Homework #2

CS 4120/5220 – Adv Appl Development in Java

Fall 2025

100 Points
Due: 09/26/2025, 11:59 PM

Instructions: Submit all required project files, including source code, as a single compressed archive (ZIP file). Ensure that your project is well-organized, with appropriate folder structures for source files, resources, and any required dependencies. Include a README file if necessary to explain how to run the program. Do not copy and paste code from external sources. Clearly comment on your code to explain important logic. Convert any written explanations, analysis, or required screenshots into a single PDF file and include it in the ZIP archive. Upload the ZIP file to Brightspace before the due date and time.

Objectives: Develop a **Library Management System** that allows users to borrow different types of library items, including books, magazines, and DVDs. The system should be designed using **object-oriented programming (OOP) principles**, emphasizing **inheritance and polymorphism** to efficiently manage different item types and borrowing operations.

Requirements:

1. Define an abstract base class LibraryItem that includes:
    a. Protected attributes: itemId, title, borrowPricePerDay
    b. A constructor to initialize common attributes
    c. A getter method for borrowPricePerDay
    d. An abstract method displayDetails() to be implemented by subclasses

2. Create three subclasses (Book, Magazine, and DVD) that inherit from LibraryItem:
    a. Each subclass should have specific attributes:
        i. Book: author, numPages
        ii. Magazine: issueNumber, publisher
        iii. DVD: duration, ageRating
    b. Each subclass should override displayDetails() to display its attributes

3. Create an interface Borrowable that declares:
    a. A method calculateBorrowCost(int days) that calculates and returns the total borrow cost

b. Each item subclass should implement this method

4. Manage a fixed number of items using an array (LibraryItem[] availableItems):
    a. The system should store exactly 5 items at startup
    b. Once an item is borrowed, set that position in the array to null

5. Create a MainApp class to:
    a. Provide a menu-driven interface for users to:
        i. View available items.
        ii. Borrow an item by selecting its ID and the number of days
        iii. Display the total borrow cost after selection
    b. Ensure that once an item is borrowed, it is no longer available for borrowing

Procedure:

1. Define the Abstract class LibraryItem
    a. Create an abstract class LibraryItem to serve as a base class
    b. Define protected attributes: itemId (String), title (String), borrowPricePerDay (double)
    c. Implement a constructor to initialize these attributes.
    d. Create a getter method for borrowPricePerDay to ensure encapsulation
    e. Declare an abstract method displayDetails() to be overridden in subclasses

2. Creating the Borrowable Interface
    a. Define an interface Borrowable to enforce a common behavior for all borrowable items
    b. Declare a method calculateBorrowCost(int days) to compute the total borrow cost

3. Create Subclasses for Different Item Types
    a. **Book Class**: attributes author, numPages
    b. **Magazine Class**: attributes issueNumber, publisher
    c. **DVD Class**: attributes duration, ageRating
    d. Each subclass overrides displayDetails() and implements calculateBorrowCost(int days)

4. Initializing Available Items Using an Array
    a. In the MainApp class, create an array of LibraryItem objects to store exactly 5 items at startup
    b. Populate the array with predefined objects (Book, Magazine, DVD)
5. Create a Menu-Driven System
    a. Use a while loop to provide an interactive menu for users:

i. View Available Items (call displayDetails() if not null)
ii. Borrow an Item (prompt ID and days, calculate cost, set to null)
iii. Exit the System (terminate the program)

Deliverables:

Submit a project folder containing: LibraryItem.java, Borrowable.java, Book.java, Magazine.java, DVD.java, MainApp.java

Sample execution results: