# Báo cáo thực hành Lập trình hướng đối tượng Lab 04

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google docs
github

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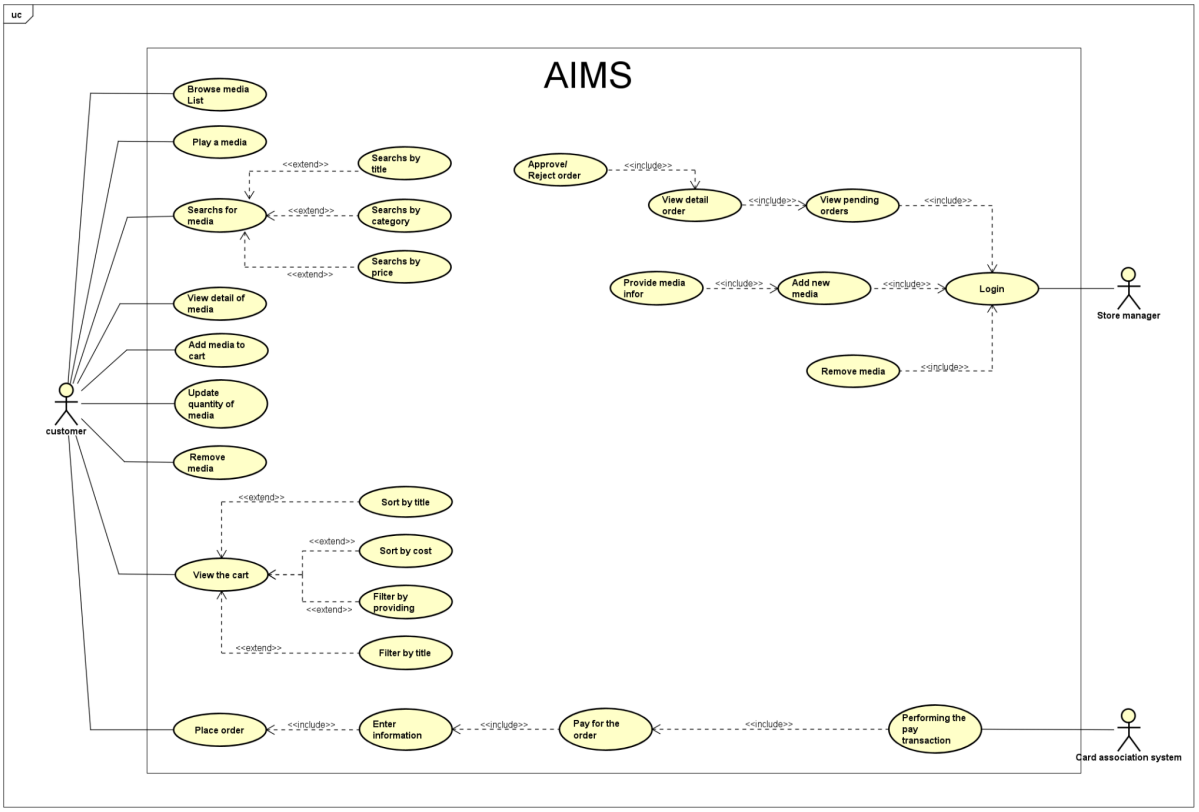
## 1. Import the existing project into the workspace of Eclipse

## 2. Additional requirements of AIMS




## 3. Creating the Book class

## 4. Creating the abstract Media class (Gộp phần 3 và 4 làm một)

- Book class:

```java
public class Book extends Media {  8 usages  Long Pham +1
    private List<String> authors = new ArrayList<String>();  6 usages

    public Book() { super(); }

    public Book(int id, String title, String category, float cost, List<String> authors) {  3 usages  Lon
        super(id, title, category, cost);
        this.authors = authors;
    }

    public Book(int id, String title, String category, float cost) { super(id, title, category, cost); }

    public Book(String title, String category, float cost) { super(nbMedia++, title, category, cost); }

    public void addAuthor(String authorName) {  4 usages  Long Pham +1
        if(!authors.contains(authorName)) {
            authors.add(authorName);
            System.out.println("Author added");
        }
        else System.out.println("Author is already in the list");
    }

    public void removeAuthor(String authorName) {  no usages  Long Pham +1
        if(authors.contains(authorName)) {
            authors.remove(authorName);
            System.out.println("Author removed");
        }
        else System.out.println("Author is not in the list");
    }

    @Override  Long Pham +1
    public String toString() {
        return "Book: " +
                "id = " + getId() +
                " - title = '" + getTitle() + '\'' +
                " - category = '" + getCategory() + '\'' +
                " - cost = " + getCost() +
                " - (List of) authors = " + authors;
    }
```

