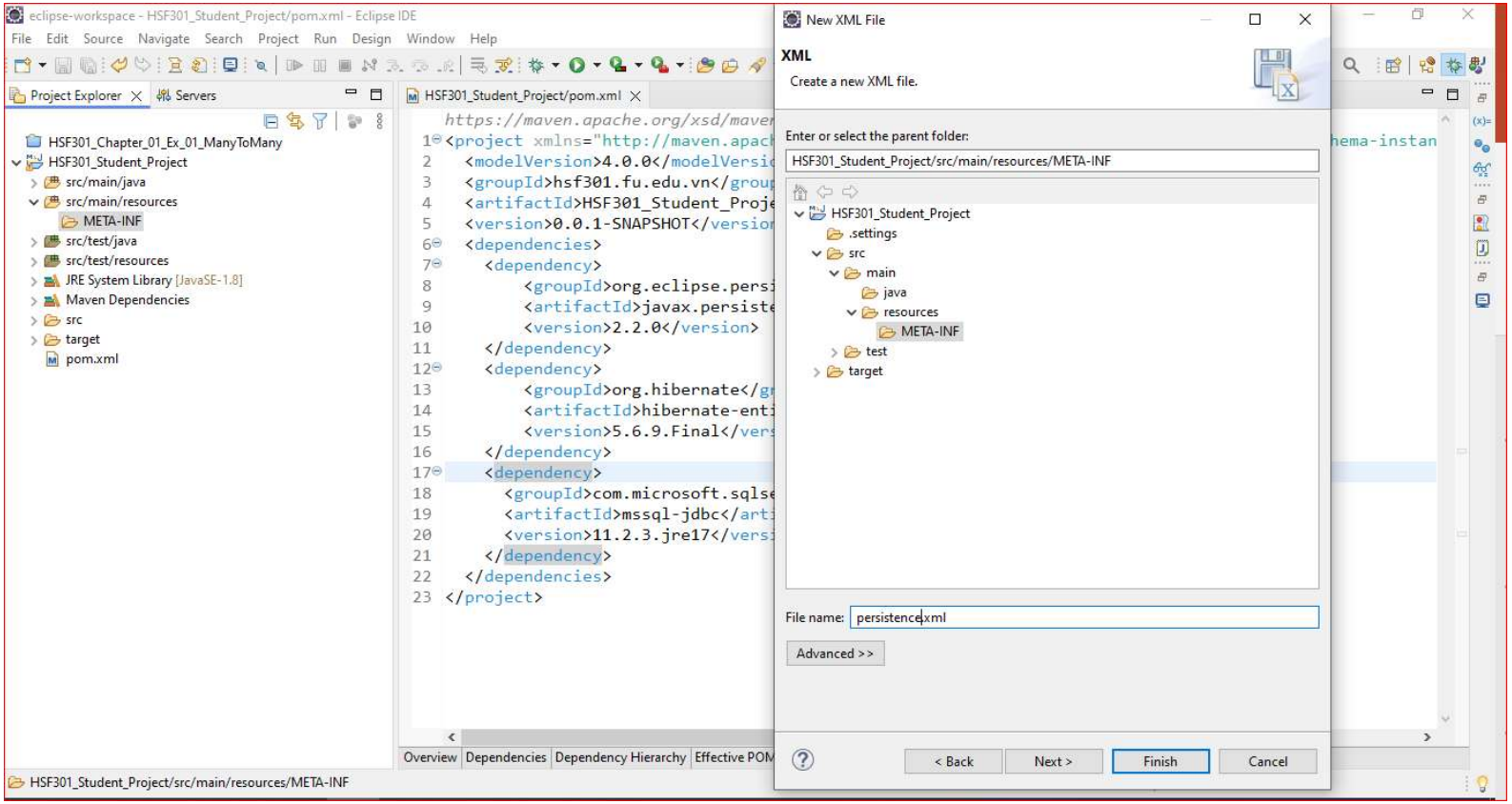
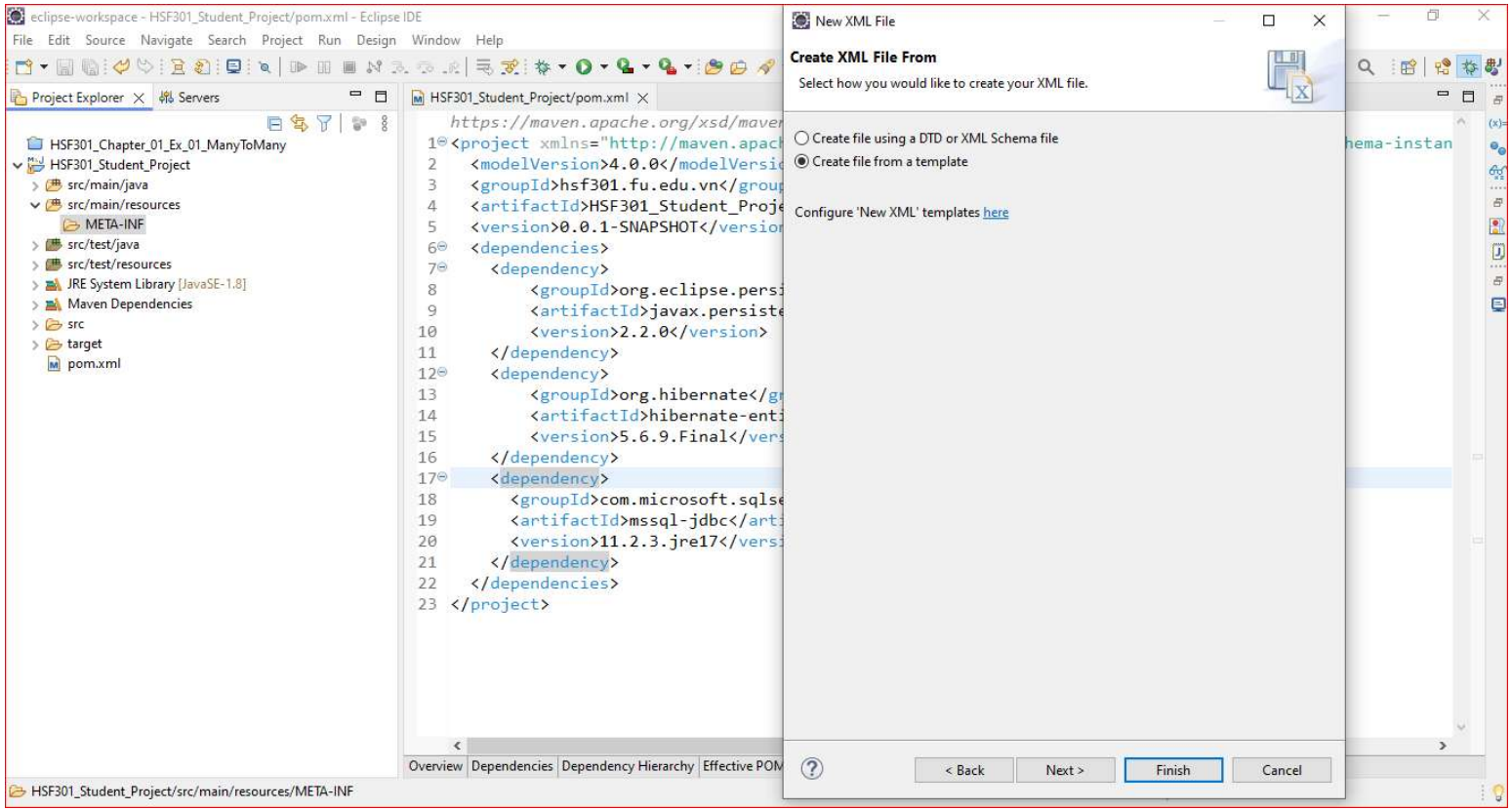
6. Create persistence.xml in META-INF folder



7. Create persistence.xml in META-INF folder



8. Create persistence.xml in META-INF folder



9. Edit the persistence.xml in META-INF folder

eclipse-workspace - HSF301_Student_Project/src/main/resources/META-INF/persistence.xml - Eclipse IDE

File Edit Source Source Navigate Search Project Run Window Help

Project Expl... | Servers

- HSF301_Chapter_01_Ex_01_ManyToMar
- HSF301_Student_Project
  - src/main/java
  - src/main/resources
    - META-INF
      - persistence.xml
  - src/test/java
  - src/test/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

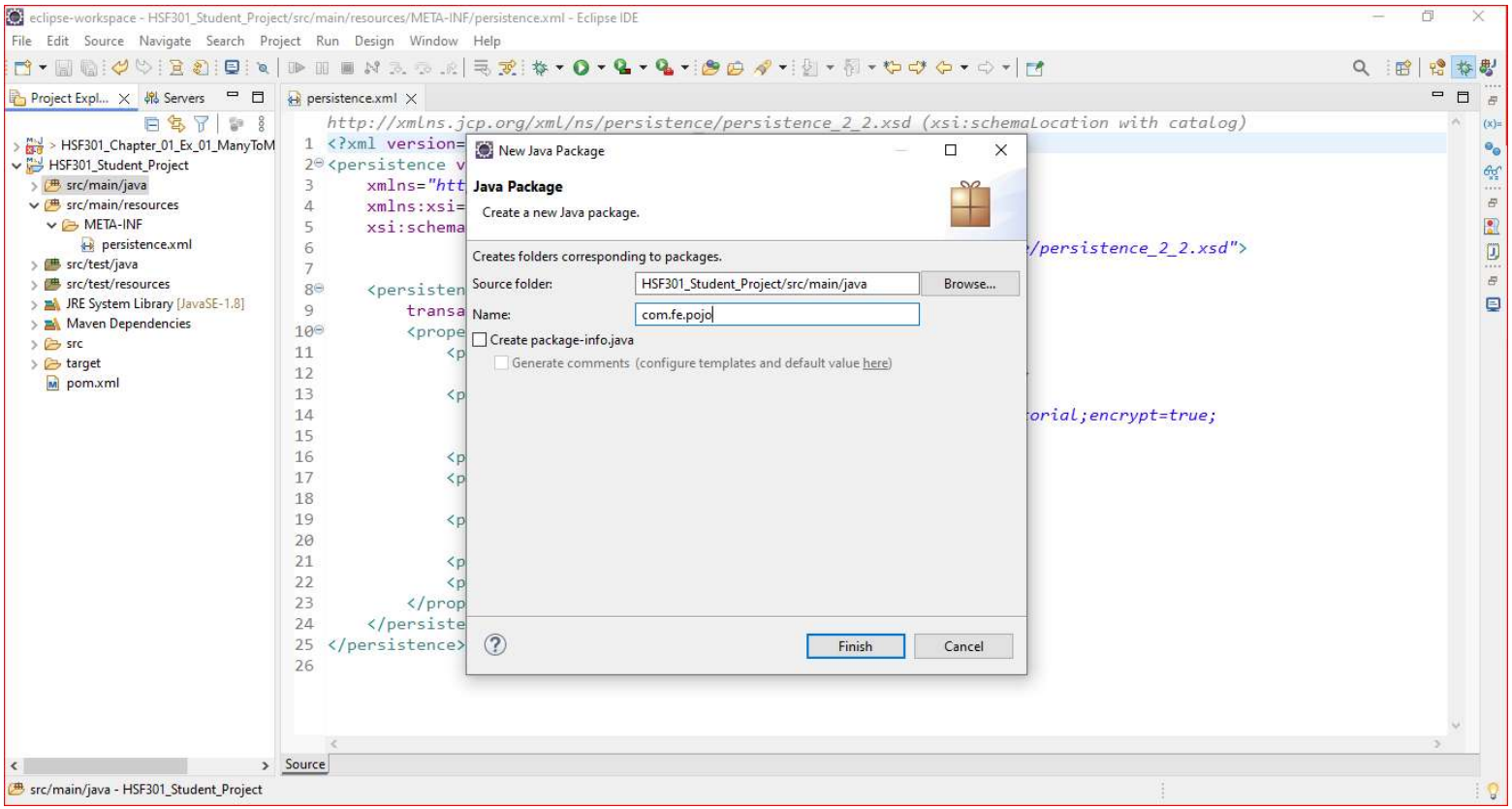
persistence.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<persistence version="2.2"
    xmlns="http://xmlns.jcp.org/xml/ns/persistence"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://xmlns.jcp.org/xml/ns/persistence
                        http://xmlns.jcp.org/xml/ns/persistence/persistence_2_2.xsd">

    <persistence-unit name="JPAs"
        transaction-type="RESOURCE_LOCAL">
        <properties>
            <property name="javax.persistence.jdbc.driver"
                value="com.microsoft.sqlserver.jdbc.SQLServerDriver" />
            <property name="javax.persistence.jdbc.url"
                value="jdbc:sqlserver://localhost:1433;DatabaseName=tutorial;encrypt=true;
                trustServerCertificate=true;" />
            <property name="javax.persistence.jdbc.user" value="sa" />
            <property name="javax.persistence.jdbc.password"
                value="Aesx5099@@" />
            <property name="hibernate.dialect"
                value="org.hibernate.dialect.SQLServerDialect" />
            <property name="hibernate.show_sql" value="true" />
            <property name="hibernate.hbm2ddl.auto" value="update" />
        </properties>
    </persistence-unit>
</persistence>
```

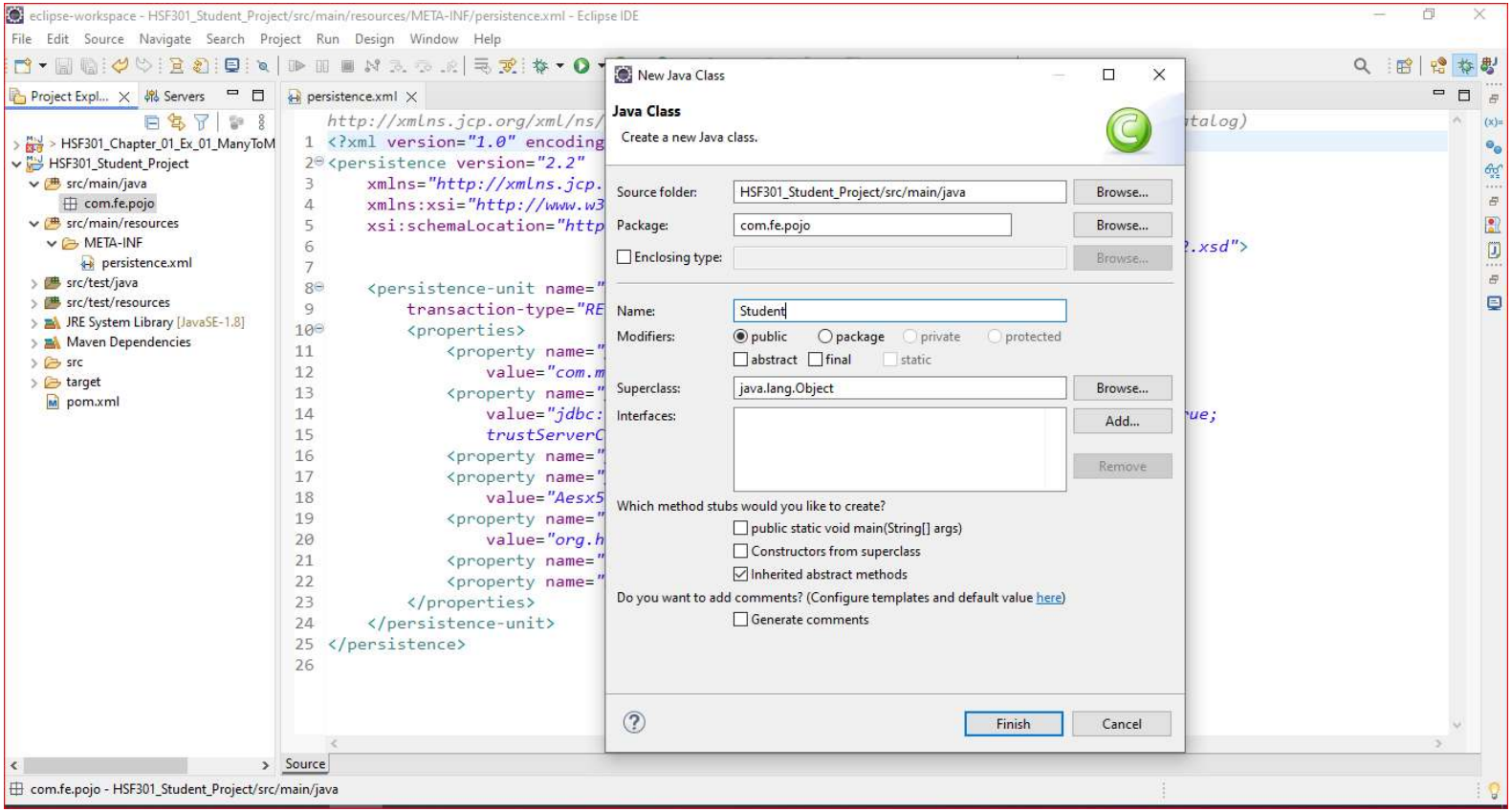
Design | Source

persistence/persistence-unit | Writable | Smart Insert | 24 : 22 : 1120

10. Add com.fe.pojo Package in src/main/java



11. Add Student.java in com.fe.pojo package



12. Edit the Student.java

eclipse-workspace - HSF301_Student_Project/src/main/java/com/fe/pojo/Student.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Expl... | Servers

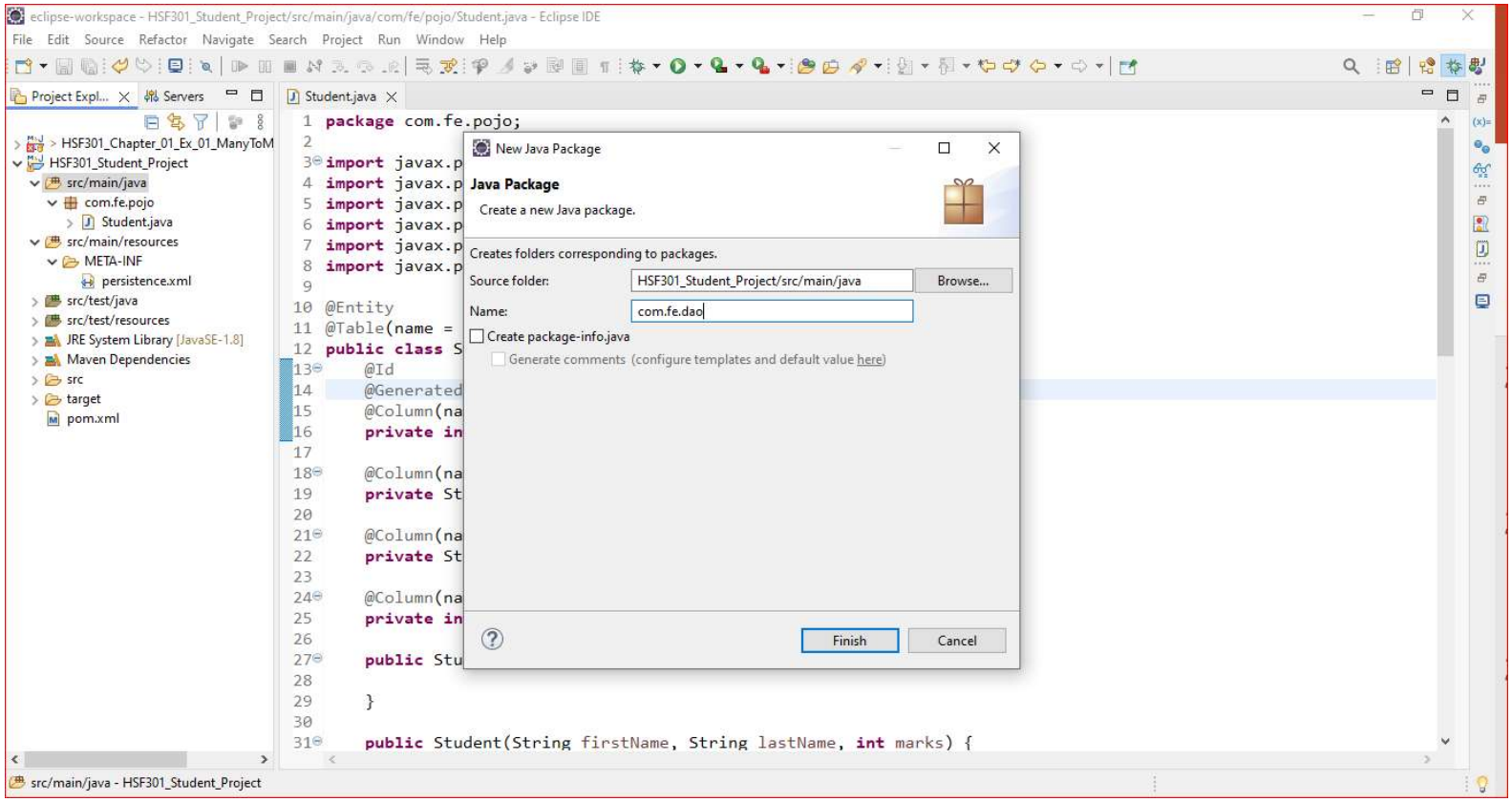
- HSF301_Chapter_01_Ex_01_ManyToM
- HSF301_Student_Project
  - src/main/java
    - com.fe.pojo
      - Student.java
  - src/main/resources
    - META-INF
      - persistence.xml
  - src/test/java
  - src/test/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

Student.java

```java
package com.fe.pojo;

import javax.persistence.Column;
import javax.persistence.Entity;
import javax.persistence.GeneratedValue;
import javax.persistence.GenerationType;
import javax.persistence.Id;
import javax.persistence.Table;

@Entity
@Table(name = "STUDENTS")
public class Student {
    @Id
    @GeneratedValue(strategy = GenerationType.AUTO)
    @Column(name = "id")
    private int id;

    @Column(name = "fistName", nullable = false, unique = false)
    private String firstName;

    @Column(name = "lastName")
    private String lastName;

    @Column(name = "marks")
    private int marks;

    public Student() {

    }

    public Student(String firstName, String lastName, int marks) {
```

0 items selected

13. Add com.fe.dao Package in src/main/java



14. Create StudentDAO in com.fe.dao

eclipse-workspace - HSF301_Student_Project/src/main/java/com/fe/pojo/Student.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Expl... | Servers

- HSF301_Chapter_01_Ex_01_ManyToM
- HSF301_Student_Project
  - src/main/java
    - com.fe.dao
    - com.fe.pojo
      - Student.java
  - src/main/resources
    - META-INF
      - persistence.xml
  - src/test/java
  - src/test/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

Student.java

```
1  package com.fe.pojo;
2
3  import javax.persistence.Col
4  import javax.persistence.Ent
5  import javax.persistence.Gen
6  import javax.persistence.Gen
7  import javax.persistence.Id;
8  import javax.persistence.Tab
9
10 @Entity
11 @Table(name = "STUDENTS")
12 public class Student {
13     @Id
14     @GeneratedValue(strategy
15     @Column(name = "id")
16     private int id;
17
18     @Column(name = "fistName
19     private String firstName
20
21     @Column(name = "lastName
22     private String lastName;
23
24     @Column(name = "marks")
25     private int marks;
26
27     public Student() {
28
29     }
30
31     public Student(String fi
```

New Java Class

Java Class

Create a new Java class.

Source folder: HSF301_Student_Project/src/main/java [Browse...]

Package: com.fe.dao [Browse...]

☐ Enclosing type: [Browse...]

Name: StudentDAO

Modifiers: ◉ public ○ package ○ private ○ protected

☐ abstract ☐ final ☐ static

Superclass: java.lang.Object [Browse...]

Interfaces: [Add...] [Remove]

Which method stubs would you like to create?

☐ public static void main(String[] args)

☐ Constructors from superclass

☑ Inherited abstract methods

Do you want to add comments? (Configure templates and default value here)

☐ Generate comments

[Finish] [Cancel]

com.fe.dao - HSF301_Student_Project/src/main/java

15. Edit the StudentDAO in com.fe.dao

eclipse-workspace - HSF301_Student_Project/src/main/java/com/fe/dao/StudentDAO.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Expl... | Servers

- HSF301_Chapter_01_Ex_01_ManyToM
- HSF301_Student_Project
  - src/main/java
    - com.fe.dao
      - StudentDAO.java
    - com.fe.pojo
      - Student.java
  - src/main/resources
    - META-INF
      - persistence.xml
  - src/test/java
  - src/test/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

Student.java | StudentDAO.java

```java
1  package com.fe.dao;
2
3  import java.util.List;
4
5  import javax.persistence.EntityManager;
6  import javax.persistence.EntityManagerFactory;
7  import javax.persistence.Persistence;
8
9  import com.fe.pojo.Student;
10
11 public class StudentDAO {
12
13     private static EntityManager em;
14     private static EntityManagerFactory emf;
15
16     public StudentDAO(String persistanceName) {
17         emf = Persistence.createEntityManagerFactory(persistanceName);
18     }
19
20     public void save(Student student) {
35
36     public List<Student> getStudents() {
51
52     public void delete(Long studentID) {
65
66     public Student findById(Long studentID) {
80
81     public void update(Student student) {
98 }
99
```

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16. Save Student Method

eclipse-workspace - HSF301_Student_Project/src/main/java/com/fe/dao/StudentDAO.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Expl... | Servers | Student.java | StudentDAO.java

- HSF301_Chapter_01_Ex_01_ManyToM
- HSF301_Student_Project
  - src/main/java
    - com.fe.dao
      - StudentDAO.java
    - com.fe.pojo
      - Student.java
  - src/main/resources
    - META-INF
      - persistence.xml
  - src/test/java
  - src/test/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

```java
3  import java.util.List;
10
11 public class StudentDAO {
12
13     private static EntityManager em;
14     private static EntityManagerFactory emf;
15
16     public StudentDAO(String persistanceName) {
17         emf = Persistence.createEntityManagerFactory(persistanceName);
18     }
19
20     public void save(Student student) {
21         try {
22             em = emf.createEntityManager();
23             em.getTransaction().begin();
24             em.persist(student);
25             em.getTransaction().commit();
26         } catch (Exception ex) {
27             em.getTransaction().rollback();
28             System.out.println("Error " + ex.getMessage());
29         } finally {
30             em.close();
31
32         }
33
34     }
35
36     public List<Student> getStudents() {
51
52     public void delete(int studentID) {
65
```

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17. Get All Students Method

eclipse-workspace - HSF301_Student_Project/src/main/java/com/fe/dao/StudentDAO.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Expl... | Servers

- HSF301_Chapter_01_Ex_01_ManyToM
- HSF301_Student_Project
  - src/main/java
    - com.fe.dao
      - StudentDAO.java
    - com.fe.pojo
      - Student.java
  - src/main/resources
    - META-INF
      - persistence.xml
  - src/test/java
  - src/test/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

Student.java | StudentDAO.java

```java
package com.fe.dao;

import java.util.List;

public class StudentDAO {

    private static EntityManager em;
    private static EntityManagerFactory emf;

    public StudentDAO(String persistanceName) {
        emf = Persistence.createEntityManagerFactory(persistanceName);
    }

    public void save(Student student) {

    public List<Student> getStudents() {
        List<Student> students = null;
        try {
            em = emf.createEntityManager();
            em.getTransaction().begin();
            students = em.createQuery("from Student").getResultList();
        } catch (Exception ex) {

