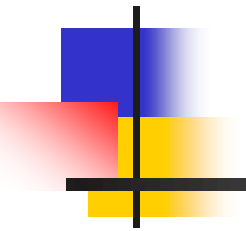
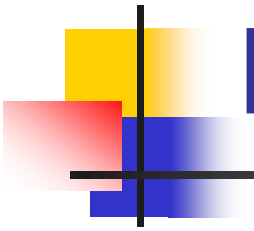


Lab 7 Abstract Class and Interface

Lý thuyết và ngôn ngữ hướng đối tượng (bài tập)

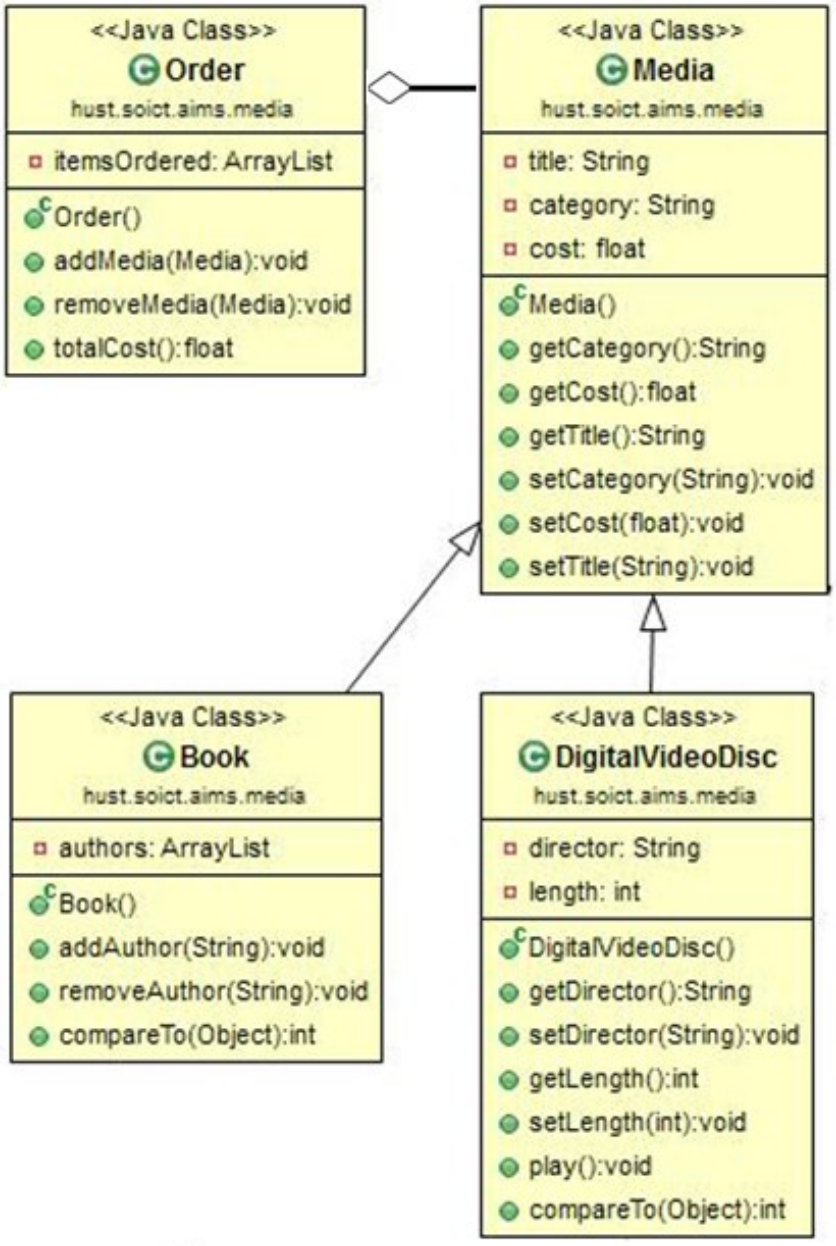


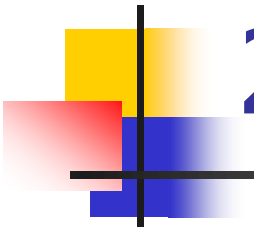
Lab's Objectives

- In this lab, you will practice with:
  - Creating abstract class, abstract methods
  - Creating interface and implement it
  - Using Threads

