

Java Exam Coding Question

Background

You are tasked with developing a simple library management system. This system should demonstrate key Object-Oriented Programming (OOP) principles: inheritance, polymorphism, abstraction, and encapsulation. Additionally, you will perform CRUD (Create, Read, Update, Delete) operations on a collection of books using `ArrayList`.

Question

1. Define Classes and Inheritance:

Create a base class called `Person` with the following attributes and methods:

- **Attributes:**
 - `name` (String): The name of the person.
 - `email` (String): The email of the person.
- **Methods:**
 - `public Person(String name, String email)`: Constructor to initialize all attributes.
 - `public String getName()`: Returns the person's name.
 - `public String getEmail()`: Returns the person's email.

Create a subclass called `Author` that extends `Person` with the following additional attributes and methods:

- **Attributes:**
 - `bio` (String): The biography of the author.
- **Methods:**
 - `public Author(String name, String email, String bio)`: Constructor to initialize all attributes, including those from the base class.
 - `public String getBio()`: Returns the author's biography.

2. Implement Abstraction and Polymorphism:

Create an abstract class called `LibraryItem` with the following attributes and methods:

- **Attributes:**
 - `id` (int): A unique identifier for the item.
 - `title` (String): The title of the item.
 - `yearPublished` (int): The year the item was published.
- **Methods:**
 - `public LibraryItem(int id, String title, int yearPublished)`: Constructor to initialize all attributes.
 - `public int getId()`: Returns the item's id.
 - `public String getTitle()`: Returns the item's title.
 - `public int getYearPublished()`: Returns the item's year of publication.
 - `public abstract void displayInfo()`: An abstract method to display the information about the item.

Create a subclass called `Book` that extends `LibraryItem` with the following additional attributes and methods:

- **Attributes:**
 - `author` (Author): The author of the book.
 - `genre` (String): The genre of the book.
- **Methods:**
 - `public Book(int id, String title, int yearPublished, Author author, String genre)`: Constructor to initialize all attributes, including those from the base class.
 - `public Author getAuthor()`: Returns the book's author.
 - `public String getGenre()`: Returns the book's genre.
 - Override the `displayInfo()` method to include the author and genre information.

3. Encapsulation and CRUD Operations:

Create a class called `LibraryManager` with the following methods to manage a collection of `LibraryItem` objects using an `ArrayList`:

- **Attributes:**
 - `private ArrayList<LibraryItem> items`: A list to store the items in the library.
- **Methods:**
 - `public void addItem(LibraryItem item)`: Adds the given item to the `items` list.
 - `public void removeItem(int id)`: Removes the item with the given id from the `items` list.
 - `public LibraryItem getItem(int id)`: Retrieves and returns the item with the given id from the `items` list.
 - `public void displayAllItems()`: Iterates through the `items` list and calls `displayInfo()` on each item.

4. Testing:

- Implement a `main` method to test the functionality:
 - Create an instance of `LibraryManager`.
 - Create several `Author` and `Book` objects.
 - Add at least three `Book` objects to the library.
 - Display all items in the library.
 - Retrieve and display the details of a book by its id.
 - Remove a book by its id and display the remaining items.

Method Signatures:

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// Person class  
public Person(String name, String email)  
public String getName()  
public String getEmail()  
  
// Author class (extends Person)  
public Author(String name, String email, String bio)  
public String getBio()  
  
// LibraryItem abstract class  
public LibraryItem(int id, String title, int yearPublished)  
public int getId()  
public String getTitle()  
public int getYearPublished()  
public abstract void displayInfo()  
  
// Book class (extends LibraryItem)  
public Book(int id, String title, int yearPublished, Author author, String genre)  
public Author getAuthor()  
public String getGenre()  
@Override  
public void displayInfo()  
  
// LibraryManager class  
private ArrayList<LibraryItem> items  
public void addItem(LibraryItem item)  
public void removeItem(int id)  
public LibraryItem getItem(int id)  
public void displayAllItems()
```