            System.out.println("Error " + ex.getMessage());
        } finally {
            em.close();
        }
        return students;

    }

```

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18. Find a Student Method

eclipse-workspace - HSF301_Student_Project/src/main/java/com/fe/dao/StudentDAO.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Expl... | Servers | Student.java | StudentDAO.java

- HSF301_Chapter_01_Ex_01_ManyToM
- HSF301_Student_Project
  - src/main/java
    - com.fe.dao
      - StudentDAO.java
    - com.fe.pojo
      - Student.java
  - src/main/resources
    - META-INF
      - persistence.xml
  - src/test/java
  - src/test/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

```java
13      private static EntityManager em;
14      private static EntityManagerFactory emf;
15
16      public StudentDAO(String persistanceName) {
17          emf = Persistence.createEntityManagerFactory(persistanceName);
18      }
19
20      public void save(Student student) {
35
36      public Student findById(int studentID) {
37          Student student = null;
38          try {
39              em = emf.createEntityManager();
40              em.getTransaction().begin();
41              student = em.find(Student.class, studentID);
42          } catch (Exception ex) {
43              System.out.println("Error " + ex.getMessage());
44          } finally {
45              em.close();
46          }
47          return student;
48
49      }
50
51      public List<Student> getStudents() {
66
67      public void delete(int studentID) {
80
81      public void update(Student student) {
98  }
99
```

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19. Delete Student Method

eclipse-workspace - HSF301_Student_Project/src/main/java/com/fe/dao/StudentDAO.java - Eclipse IDE

```java
    private static EntityManager em;
    private static EntityManagerFactory emf;

    public StudentDAO(String persistanceName) {
        emf = Persistence.createEntityManagerFactory(persistanceName);
    }

    public void save(Student student) {

    public Student findById(int studentID) {

    public List<Student> getStudents() {

    public void delete(int studentID) {
        try {
            em = emf.createEntityManager();
            em.getTransaction().begin();
            Student s = em.find(Student.class, studentID);
            em.remove(s);
            em.getTransaction().commit();
        } catch (Exception ex) {
            System.out.println("Error " + ex.getMessage());
        } finally {
            em.close();
        }
    }

    public void update(Student student) {
}
```

20. Update Student Method

eclipse-workspace - HSF301_Student_Project/src/main/java/com/fe/dao/StudentDAO.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Expl... | Servers | Student.java | StudentDAO.java

- HSF301_Chapter_01_Ex_01_ManyToM
- HSF301_Student_Project
  - src/main/java
    - com.fe.dao
      - StudentDAO.java
    - com.fe.pojo
      - Student.java
  - src/main/resources
    - META-INF
      - persistence.xml
  - src/test/java
  - src/test/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

```java
16      public StudentDAO(String persistanceName) {
17          emf = Persistence.createEntityManagerFactory(persistanceName);
18      }
19
20      public void save(Student student) {
35
36      public Student findById(int studentID) {
50
51      public List<Student> getStudents() {
66
67      public void delete(int studentID) {
80
81      public void update(Student student) {
82          try {
83              em = emf.createEntityManager();
84              em.getTransaction().begin();
85              Student s = em.find(Student.class, student.getId());
86              if (s != null) {
87                  s.setFirstName(student.getFirstName());
88                  s.setLastName(student.getLastName());
89                  s.setMarks(student.getMarks());
90                  em.getTransaction().commit();
91              }
92          } catch (Exception ex) {
93              System.out.println("Error " + ex.getMessage());
94          } finally {
95              em.close();
96          }
97      }
98  }
99
```

Writable | Smart Insert | 50 : 5 : 1113

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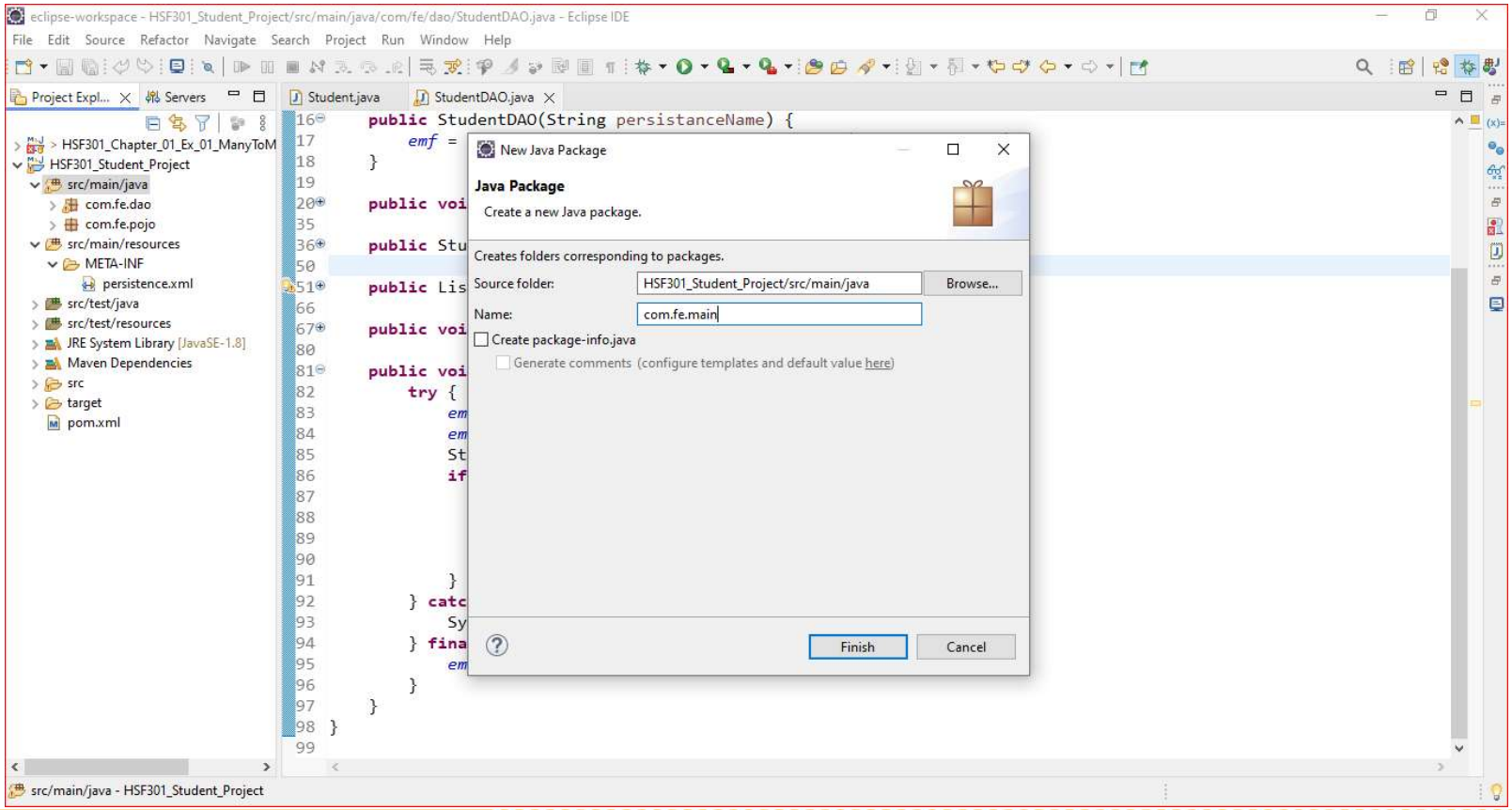
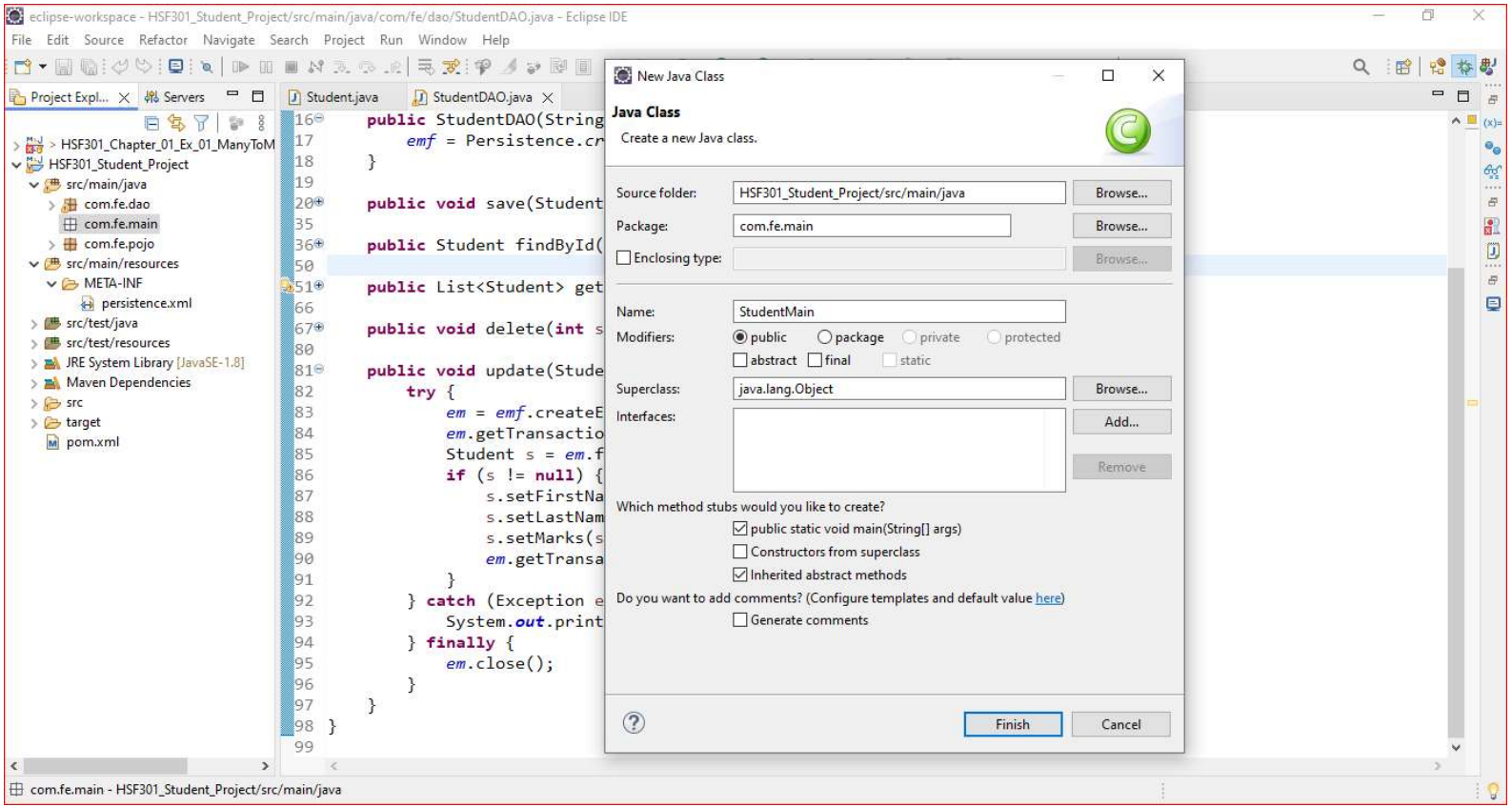
21. Add com.fe.main Package in src/main/java



22. Create StudentMain class in com.fe.main Package



23. Edit the StudentMain in com.fe.main

eclipse-workspace - HSF301_Student_Project/src/main/java/com/fe/main/StudentMain.java - Eclipse IDE

```java
package com.fe.main;

public class StudentMain {

    public static void main(String[] args) {
        // TODO Auto-generated method stub
        System.out.println("+++++++++MENU+++++++++");
        System.out.println("+ 1. Get Students    +");
        System.out.println("+ 2. Add Student     +");
        System.out.println("+ 3. Delete Student  +");
        System.out.println("+ 4. Update Student  +");
        System.out.println("+ 5. Delete Student  +");
        System.out.println("+ 6. Get a Student   +");
        System.out.println("+ 0. QUIT            +");
        System.out.println("+++++++++END++++++++++");
    }

}
```

```
<terminated> StudentMain [Java Application] D:\eclipse\plugins\org.eclipse.justj.openjdk.hotspot.jre.full
+++++++++MENU+++++++++
+ 1. Get Students    +
+ 2. Add Student     +
+ 3. Delete Student  +
+ 4. Update Student  +
+ 5. Delete Student  +
+ 6. Get a Student   +
+ 0. QUIT            +
+++++++++END++++++++++
```

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24. Edit the StudentMain in com.fe.main

eclipse-workspace - HSF301_Student_Project/src/main/java/com/fe/main/StudentMain.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Expl... | Servers

- HSF301_Chapter_01_Ex_01_ManyT
  - src/main/java
    - hsf301.fe.dao
      - StudentDAO.java
    - hsf301.fe.gui
      - ManyToManyDemo.java
    - hsf301.fe.pojo
      - Book.java
      - Student.java
    - hsf301.fe.repository
    - hsf301.fe.service
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml
- HSF301_Student_Project
  - src/main/java
    - com.fe.dao
    - com.fe.main
      - StudentMain.java
    - com.fe.pojo
      - Student.java
  - src/main/resources
    - META-INF
      - persistence.xml
  - src/test/java
  - src/test/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies

Student.java | StudentDAO.java | StudentMain.java

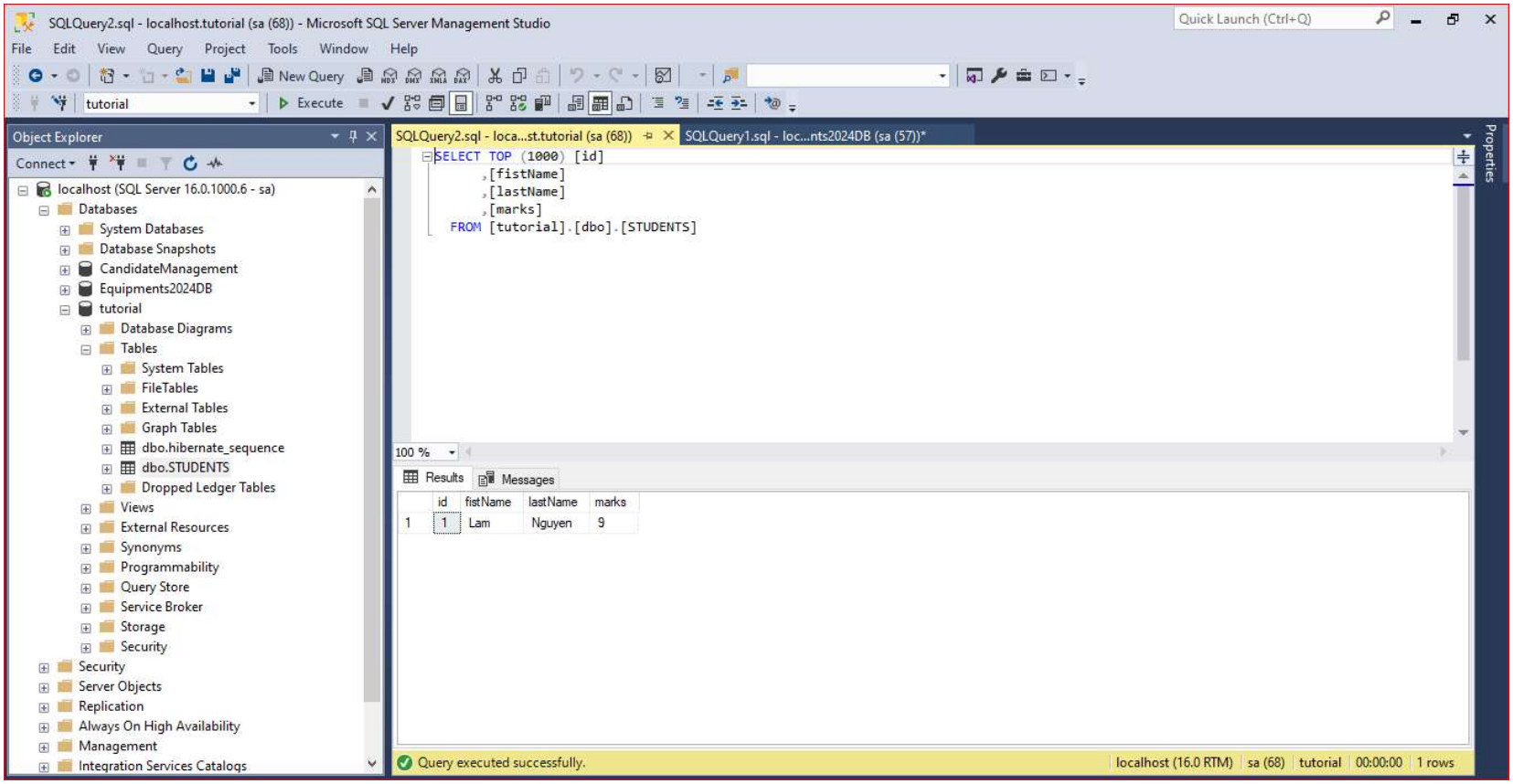
```java
        System.out.println("+ 0. QUIT            +");
        System.out.println("+++++++++END++++++++++");

        int inputKey = -1;
        while (inputKey != 0) {
            Scanner console = new Scanner(System.in);
            System.out.println("Please enter a number !");
            inputKey = console.nextInt();
            StudentDAO studentDAO = new StudentDAO("JPAs");
            Student student = new Student("Lam", "Nguyen", 9);
            switch (inputKey) {
            case 0:
                break;
            case 1:
                studentDAO.save(student);
                break;
            case 2:
                studentDAO.delete(1);
                break;
            case 3:
                student = new Student(1, "Sang", "Nguyen", 9);
                studentDAO.update(student);
            case 4:
                studentDAO.findById(1);
                break;
            default:
                System.out.println("Please choice menu !");
            }
        }

    }
```

Console

StudentMain [Java Application] [pid: 17148]

```
+++++++++MENU++++++++
+ 1. Add Student     +
+ 2. Delete Student  +
+ 3. Update Student  +
+ 4. Get a Student   +
+ 0. QUIT            +
+++++++++END++++++++++
Please enter a number !
1
Apr 14, 2024 10:26:51 PM org.hibernate.jpa.ir
INFO: HHH000204: Processing PersistenceUnitIr
Apr 14, 2024 10:26:52 PM org.hibernate.Versic
INFO: HHH000412: Hibernate ORM core version 5
Apr 14, 2024 10:26:52 PM org.hibernate.annota
INFO: HCANN000001: Hibernate Commons Annotati
Apr 14, 2024 10:26:52 PM org.hibernate.engine
WARN: HHH10001002: Using Hibernate built-in c
Apr 14, 2024 10:26:53 PM org.hibernate.engine
INFO: HHH10001005: using driver [com.microsof
Apr 14, 2024 10:26:53 PM org.hibernate.engine
INFO: HHH10001001: Connection properties: {pa
Apr 14, 2024 10:26:53 PM org.hibernate.engine
INFO: HHH10001003: Autocommit mode: false
Apr 14, 2024 10:26:53 PM org.hibernate.engine
INFO: HHH000115: Hibernate connection pool si
Apr 14, 2024 10:26:53 PM org.hibernate.dialec
INFO: HHH000400: Using dialect: org.hibernate
Apr 14, 2024 10:26:54 PM org.hibernate.resour
INFO: HHH10001501: Connection obtained from J
```

25. Result


SQLQuery2.sql - localhost.tutorial (sa (68)) - Microsoft SQL Server Management Studio
File Edit View Query Project Tools Window Help
New Query
tutorial
Execute
Object Explorer
Connect
localhost (SQL Server 16.0.1000.6 - sa)
Databases
System Databases
Database Snapshots
CandidateManagement
Equipments2024DB
tutorial
Database Diagrams
Tables
System Tables
FileTables
External Tables
Graph Tables
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
SQLQuery2.sql - loca...st.tutorial (sa (68))
SQLQuery1.sql - loc...nts2024DB (sa (57))*
SELECT TOP (1000) [id]
,[fistName]
,[lastName]
,[marks]
FROM [tutorial].[dbo].[STUDENTS]
100 %
Results
Messages
id fistName lastName marks
1 1 Lam Nguyen 9
Query executed successfully.
localhost (16.0 RTM) sa (68) tutorial 00:00:00 1 rows
Properties

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Java

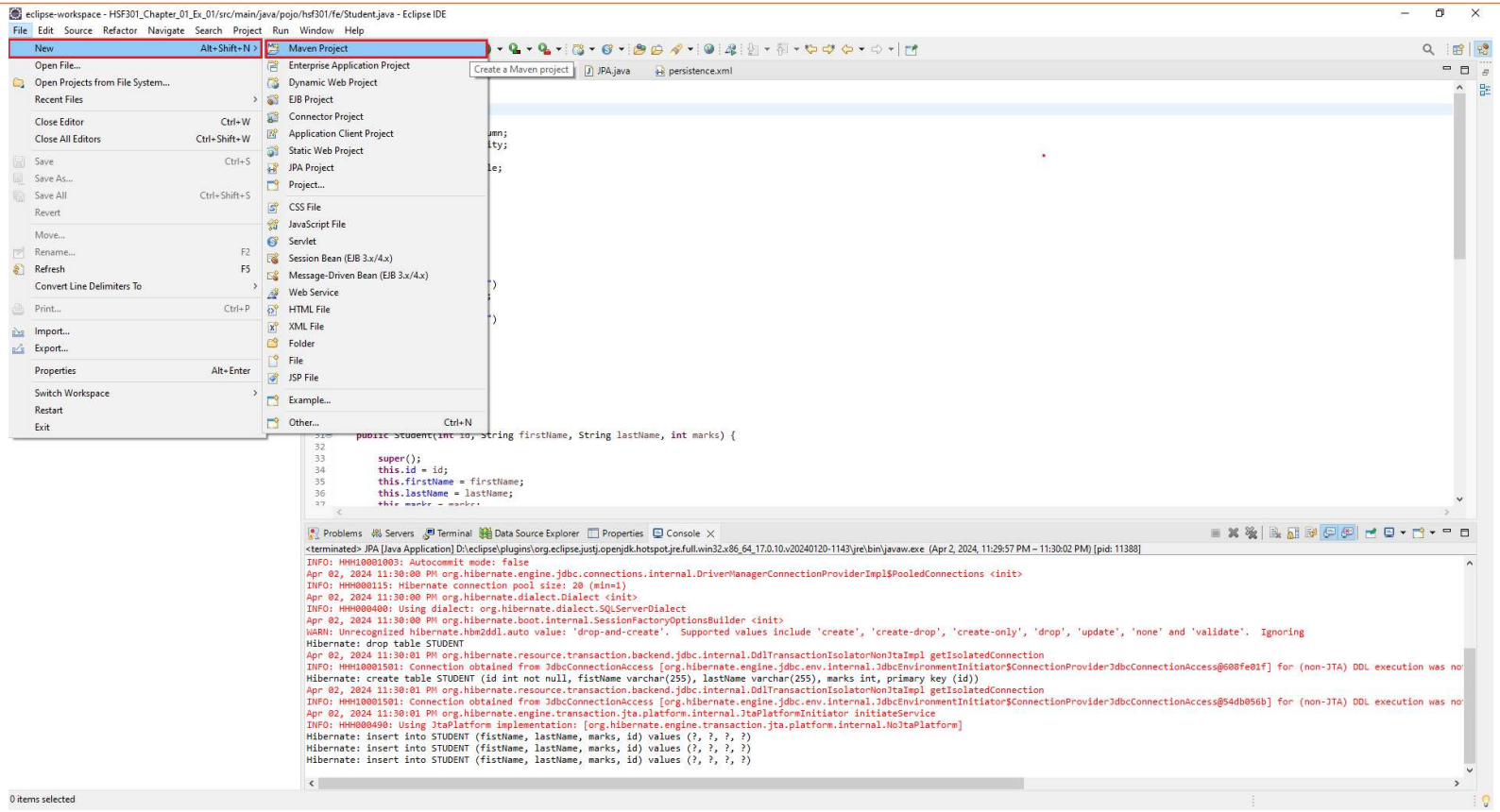
Mapping in JPA

Relationships Annotations in JPA

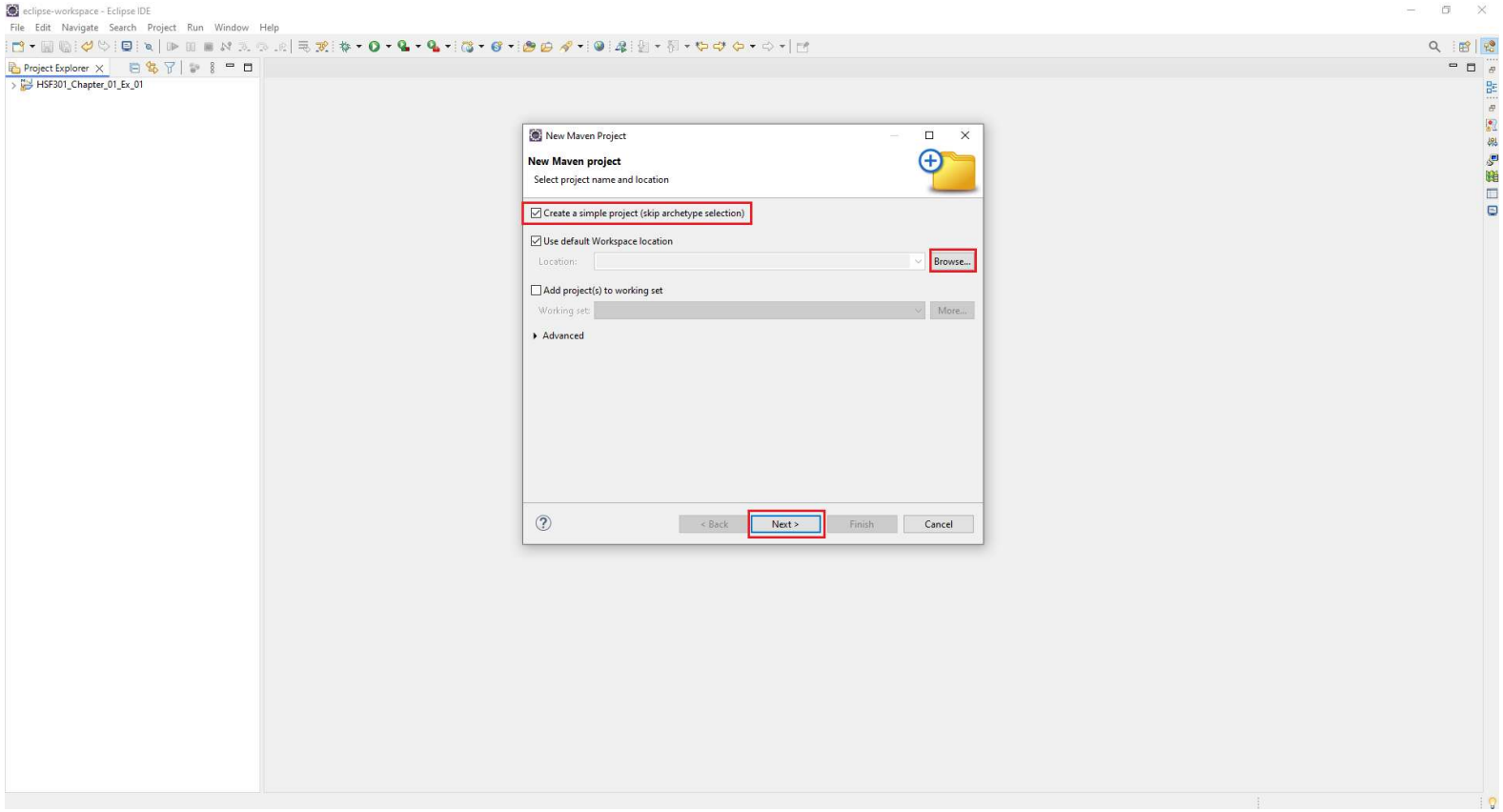
- **@ManyToOne:** This annotation defines a many-to-one relationship between two entities.
- **@OneToMany:** This annotation defines a one-to-many relationship between two entities.
- **@OneToOne:** This annotation defines a one-to-one relationship between two entities.
- **@ManyToMany:** This annotation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

Demo JPA
(One To Many)

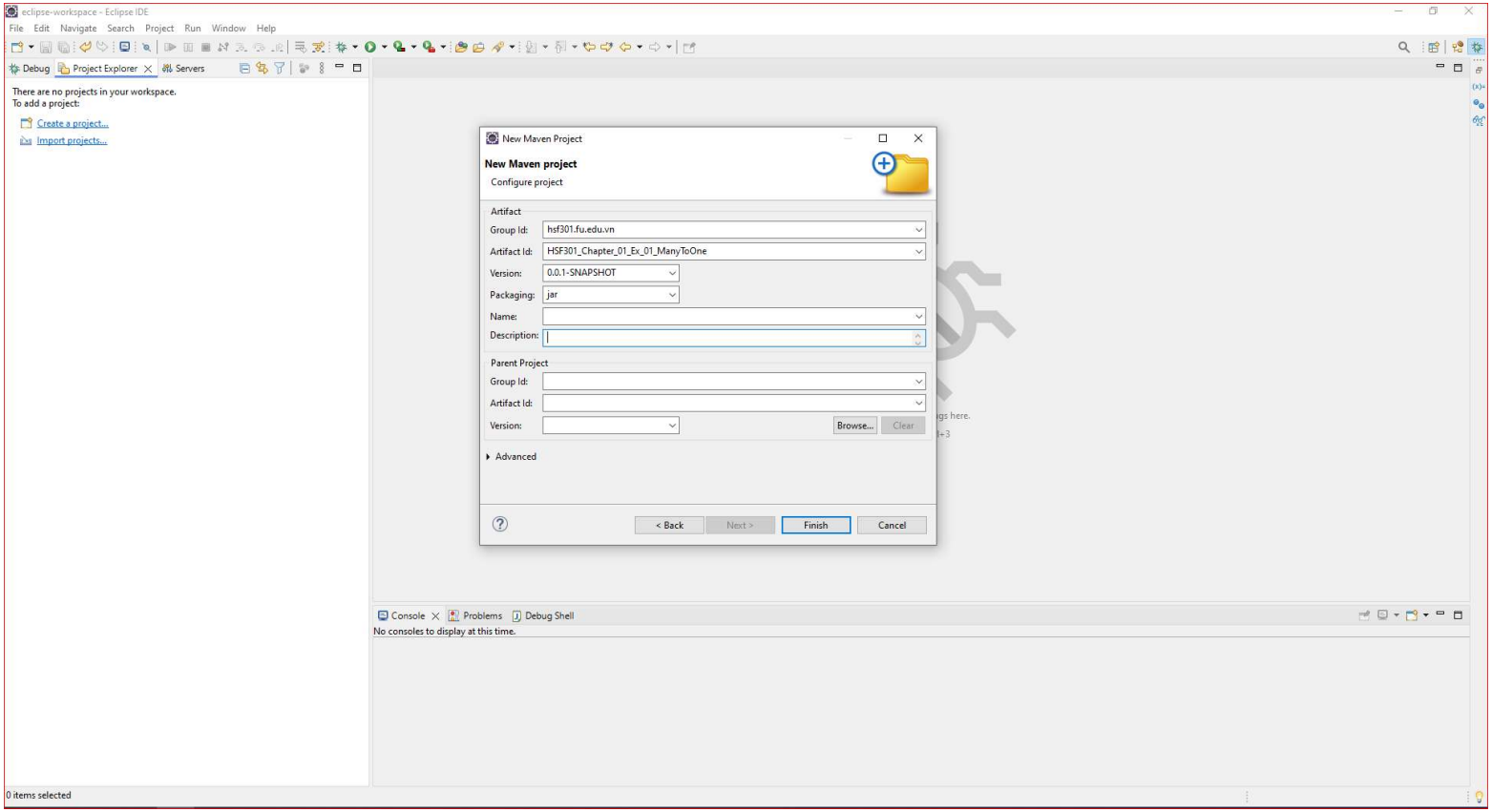
1. Open Eclipse, File | New | Maven Project



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



3. Fill the information Project -> Click Finish



4. Structure of Maven Project

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToOne/pom.xml - Eclipse IDE

File Edit Source Navigate Search Project Run Design Window Help

Project Explorer | Servers

- HSF301_Chapter_01_Ex_01_ManyToOne [HSF301 main]
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
    - hsf301.fe.gui
    - hsf301.fe.pojo
    - hsf301.fe.repository
    - hsf301.fe.service
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

HSF301_Chapter_01_Ex_01_ManyToOne/pom.xml

```
https://maven.apache.org/xsd/maven-4.0.0.xsd (xsi:schemaLocation)
1  <project xmlns="http://maven.apache.org/POM/4.0.0"
2      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
3      xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 https://maven.apache.org/xsd/maven-4.0.0.xsd":
4      <modelVersion>4.0.0</modelVersion>
5      <groupId>fe.edu.vn</groupId>
6      <artifactId>HSF301_Chapter_01_Ex_01_ManyToOne</artifactId>
7      <version>0.0.1-SNAPSHOT</version>
8      <dependencies>
9          <dependency>
10             <groupId>org.eclipse.persistence</groupId>
11             <artifactId>javax.persistence</artifactId>
12             <version>2.2.0</version>
13         </dependency>
14         <dependency>
15             <groupId>org.hibernate</groupId>
16             <artifactId>hibernate-entitymanager</artifactId>
17             <version>5.6.9.Final</version>
18         </dependency>
19         <dependency>
20             <groupId>com.microsoft.sqlserver</groupId>
21             <artifactId>mssql-jdbc</artifactId>
22             <version>11.2.3.jre17</version>
23         </dependency>
24     </dependencies>
25 </project>
```

Overview | Dependencies | Dependency Hierarchy | Effective POM | pom.xml

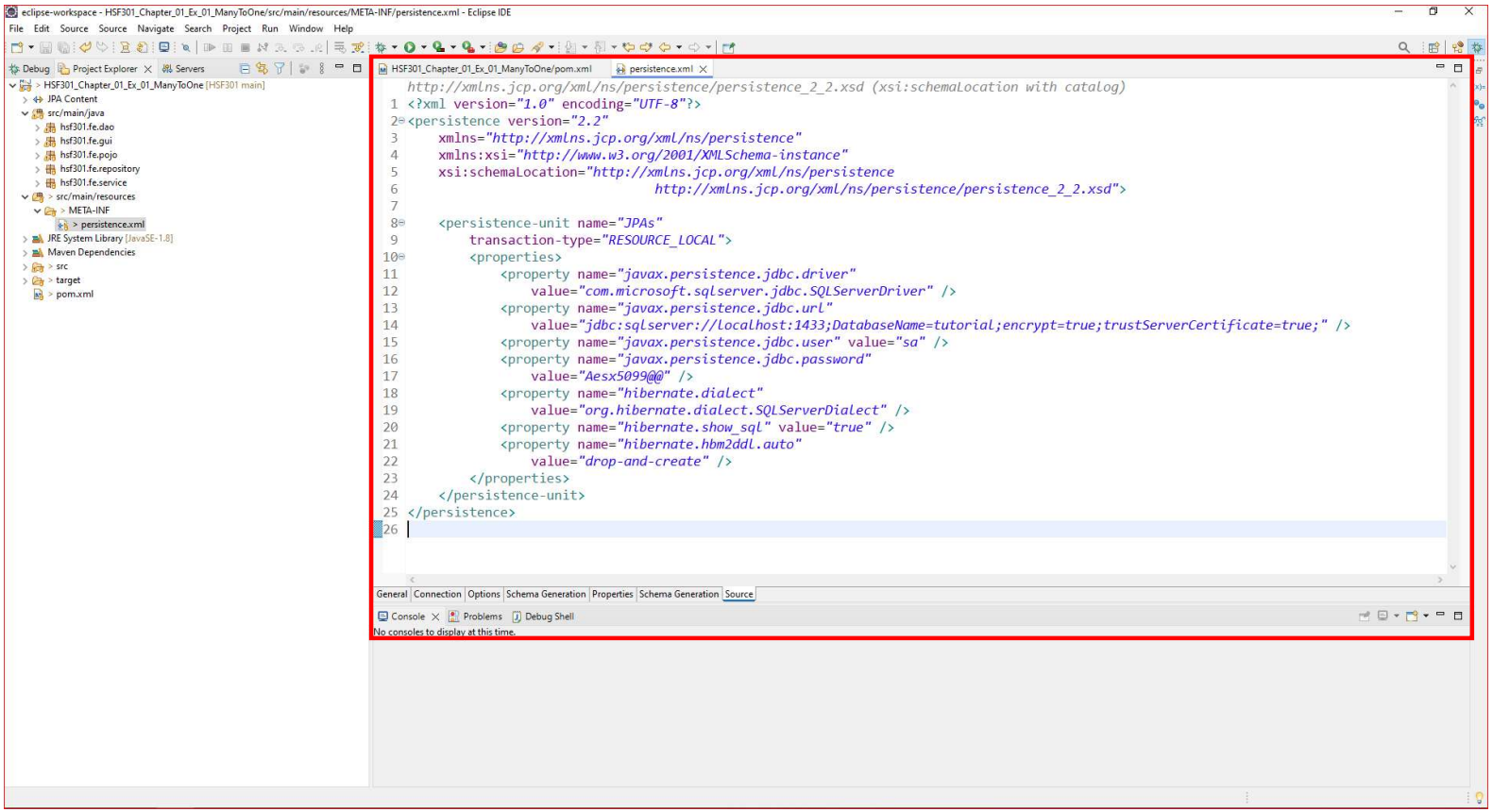
Console | Problems | Debug Shell

No consoles to display at this time.

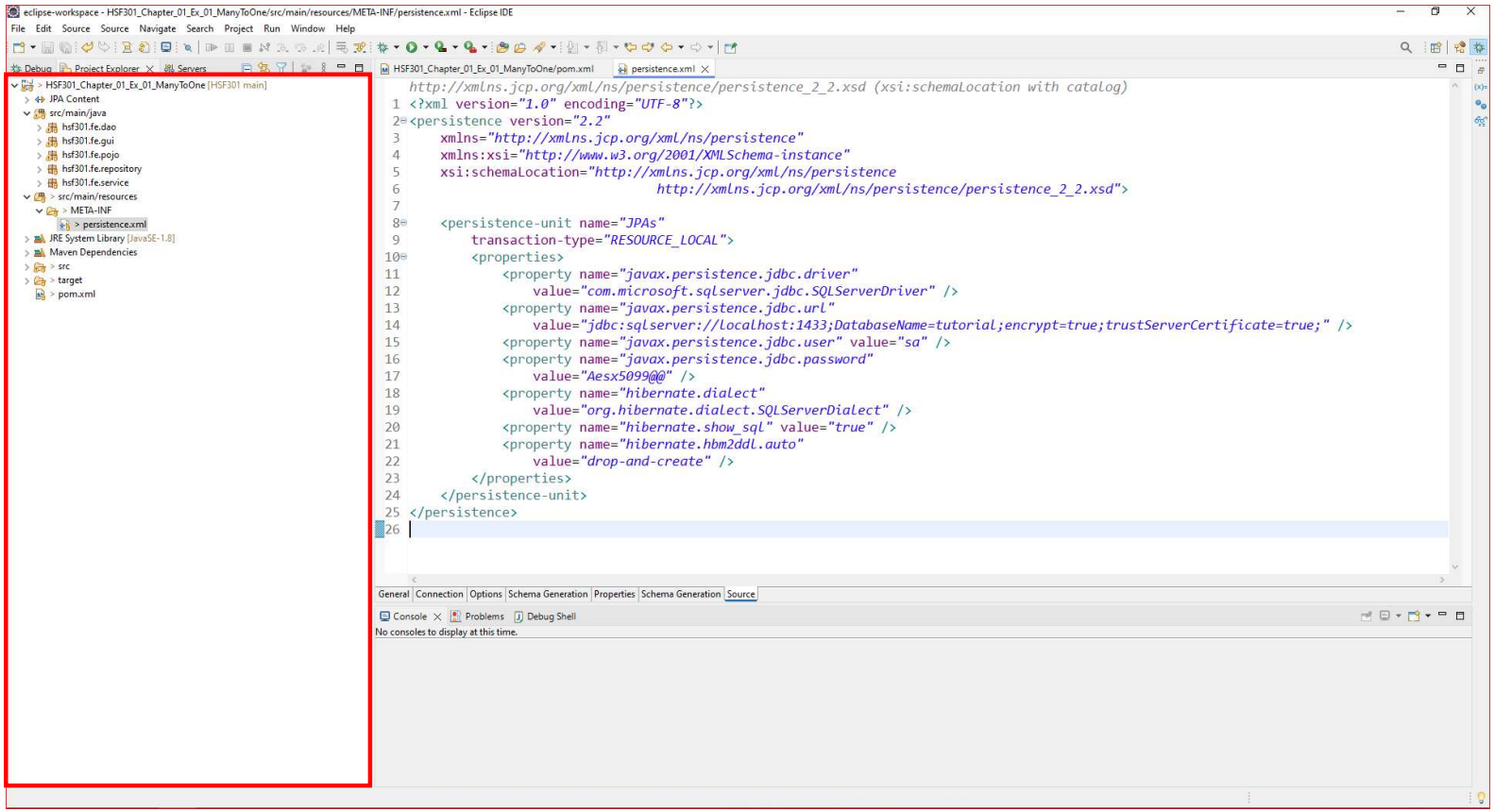
Writable | Insert | 12 : 37 : 530

Edit the content of pom.xml

5. Create persistence.xml in META-INF folder



6. Create structure of project



7. Create Books in Pojo

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToOne/src/main/java/hsf301/fe/pojo/Book.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Explorer | Servers

- HSF301_Chapter_01_Ex_01_ManyToOne [HSF301 main
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
    - hsf301.fe.gui
    - hsf301.fe.pojo
      - Book.java
      - Student.java
    - hsf301.fe.repository
    - hsf301.fe.service
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

Book.java

```java
package hsf301.fe.pojo;

import javax.persistence.CascadeType;

@Entity
@Table(name = "BOOKS")
public class Book {

    @Id
    @GeneratedValue(strategy = GenerationType.AUTO)
    private Long id;

    @Column(name = "title", length = 30)
    private String title;

    private String author;

    private String isbn;

    @ManyToOne(cascade = CascadeType.ALL)
    @JoinColumn(name = "student_id")
    private Student student;

    public Book() {
        super();
    }

}
```

Console | Problems | Debug Shell

No consoles to display at this time.

Writable | Smart Insert | 28 : 42 : 646

8. Create Students in Pojo

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToOne/src/main/java/hsf301/fe/pojo/Student.java - Eclipse IDE

```java
package hsf301.fe.pojo;

import java.util.HashSet;

@Entity
@Table(name = "STUDENTS")
public class Student {

    @Id
    @GeneratedValue(strategy = GenerationType.AUTO)
    @Column(name = "id")
    private int id;

    @Column(name = "fistName", nullable = false, unique = true)
    private String firstName;

    @Column(name = "lastName")
    private String lastName;

    @Column(name = "marks")
    private int marks;

    @OneToMany(cascade = CascadeType.ALL)
    @JoinColumn(name = "student_id")
    private Set<Book> books;

    public Student() {
```

9. Create StudentDAO

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToOne/src/main/java/hsf301/fe/dao/StudentDAO.java - Eclipse IDE

```
1  package hsf301.fe.dao;
2
3⊕ import java.util.List;
10
11 public class StudentDAO {
12
13     private static EntityManager em;
14     private static EntityManagerFactory emf;
15
16⊕    public StudentDAO(String persistanceName) {
19
20⊕    public void save(Student student) {
35
36⊕    public List<Student> getStudents() {
51
52⊕    public void delete(Long studentID) {
65
66⊕    public Student findById(Long studentID) {
80
81⊕    public void update(Student student) {
98 }
99
```

10. Save Student in StudentDAO

eclipse-workspace - HSF301_Chapter_01_Ex_01_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_01_ManyToOne [HSF301 main
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
      - StudentDAO.java
    - hsf301.fe.gui
    - hsf301.fe.pojo
    - hsf301.fe.repository
    - hsf301.fe.service
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

Book.java | Student.java | *StudentDAO.java

```java
import java.util.List;

public class StudentDAO {

    private static EntityManager em;
    private static EntityManagerFactory emf;

    public StudentDAO(String persistanceName) {
        emf = Persistence.createEntityManagerFactory(persistanceName);
    }

    public void save(Student student) {
        try {
            em = emf.createEntityManager();
            em.getTransaction().begin();
            em.merge(student);
            em.getTransaction().commit();
        } catch (Exception ex) {
            em.getTransaction().rollback();
            System.out.println("Error " + ex.getMessage());
        } finally {
            em.close();

        }
    }
```

Console | Problems | Debug Shell

No consoles to display at this time.

Writable | Smart Insert | 34 : 1 : 774

11. Get All Students in StudentDAO

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToOne/src/main/java/hsf301/fe/dao/StudentDAO.java - Eclipse IDE

```java
    private static EntityManager em;
    private static EntityManagerFactory emf;

    public StudentDAO(String persistanceName) {
        emf = Persistence.createEntityManagerFactory(persistanceName);
    }

    public void save(Student student) {

    public List<Student> getStudents() {
        List<Student> students = null;
        try {
            em = emf.createEntityManager();
            em.getTransaction().begin();
            students = em.createQuery("from Student").getResultList();
        } catch (Exception ex) {

            System.out.println("Error " + ex.getMessage());
        } finally {
            em.close();
        }
        return students;

    }

    public void delete(Long studentID) {
```

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12. Delete Student in StudentDAO

eclipse-workspace - HSF301_Chapter_01_Ex_01_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_01_ManyToOne [HSF301 main
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
      - StudentDAO.java
    - hsf301.fe.gui
    - hsf301.fe.pojo
    - hsf301.fe.repository
    - hsf301.fe.service
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

Book.java | Student.java | *StudentDAO.java

```java
public class StudentDAO {

    private static EntityManager em;
    private static EntityManagerFactory emf;

    public StudentDAO(String persistanceName) {
        emf = Persistence.createEntityManagerFactory(persistanceName);
    }

    public void save(Student student) {

    public List<Student> getStudents() {

    public void delete(Long studentID) {
        try {
            em = emf.createEntityManager();
            em.getTransaction().begin();
            Student s = em.find(Student.class, studentID);
            em.remove(s);
            em.getTransaction().commit();
        } catch (Exception ex) {
            System.out.println("Error " + ex.getMessage());
        } finally {
            em.close();
        }
    }
```

Console | Problems | Debug Shell

No consoles to display at this time.

Writable | Smart Insert | 34 : 1 : 774

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13. Get a Student in StudentDAO

eclipse-workspace - HSF301_Chapter_01_Ex_01_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_01_ManyToOne [HSF301 main
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
      - StudentDAO.java
    - hsf301.fe.gui
    - hsf301.fe.pojo
    - hsf301.fe.repository
    - hsf301.fe.service
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

Book.java | Student.java | *StudentDAO.java

```
16      public StudentDAO(String persistanceName) {
17          emf = Persistence.createEntityManagerFactory(persistanceName);
18      }
19
20      public void save(Student student) {
34
35      public List<Student> getStudents() {
50
51      public void delete(Long studentID) {
64
65      public Student findById(Long studentID) {
66          Student student = null;
67          try {
68              em = emf.createEntityManager();
69              em.getTransaction().begin();
70              student = em.find(Student.class, studentID);
71          } catch (Exception ex) {
72              System.out.println("Error " + ex.getMessage());
73          } finally {
74              em.close();
75          }
76          return student;
77
78      }
79
80      public void update(Student student) {
97  }
```

Console | Problems | Debug Shell

No consoles to display at this time.

Writable | Smart Insert | 34 : 1 : 774

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14. Get a Student in StudentDAO

eclipse-workspace - HSF301_Chapter_01_Ex_01_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_01_ManyToOne [HSF301 main
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
      - StudentDAO.java
    - hsf301.fe.gui
    - hsf301.fe.pojo
    - hsf301.fe.repository
    - hsf301.fe.service
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

Book.java | Student.java | *StudentDAO.java

```
20⊕     public void save(Student student) {
34
35⊕     public List<Student> getStudents() {
50
51⊕     public void delete(Long studentID) {
64
65⊕     public Student findById(Long studentID) {
79
80⊖     public void update(Student student) {
81          try {
82              em = emf.createEntityManager();
83              em.getTransaction().begin();
84              Student s = em.find(Student.class, student.getId());
85              if (s != null) {
86                  s.setFirstName(student.getFirstName());
87                  s.setLastName(student.getLastName());
88                  s.setMarks(student.getMarks());
89                  em.getTransaction().commit();
90              }
91          } catch (Exception ex) {
92              System.out.println("Error " + ex.getMessage());
93          } finally {
94              em.close();
95          }
96      }
97  }
98
```

Console | Problems | Debug Shell

No consoles to display at this time.

Writable | Smart Insert | 34 : 1 : 774

15. Create IStudentRepository

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToOne/src/main/java/hsf301/fe/repository/IStudentRepository.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Explorer | Servers

- HSF301_Chapter_01_Ex_01_ManyToOne [HSF301 main
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
    - hsf301.fe.gui
    - hsf301.fe.pojo
    - hsf301.fe.repository
      - IStudentRepository.java
      - StudentRepository.java
    - hsf301.fe.service
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

IStudentRepository.java

```java
package hsf301.fe.repository;

import java.util.List;

public interface IStudentRepository {
    public List<Student> findAll();

    public void save(Student student);

    public void delete(Long studentID);

    public Student findById(Long studentID);

    public void update(Student student);
}
```

Console | Problems | Debug Shell

No consoles to display at this time.

Writable | Smart Insert | 1 : 1 : 0

16. Create StudentRepository

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToOne/src/main/java/hsf301/fe/repository/StudentRepository.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Explorer | Servers

- HSF301_Chapter_01_Ex_01_ManyToOne [HSF301 main
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
    - hsf301.fe.gui
    - hsf301.fe.pojo
    - hsf301.fe.repository
      - IStudentRepository.java
      - StudentRepository.java
    - hsf301.fe.service
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

IStudentRepository.java | StudentRepository.java

```java
package hsf301.fe.repository;

import java.util.List;

public class StudentRepository implements IStudentRepository {
    private StudentDAO studentDAO = null;

    public StudentRepository(String fileConfig) {
        studentDAO = new StudentDAO(fileConfig);
    }
    @Override
    public void save(Student student) {
        // TODO Auto-generated method stub
        studentDAO.save(student);
    }
    @Override
    public List<Student> findAll() {
        // TODO Auto-generated method stub
        return studentDAO.getStudents();
    }
    @Override
    public void delete(Long studentID) {
        studentDAO.delete(studentID);
    }
    @Override
    public Student findById(Long studentID) {
        // TODO Auto-generated method stub
        return studentDAO.findById(studentID);
    }
    @Override
    public void update(Student student) {
        studentDAO.update(student);
    }
```

Console | Problems | Debug Shell

No consoles to display at this time.

Writable | Smart Insert | 35 : 36 : 885

17. Create IStudentService

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToOne/src/main/java/hsf301/fe/service/IStudentService.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Explorer | Servers

- HSF301_Chapter_01_Ex_01_ManyToOne [HSF301 main
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
    - hsf301.fe.gui
    - hsf301.fe.pojo
    - hsf301.fe.repository
    - hsf301.fe.service
      - IStudentService.java
      - StudentService.java
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

IStudentRepository.java | StudentRepository.java | IStudentService.java

```java
package hsf301.fe.service;

import java.util.List;

public interface IStudentService {
    public List<Student> findAll();

    public void save(Student student);

    public void delete(Long studentID);

    public Student findById(Long studentID);

    public void update(Student student);

}
```

Console | Problems | Debug Shell

No consoles to display at this time.

Writable | Smart Insert | 1 : 1 : 0

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18. Create StudentService

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToOne/src/main/java/hsf301/fe/service/StudentService.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Explorer | Servers

- HSF301_Chapter_01_Ex_01_ManyToOne [HSF301 main
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
    - hsf301.fe.gui
    - hsf301.fe.pojo
    - hsf301.fe.repository
    - hsf301.fe.service
      - IStudentService.java
      - StudentService.java
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

IStudentRepository.java | StudentRepository.java | IStudentService.java | *StudentService.java

```java
import java.util.List;
public class StudentService implements IStudentService {
    private IStudentRepository iStudentRepo = null;
    public StudentService(String fileName) {
        iStudentRepo = new StudentRepository(fileName);
    }
    @Override
    public void save(Student student) {
        iStudentRepo.save(student);
    }
    @Override
    public List<Student> findAll() {
        return iStudentRepo.findAll();
    }
    @Override
    public void delete(Long studentID) {
        iStudentRepo.delete(studentID);
    }
    @Override
    public Student findById(Long studentID) {
        return iStudentRepo.findById(studentID);
    }
    @Override
    public void update(Student student) {
        iStudentRepo.update(student);
    }
}
```

Console | Problems | Debug Shell

No consoles to display at this time.

Writable | Smart Insert | 26 : 49 : 747

19. Create Main function

```java
package hsf301.fe.gui;

import java.util.ArrayList;

public class ManyToOne {

    public static void main(String[] args) {
        // TODO Auto-generated method stub

        //Many To
        String fileName = "JPAs";
        IStudentService studentService = new StudentService(fileName);
        Student student = new Student("Lam","Nguyen",9);
        Book book = new Book("Java Persistence with Spring","Catalin Tudose","9781617299186");
        student.getBooks().add(book);
        studentService.AddStudent(student);
    }