1. Continue the AimsProject

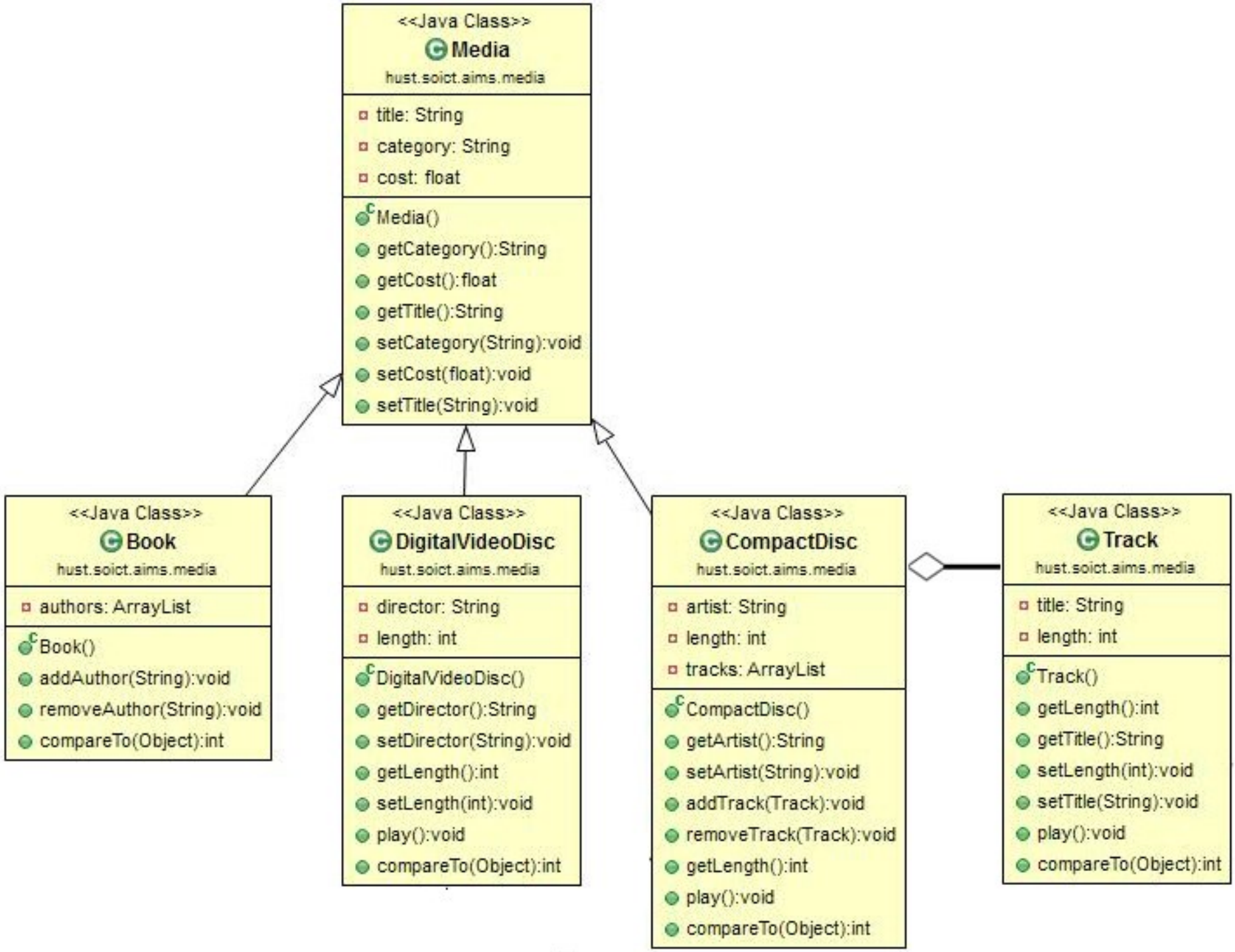
- **Open Eclipse**
- **Open AimsProject**

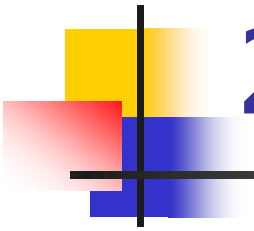




2. Extending the AIMS project

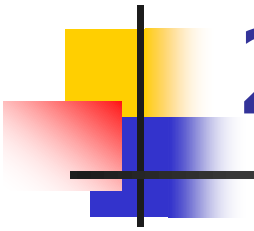
- **Extending the AIMS project to allow the ordering of CDs (Compact Discs)**
  - As with **DigitalVideoDisc** and **Book**, the **CompactDisc** class will extend **Media**, inheriting the **title**, **category** and **cost** fields and the associated methods.