- Media class:

```java
public abstract class Media implements Comparable<Media> {  4 inheritors  Long Pham +1
    public static final Comparator<Media> COMPARE_BY_TITLE_COST = new MediaComparatorByTitleCost();
    public static final Comparator<Media> COMPARE_BY_COST_TITLE = new MediaComparatorByCostTitle();
    private int id;  4 usages
    private String title;  8 usages
    private String category;  4 usages
    private float cost;  6 usages

    public static int nbMedia = 1;  6 usages

    public Media() {  Long Pham

    }

    public Media(int id, String title, String category, float cost) {  Long Pham
        this.id = id;
        this.title = title;
        this.category = category;
        this.cost = cost;
    }

    public int getId() {  6 usages  Long Pham
        return id;
    }

    public void setId(int id) { this.id = id; }

    public String getTitle() {  Long Pham
        return title;
    }

    public void setTitle(String title) { this.title = title; }

    public String getCategory() { return category; }

    public void setCategory(String category) { this.category = category; }

    public float getCost() {  11 usages  Long Pham
        return cost;
    }

    public void setCost(float cost) { this.cost = cost; }

    @Override  4 overrides  Long Pham
    public String toString() {
        return "Media: " +
                "id=" + id +
                " - title='" + title + '\'' +
                " - category='" + category + '\'' +
                " - cost=" + cost;
    }

    @Override  Long Pham
    public boolean equals(Object o) {
        if (this == o) return true;
        if (o == null || getClass() != o.getClass()) return false;
        Media media = (Media) o;
        return Objects.equals(title, media.title);
    }

    @Override  1 override  Long Pham
    public int compareTo(Media other) {
        int titleComparison = this.title.compareTo(other.title);
        if (titleComparison != 0) return titleComparison;


        return Float.compare(other.cost, this.cost);
    }
```

## 5. Creating the CompactDisc class

### 5.1. Create the Disc class extending the Media class

```java
public class Disc extends Media {  2 usages  2 inheritors  Long Pham
    private int length;  3 usages
    private String director;  3 usages

    public Disc() {  1 usage  Long Pham
        super();
    }

    public Disc(int id, String title, String category, float cost, int length, String director) {
        super(id, title, category, cost);
        this.length = length;
        this.director = director;
    }

    public int getLength() {  11 usages  1 override  Long Pham
        return length;
    }

    public void setLength(int length) {  no usages  Long Pham
        this.length = length;
    }

    public String getDirector() {  3 usages  Long Pham
        return director;
    }

    public void setDirector(String director) {  no usages  Long Pham
        this.director = director;
    }

    @Override  2 overrides  Long Pham
    public String toString() {
        return "Disc: " +
                "id=" + getId() +
                " - title = '" + getTitle() + '\'' +
                " - category = '" + getCategory() + '\'' +
                " - cost = " + getCost() +
                " - length = " + getLength() +
                " - director = '" + getDirector() + '\'';
    }
}
```

**5.2. Create the Track class which models a track on a compact disc and will store information including the title and length of the track**

```java
public class Track implements Playable {  26 usages  Long Pham +1
    private String title;  6 usages
    private int length;  6 usages

    public Track() {  no usages  Long Pham
        super();
    }

    public Track(String title, int length) {  9 usages  Long Pham
        this.title = title;
        this.length = length;
    }

    public String getTitle() {  Long Pham
        return title;
    }

    public void setTitle(String title) {  Long Pham
        this.title = title;
    }

    public int getLength() {  3 usages  Long Pham
        return length;
    }

    public void setLength(int length) {  no usages  Long Pham
        this.length = length;
    }

    @Override  7 usages  Long Pham +1
    public void play() {
        System.out.println("Playing track: " + getTitle());
        if (getLength() == 0) System.out.println("Track cannot be played.");
        else System.out.println("Track length: " + getLength());
    }

    @Override  Long Pham
    public boolean equals(Object o) {
        if (this == o) return true;
        if (o == null || getClass() != o.getClass()) return false;
        Track track = (Track) o;
        return length == track.length && Objects.equals(title, track.title);
    }

    @Override  Long Pham
    public String toString() {
        return "Track: " +
                "title = '" + title + '\'' +
                " - length = " + length;
    }
}
```