}
```

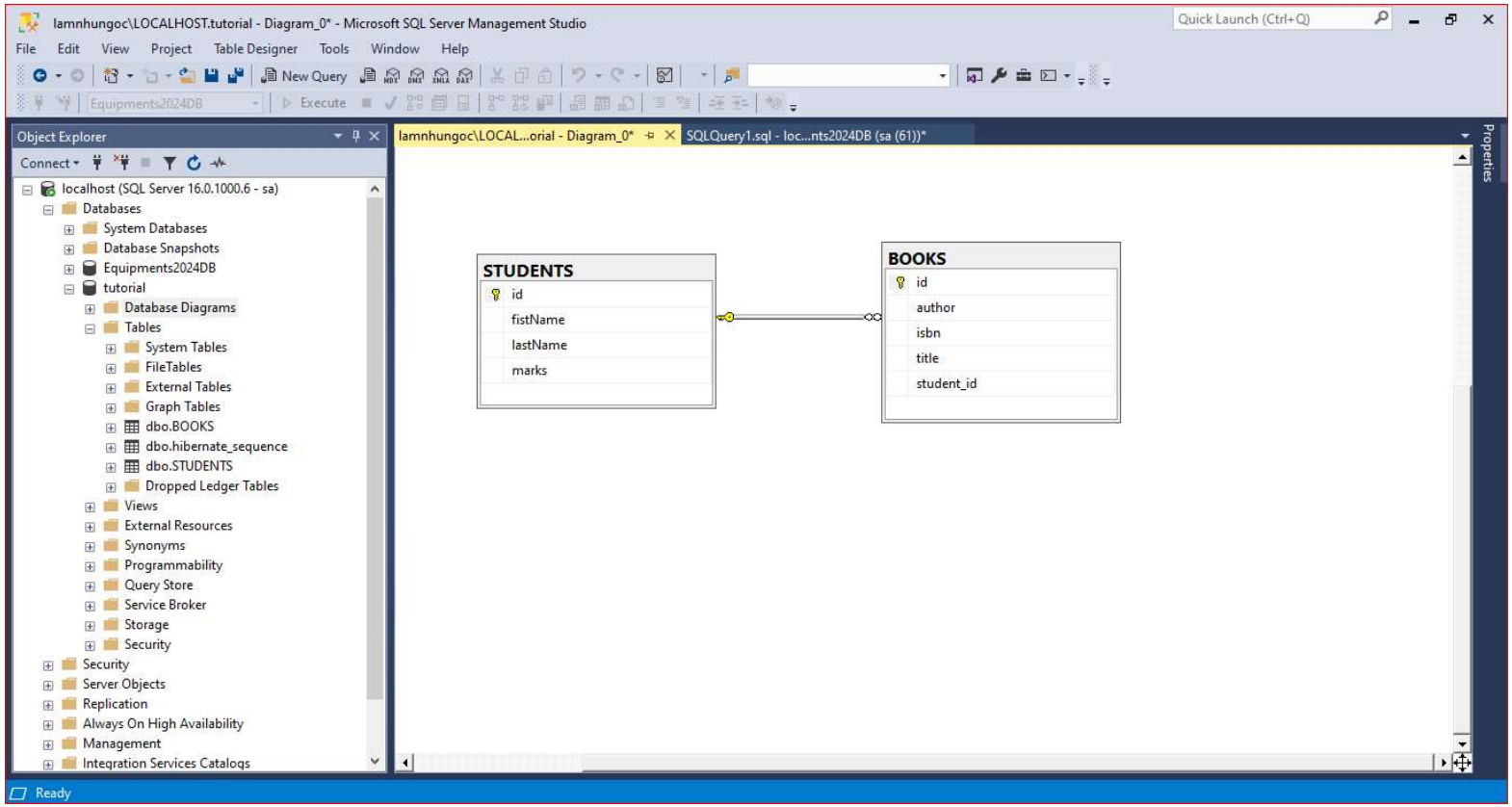
20. Run Program

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToOne/src/main/java/hsf301/fe/gui/ManyToOne.java - Eclipse IDE

```java
package hsf301.fe.gui;

import hsf301.fe.pojo.Book;

public class ManyToOne {

    public static void main(String[] args) {
        // TODO Auto-generated method stub

        //Many To
        String fileName = "JPAs";
        IStudentService studentService = new StudentService(fileName);
        Student student = new Student("Lam","Nguyen",9);
        Book book = new Book("Java Persistence with Spring","Catalin Tudose","9781617299186");
        student.getBooks().add(book);
        studentService.save(student);
    }

}
```

Non-externalized string literal; it should be followed by //$NON-NLS-<n>$ | Writable | Smart Insert | 17 : 55 : 496

21. Result


lamnhungoc\LOCALHOST.tutorial - Diagram_0* - Microsoft SQL Server Management Studio
Quick Launch (Ctrl+Q)
File Edit View Project Table Designer Tools Window Help
New Query
Equipments2024DB
Execute
Object Explorer
Connect
localhost (SQL Server 16.0.1000.6 - sa)
Databases
System Databases
Database Snapshots
Equipments2024DB
tutorial
Database Diagrams
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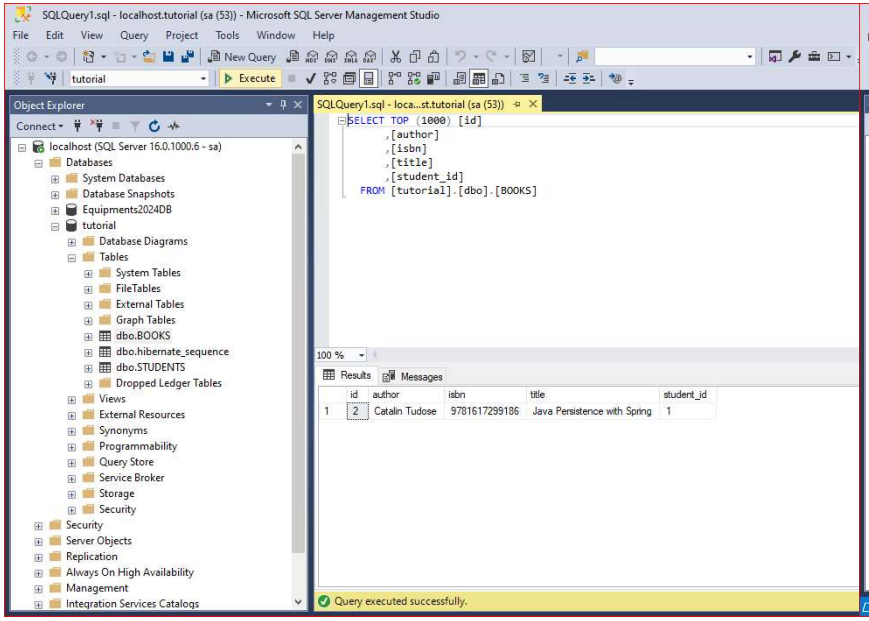
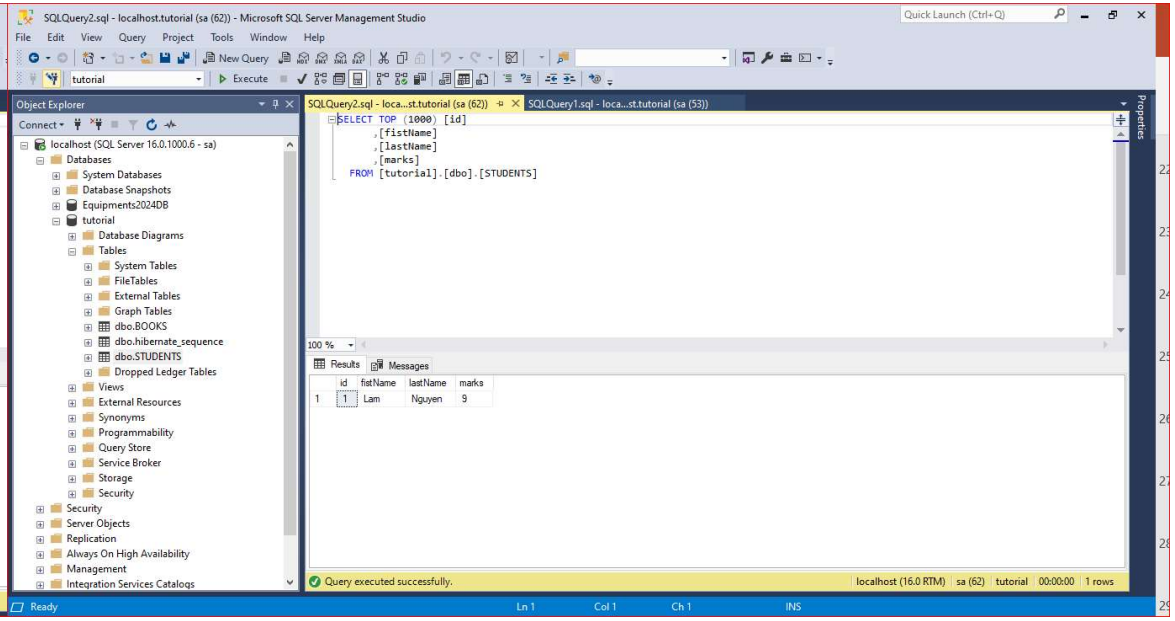
System Tables
FileTables
External Tables
Graph Tables
dbo.BOOKS
dbo.hibernate_sequence
dbo.STUDENTS
Dropped Ledger Tables
Views
External Resources
Synonyms
Programmability
Query Store
Service Broker
Storage
Security
Security
Server Objects
Replication
Always On High Availability
Management
Integration Services Catalogs
lamnhungoc\LOCAL...orial - Diagram_0*
SQLQuery1.sql - loc...nts2024DB (sa (61))*
Properties
STUDENTS
id
fistName
lastName
marks
BOOKS
id
author
isbn
title
student_id
Ready

22. Result


SQLQuery1.sql - localhost.tutorial (sa (53)) - Microsoft SQL Server Management Studio
File Edit View Query Project Tools Window Help
New Query
tutorial
Execute
Object Explorer
Connect
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]
100 %
Results
Messages
id author isbn title student_id
1 2 Catalin Tudose 9781617299186 Java Persistence with Spring 1
Query executed successfully.


SQLQuery2.sql - localhost.tutorial (sa (62)) - Microsoft SQL Server Management Studio
Quick Launch (Ctrl+Q)
File Edit View Query Project Tools Window Help
New Query
tutorial
Execute
Object Explorer
Connect
localhost (SQL Server 16.0.1000.6 - sa)
Databases
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Database Snapshots
Equipments2024DB
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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
SQLQuery2.sql - loca...st.tutorial (sa (62))
SQLQuery1.sql - loca...st.tutorial (sa (53))
SELECT TOP (1000) [id]
,[fistName]
,[lastName]
,[marks]
FROM [tutorial].[dbo].[STUDENTS]
Properties
100 %
Results
Messages
id fistName lastName marks
1 1 Lam Nguyen 9
Query executed successfully.
localhost (16.0 RTM) sa (62) tutorial 00:00:00 1 rows
Ready
Ln 1 Col 1 Ch 1 INS

Demo JPA
(Many To Many)

1. Create Books in Pojo's Package

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToMany/src/main/java/hsf301/fe/pojo/Book.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Explorer | Servers

- HSF301_Chapter_01_Ex_01_ManyToMany [HSF301 main]
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
      - StudentDAO.java
    - hsf301.fe.gui
      - ManyToManyDemo.java
    - hsf301.fe.pojo
      - Book.java
      - Student.java
    - hsf301.fe.repository
    - hsf301.fe.service
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

persistence.xml | StudentDAO.java | Book.java

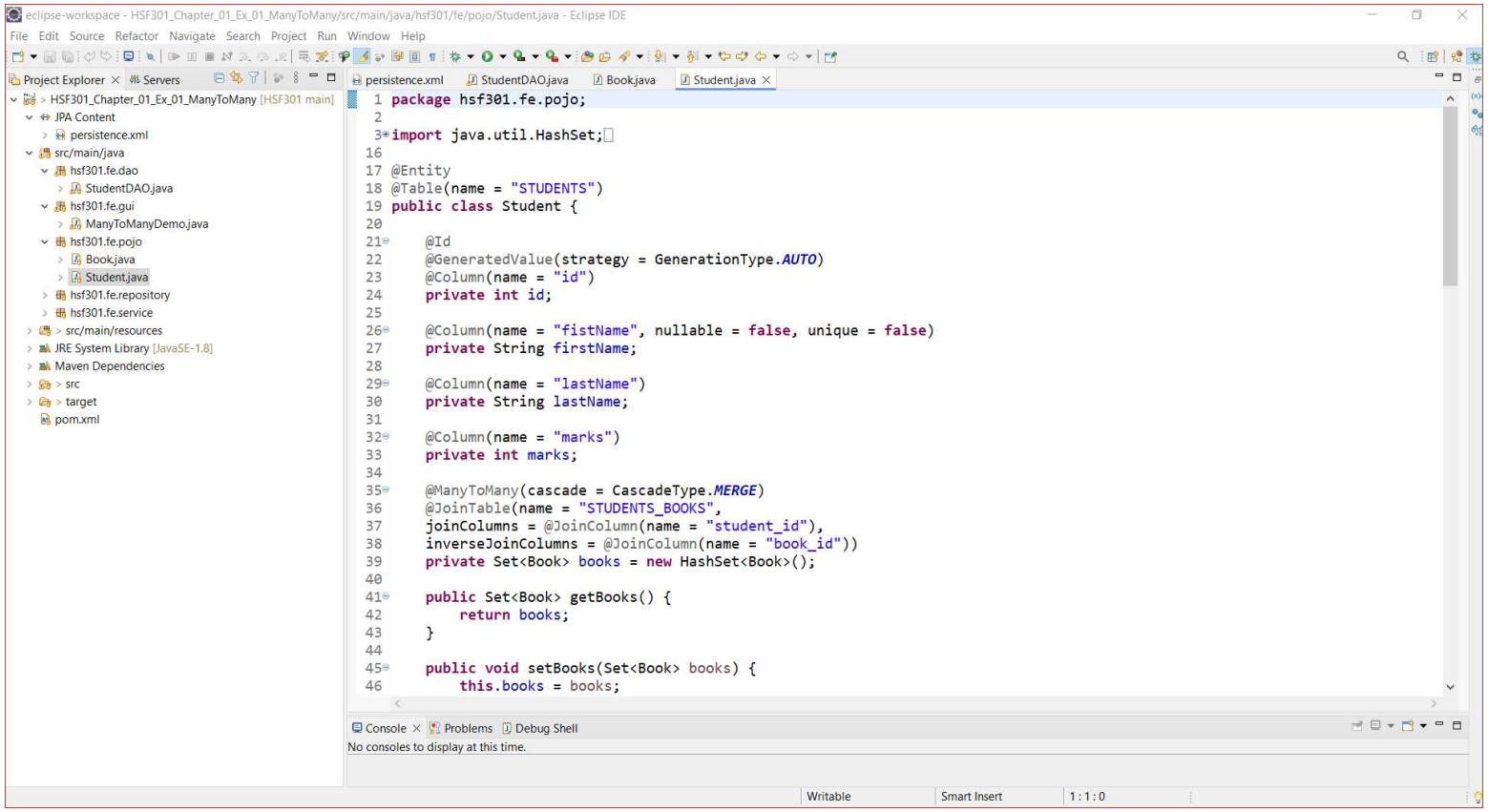
```java
package hsf301.fe.pojo;

import java.util.HashSet;