<<Java Class>>
Media
hust.soict.aims.media
title: String
category: String
cost: float
Media()
getCategory():String
getCost():float
getTitle():String
setCategory(String):void
setCost(float):void
setTitle(String):void
<<Java Class>>
Book
hust.soict.aims.media
authors: ArrayList
Book()
addAuthor(String):void
removeAuthor(String):void
compareTo(Object):int
<<Java Class>>
DigitalVideoDisc
hust.soict.aims.media
director: String
length: int
DigitalVideoDisc()
getDirector():String
setDirector(String):void
getLength():int
setLength(int):void
play():void
compareTo(Object):int
<<Java Class>>
CompactDisc
hust.soict.aims.media
artist: String
length: int
tracks: ArrayList
CompactDisc()
getArtist():String
setArtist(String):void
addTrack(Track):void
removeTrack(Track):void
getLength():int
play():void
compareTo(Object):int
<<Java Class>>
Track
hust.soict.aims.media
title: String
length: int
Track()
getLength():int
getTitle():String
setLength(int):void
setTitle(String):void
play():void
compareTo(Object):int



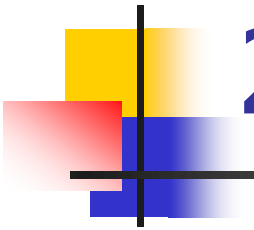
2. Extending the AIMS project

- **2.1. Make the Media abstract class**
  - Open **Media** class
  - Modify the **Media** class and make it **abstract**
  - Keep three fields of **Media**: **title**, **category**, **cost** and their associated methods



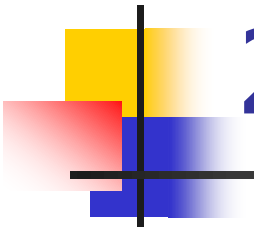
2. Extending the AIMS project

- **2.2. Create the Disc class extending the Media class**
  - The **Disc** class has two fields: **length** and **director**
  - Create **getter**/**setter** methods for these fields
  - Make the **DigitalVideoDisc** extending the **Disc** class
  - Create the **CompactDisc** extending the **Disc** class



2. Extending the AIMS project

- **2.3. Create the Track class which models a track on a compact disc and will store information incuding the title and length of the track**
  - Open the **Track** class
  - Add two fields: **String title** and **int length**
  - Make these fields **private** and create their **getter** and **setter** methods as **public**
  - Save your changes

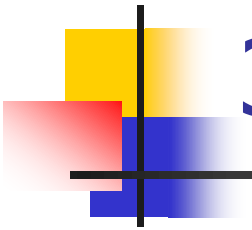


2. Extending the AIMS project

- **2.4. Open the CompactDisc class**
  - Add 3 fields to this class:
    - a **String** as **artist**
    - an **int** field as **length**
    - an **ArrayList** of **Track** as **tracks**
  - Make all these fields as **private**
  - Create **getter** and **setter** methods for only **artist**, make them **public**