@Entity
@Table(name = "BOOKS")

public class Book {

    @Id
    @GeneratedValue(strategy = GenerationType.AUTO)
    @Column(name = "id")
    private Long id;

    @Column(name = "title", length = 30)
    private String title;

    private String author;

    private String isbn;

    @ManyToMany(mappedBy = "books")
    private Set<Student> student = new HashSet<Student>();

    public Book() {
        super();
    }
    public Book(String title, String author, String isbn) {
        super();
        this.title = title;
        this.author = author;
        this.isbn = isbn;
    }

```

Console | Problems | Debug Shell

No consoles to display at this time.

Writable | Smart Insert | 1 : 1 : 0

2. Create Students in Pojo's Package



3. Run Program

eclipse-workspace - HSF301_Chapter_01_Ex_01_ManyToMany/src/main/java/hsf301/fe/gui/ManyToManyDemo.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Explorer | Servers

- HSF301_Chapter_01_Ex_01_ManyToMany [HSF301 main]
  - JPA Content
    - persistence.xml
  - src/main/java
    - hsf301.fe.dao
      - StudentDAO.java
    - hsf301.fe.gui
      - ManyToManyDemo.java
    - hsf301.fe.pojo
      - Book.java
      - Student.java
    - hsf301.fe.repository
    - hsf301.fe.service
  - src/main/resources
  - JRE System Library [JavaSE-1.8]
  - Maven Dependencies
  - src
  - target
  - pom.xml

persistence.xml | StudentDAO.java | Book.java | Student.java | ManyToManyDemo.java

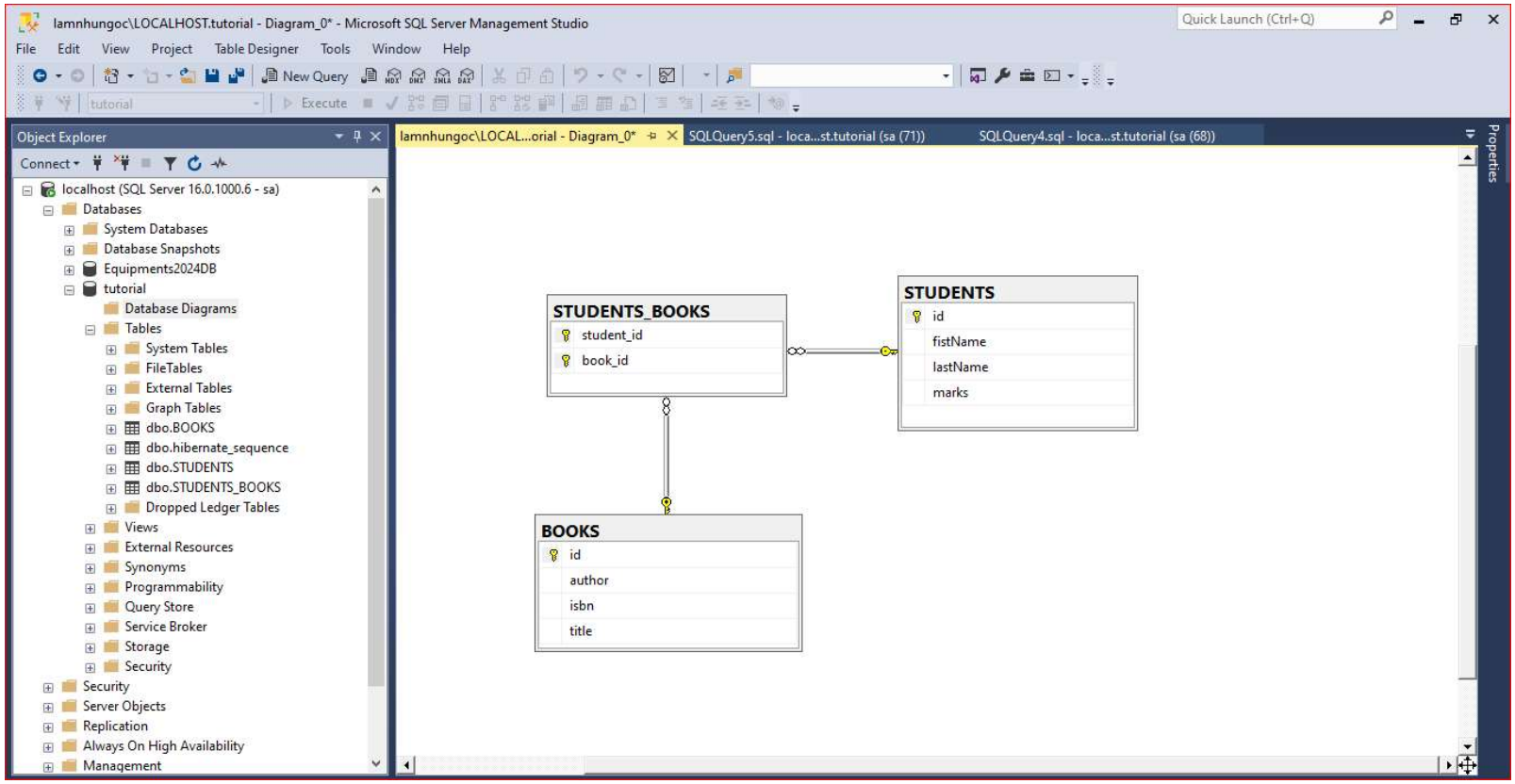
```java
package hsf301.fe.gui;

import java.util.List;

public class ManyToManyDemo {

    public static void main(String[] args) {
        // TODO Auto-generated method stub

        String fileName = "JPAs";
        IStudentService studentService = new StudentService(fileName);
        Student student = new Student("Lam", "Nguyen", 9);
        Book book = new Book("Java Persistence with Spring", "Catalin Tudose", "9781617299186");
        student.getBooks().add(book);
        studentService.save(student);
        List<Student> students = studentService.findAll();
        for(Student st : students) {
            System.out.println(st.getFirstName());
        }

    }
}
```

Console | Problems | Debug Shell

```
<terminated> ManyToManyDemo [Java Application] D:\eclipse\plugins\org.eclipse.justj.openjdk.hotspot.jre.full.win32.x86_64_17.0.10.v20240120-1143\jre\bin\javaw.exe (Apr 7, 2024, 10:36:10 PM – 10:36:14 PM) [pid: 4608
Hibernate: update hibernate_sequence set next_val= ? where next_val=?
Hibernate: select next_val as id_val from hibernate_sequence with (updlock, rowlock)
Hibernate: update hibernate_sequence set next_val= ? where next_val=?
Hibernate: insert into STUDENTS (fistName, lastName, marks, id) values (?, ?, ?, ?)
Hibernate: insert into BOOKS (author, isbn, title, id) values (?, ?, ?, ?)
Hibernate: insert into STUDENTS_BOOKS (student_id, book_id) values (?, ?)
Hibernate: select student0_.id as id1_1_, student0_.fistName as fistname2_1_, student0_.lastName as lastname3_1_, student0_.marks
Lam
```

Non-externalized string literal; it should be followed by //$NON-NLS-<n>$ | Writable | Smart Insert | 18 : 39 : 501

4. Result


lamnhungoc\LOCALHOST.tutorial - Diagram_0* - Microsoft SQL Server Management Studio
File Edit View Project Table Designer Tools Window Help
New Query
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Connect
localhost (SQL Server 16.0.1000.6 - sa)
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dbo.hibernate_sequence
dbo.STUDENTS
dbo.STUDENTS_BOOKS
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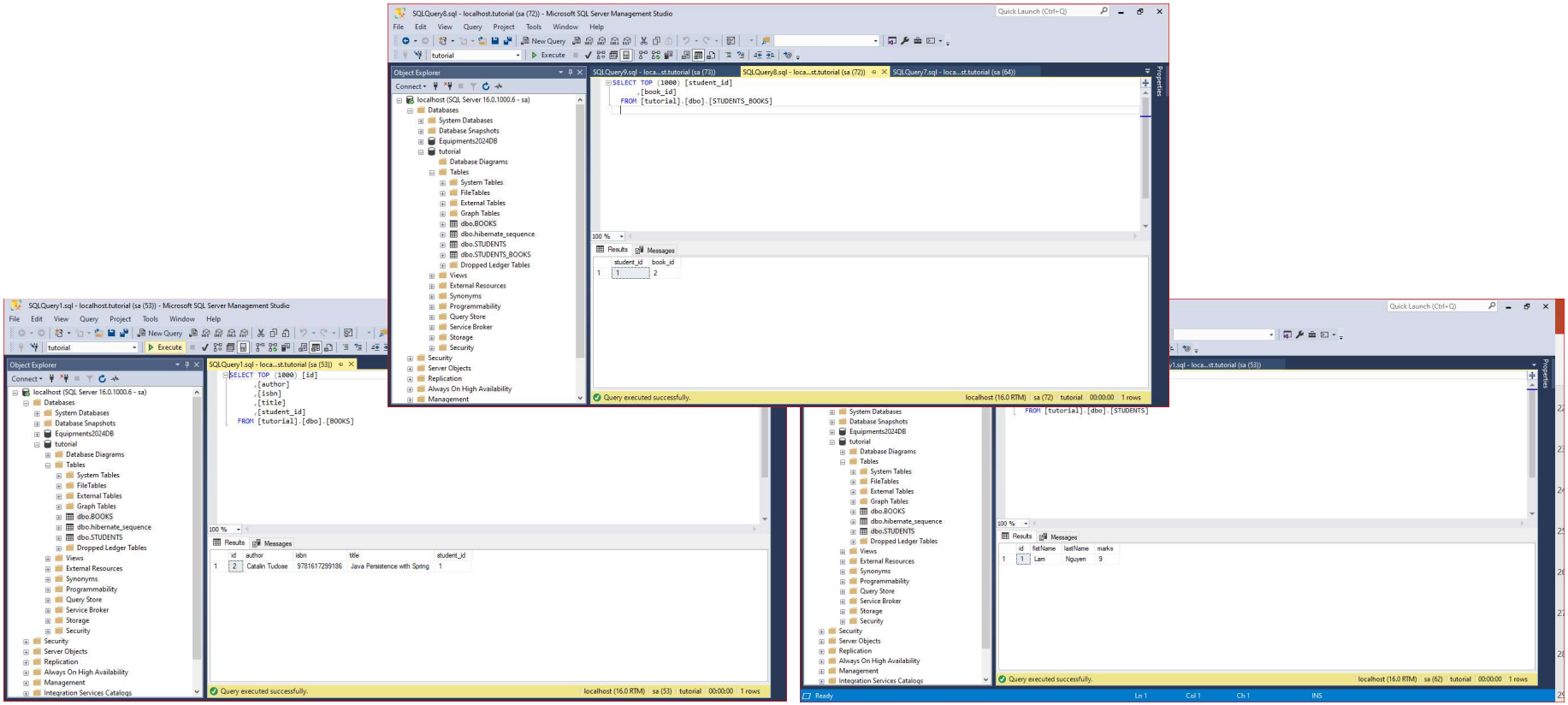
Programmability
Query Store
Service Broker
Storage
Security
Security
Server Objects
Replication
Always On High Availability
Management
lamnhungoc\LOCAL...orial - Diagram_0*
SQLQuery5.sql - loca...st.tutorial (sa (71))
SQLQuery4.sql - loca...st.tutorial (sa (68))
STUDENTS_BOOKS
student_id
book_id
STUDENTS
id
fistName
lastName
marks
BOOKS
id
author
isbn
title

5. Result


SQLQuery8.sql - localhost.tutorial (sa (72)) - Microsoft SQL Server Management Studio
SELECT TOP (1000) [student_id]
,[book_id]
FROM [tutorial].[dbo].[STUDENTS_BOOKS]
Query executed successfully.
SQLQuery1.sql - localhost.tutorial (sa (53)) - Microsoft SQL Server Management Studio
SELECT TOP (1000) [id]
,[author]
,[isbn]
,[title]
,[student_id]
FROM [tutorial].[dbo].[BOOKS]
Query executed successfully.
SELECT TOP (1000) [id]
,[fistName]
,[lastName]
,[marks]
FROM [tutorial].[dbo].[STUDENTS]
Query executed successfully.

Summary

- Concepts were introduced:
  - Overview about JPA
  - Architecture Overview new features of JPA
  - Why JPA is selected as develop application?
  - Explain and demo using Eclipse IDE to create JPA Console App
  - Create and Run cross-platform Console application with Java connect to MSSQL with Repository Pattern