2. Extending the AIMS project

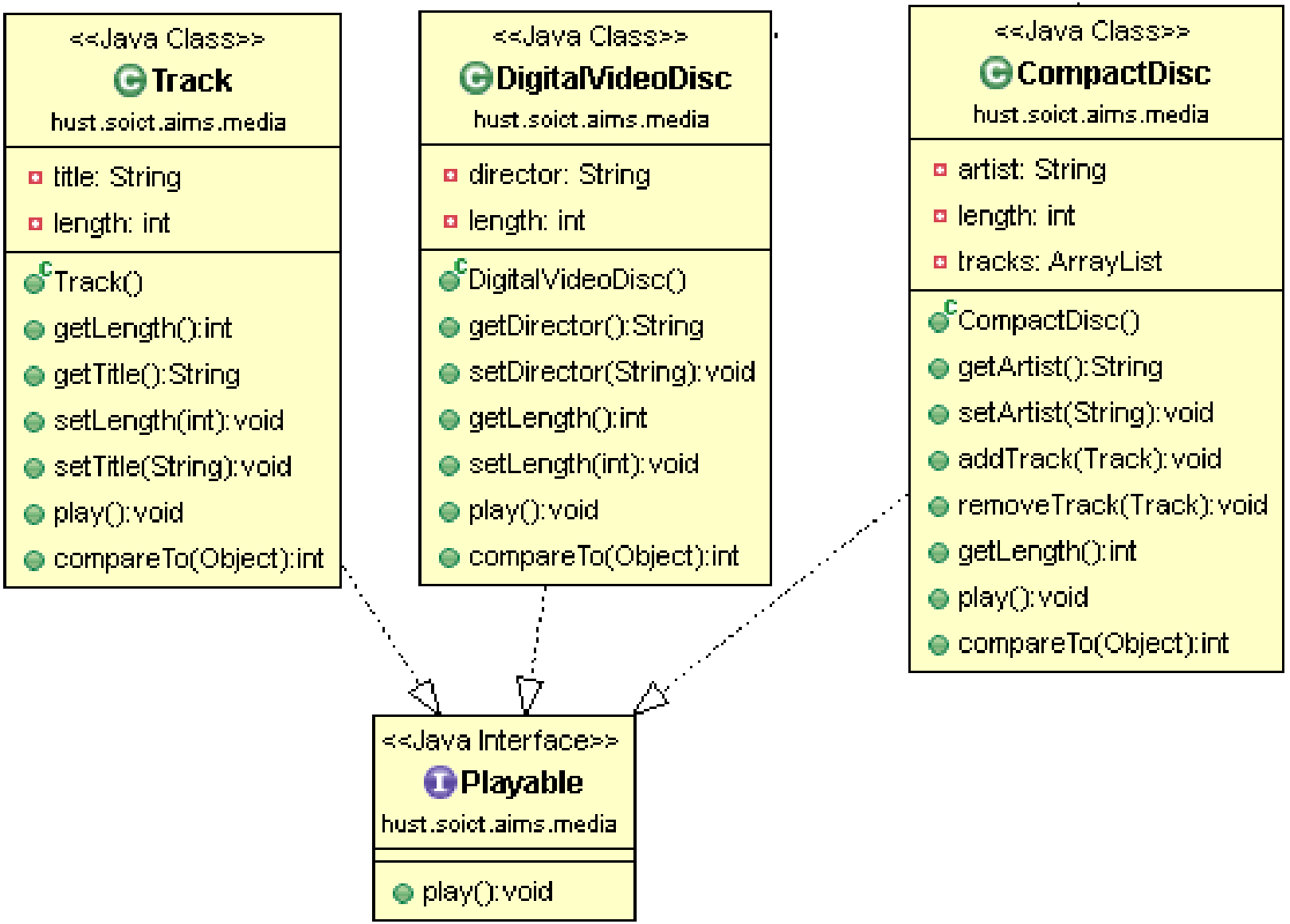
- **2.4. Open the CompactDisc class**
  - Create methods **addTrack**() and **removeTrack**()
    - The **addTrack**() method should check if the input track is already in the list of tracks and inform users
    - The **removeTrack**() method should check if the input track existed in the list of tracks and inform users
  - Create the **getLength**() method
    - Because each track in the CD has a length, the length of the CD should be the total length of all its tracks.
  - Save your changes

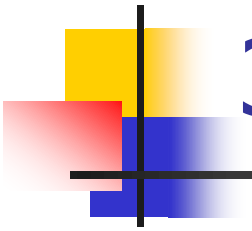


3. Create the Playable interface

- 3. Create the **Playable** interface
  - The Playable interface is created to allow classes to indicate that they implement a **play**() method
  - Add to the Playable interface the method prototype: **public void play();**
  - Save your changes

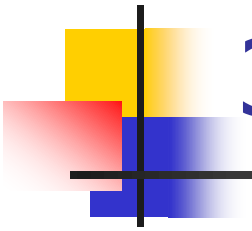
3. Create the Playable interface





3. Create the Playable interface

- 3. Create the **Playable** interface
  - Implement the **Playable interface**
    - Implement **Playable** with **CompactDisc**, **DigitalVideoDisc** and **Track**
    - For each of these classes **CompactDisc** and **DigitalVideoDisc**, edit the class description to include the keywords **implements Playable**, after the keyword **extends Disc**
    - For the **Track** class, insert the keywords **implements Playable** after the keywords **public class Track**

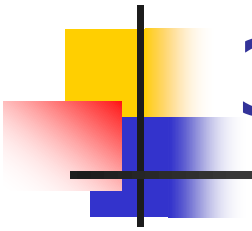


3. Create the Playable interface

- 3. Create the **Playable** interface
  - Implement **play**() for **DigitalVideoDisc** and **Track**
    - Add the method **play**() to these two classes
    - In the **DigitalVideoDisc**, simply print to screen:

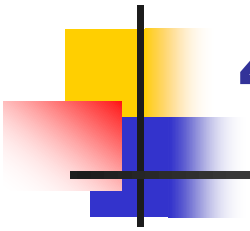
```
public void play() {
        System.out.println("Playing DVD: " + this.getTitle());
        System.out.println("DVD length: " + this.getLength());
}
```

    - For the **Track** class, you do the same



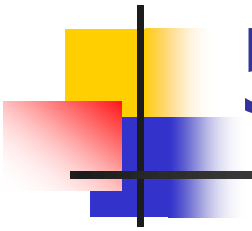
3. Create the Playable interface

- 3. Create the **Playable** interface
  - Implement **play**() for **CompactDisc**
    - Since the **CompactDisc** class contains a **ArrayList** of **Tracks**, each of which can be played on its own. The **play**() method should output some information about the **CompactDisc** to console
    - Loop through each track of the arraylist and call **Track's** play() method



4. Update the Aims class

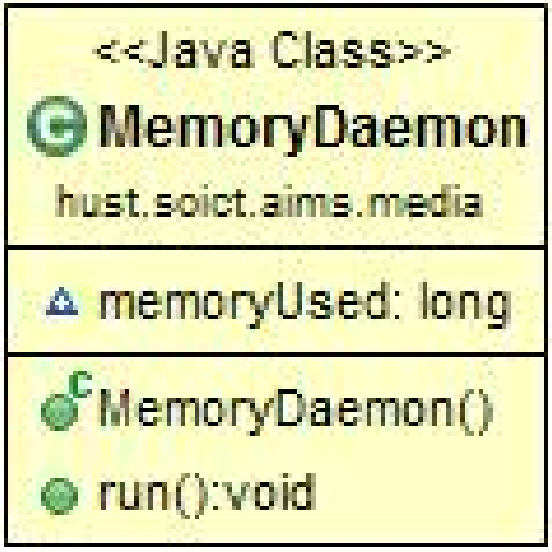
- **4. Update the Aims class**
  - You will update the **Aims** class to test your changes.
  - Create more choices for your console application
  - Update the menu of choices:
    - For the addition of new item to the order, the program should ask for the type: **Book**, **CompactDisc** or **DigitalVideoDisc**
    - For the **CompactDisc**, the program should allow to add information of **Tracks**
    - When adding a cd/dvd to the order, the user may ask for play them



5. Practice with Threads

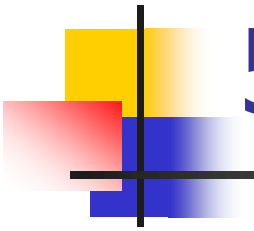
- A class called **MemoryDaemon** runs as a daemon thread, tracking the memory usage in the system.
  - The **MemoryDaemon** class implements the **java.lang.Runnable** interface
  - Implement the **run**() method
  - Add the field **long memoryUsed** to the **MemoryDaemon** class
  - Initialize this field to 0. It keeps track of the memory usage in the system.
  - Add code to the **run**() method to check memory usage as the program runs
  - Create a loop which will log the amount of memory used as the **Aims.main**() method executes. You will make use of the **java.lang.Runtime** class, which has a static method **getRuntime**().
- Save your changes

5. Practice with Threads




```
public void run(){
    Runtime rt = Runtime.getRuntime();
    long used;

    while (true) {
        used = rt.totalMemory() - rt.freeMemory();
        if (used != memoryUsed) {
          System.out.println("\tMemory used = " + used);
          memoryUsed = used;
        }
    }
}
```



5. Practice with Threads

- **5.2. Updating the Aims class**
  - The **Aims** class will create a new **MemoryDaemon** object and run it as a daemon thread
  - Open the **main**() method of **Aims** class
  - Add code to create a new **MemoryDaemon** object
  - Use this object in the constructor of the **Thread** class to create a new **Thread** object
  - Using the **setDaemon**() method to indicate that this thread is a daemon thread, add code to start the thread.
  - Save your changes
  - Run the program and see the changes.