## 5.3. Open the CompactDisc class

```java
public class CompactDisc extends Disc implements Playable {  17 usages  Long Pham +1
    private String artist;  5 usages
    private ArrayList<Track> tracks = new ArrayList<Track>();  10 usages

    public CompactDisc() {  1 usage  Long Pham
        super();
    }

    public CompactDisc(int id, String title, String category, float cost, String director, String artist) {  1 usage  Long Pham
        super(id, title, category, cost, length: 0, director);
        this.artist = artist;
    }

    public CompactDisc(int id, String title, String category, float cost, String director, String artist, ArrayList<Track> tracks) {
        super(id, title, category, cost, length: 0, director);
        this.artist = artist;
        this.tracks = tracks;
    }

    public CompactDisc(String title, String category, String artist, float cost) {  5 usages  Long Pham +1
        super(nbMedia++, title, category, cost, length: 0, director: null);
        this.artist = artist;
        this.tracks = tracks;
    }

    public String getArtist() { return artist; }

    public void addTrack(Track track) {  9 usages  Long Pham
        if (tracks.contains(track)) System.out.println("Track is already in the list");
        else {
            tracks.add(track);
            System.out.println("Track added");
        }
    }

    public void removeTrack(Track track) {  no usages  Long Pham
        if (tracks.contains(track)) {
            tracks.remove(track);
            System.out.println("Track removed");
        } else System.out.println("Track is not in the list");
    }

    public int getLength() {  11 usages  Long Pham
        int length = 0;
        for (Track track : tracks) {
            length += track.getLength();
        }
        return length;
    }

    @Override  7 usages  Long Pham +1
    public void play() {
        System.out.println("Playing CompactDisc: " + this.getTitle());

        if (getLength() == 0) System.out.println("CD cannot be played!");
        else {
            System.out.println("CD length: " + getLength());
            System.out.println("Artist: " + this.getArtist());

            for (Track track : tracks) track.play();
        }
    }

    @Override  Long Pham
    public String toString() {
        return "CompactDisc: " +
                "id = " + getId() +
                " - title = '" + getTitle() + '\'' +
                " - category = '" + getCategory() + '\'' +
                " - cost = " + getCost() +
                " - length = " + getLength() +
                " - director = '" + getDirector() + '\'' +
                " - artist = '" + artist + '\'' +
                " - tracks = " + tracks;
    }
}
```

**6. Create the Playable interface**

```java
public interface Playable {
    public void play();  7 u
}
```

- CompactDisc class:

```java
@Override  7 usages  Long Pham +1
public void play() {
    System.out.println("Playing CompactDisc: " + this.getTitle());

    if (getLength() == 0) System.out.println("CD cannot be played!");
    else {
        System.out.println("CD length: " + getLength());
        System.out.println("Artist: " + this.getArtist());

        for (Track track : tracks) track.play();
    }
}
```

- DigitalVideoDisc class:

```java
@Override  7 usages  Long Pham +1
public void play() {
    System.out.println("Playing DVD: " + getTitle());

    if (getLength() == 0) System.out.println("DVD cannot be played.");
    else System.out.println("DVD length: " + getLength());
}
```

- Track class:

```java
@Override  7 usages  Long Pham +1
public void play() {
    System.out.println("Playing track: " + getTitle());
    if (getLength() == 0) System.out.println("Track cannot be played.");
    else System.out.println("Track length: " + getLength());
}
```

**7. Update the Cart class to work with Media**

```java
public class Cart {  6 usages  Long Pham +1
    public static final int MAX_NUMBERS_ORDERED = 20;  1 usage
    private ArrayList<Media> itemsOrdered = new ArrayList<~>();

    public void addMedia(Media media) {  4 usages  Long Pham
        if (itemsOrdered.size() < MAX_NUMBERS_ORDERED) {
            itemsOrdered.add(media);
            System.out.println("The media has been added");
        } else {
            System.out.println("The media is almost full");
        }
    }

    public float totalCost() {  1 usage  Long Pham
        float totalCost = 0;
        for (Media media : itemsOrdered) {
            totalCost += media.getCost();
        }

        return totalCost;
    }
```

```java
public Media searchByTitle(String title) {  3 usages  Long Pham
    for (Media media : itemsOrdered) {
        if (media.getTitle().equals(title))
            return media;
    }

    return null;
}

public Media searchById(int id) {  1 usage  Long-1911 +1
    for (Media media : itemsOrdered) {
        if (media.getId() == id)
            return media;
    }

    return null;
}

public void sortByTitle() {  1 usage  Long Pham
    Collections.sort(itemsOrdered, Media.COMPARE_BY_TITLE_COST);
    Iterator<Media> iterator = itemsOrdered.iterator();

    while (iterator.hasNext()) {
        System.out.println((iterator.next()).toString());
    }
}

public void sortByCost() {  1 usage  Long Pham
    Collections.sort(itemsOrdered, Media.COMPARE_BY_COST_TITLE);
    Iterator<Media> iterator = itemsOrdered.iterator();

    while (iterator.hasNext()) System.out.println((iterator.next()).toString());

}
```

```java
    public void removeMedia(Media media) {  1 usage  Long Pham
        if (itemsOrdered.contains(media)) {
            itemsOrdered.remove(media);
            System.out.println("The media has been removed");
        } else System.out.println("The media is not in the cart");

    }

    public void empty() { itemsOrdered.clear(); }
}
```

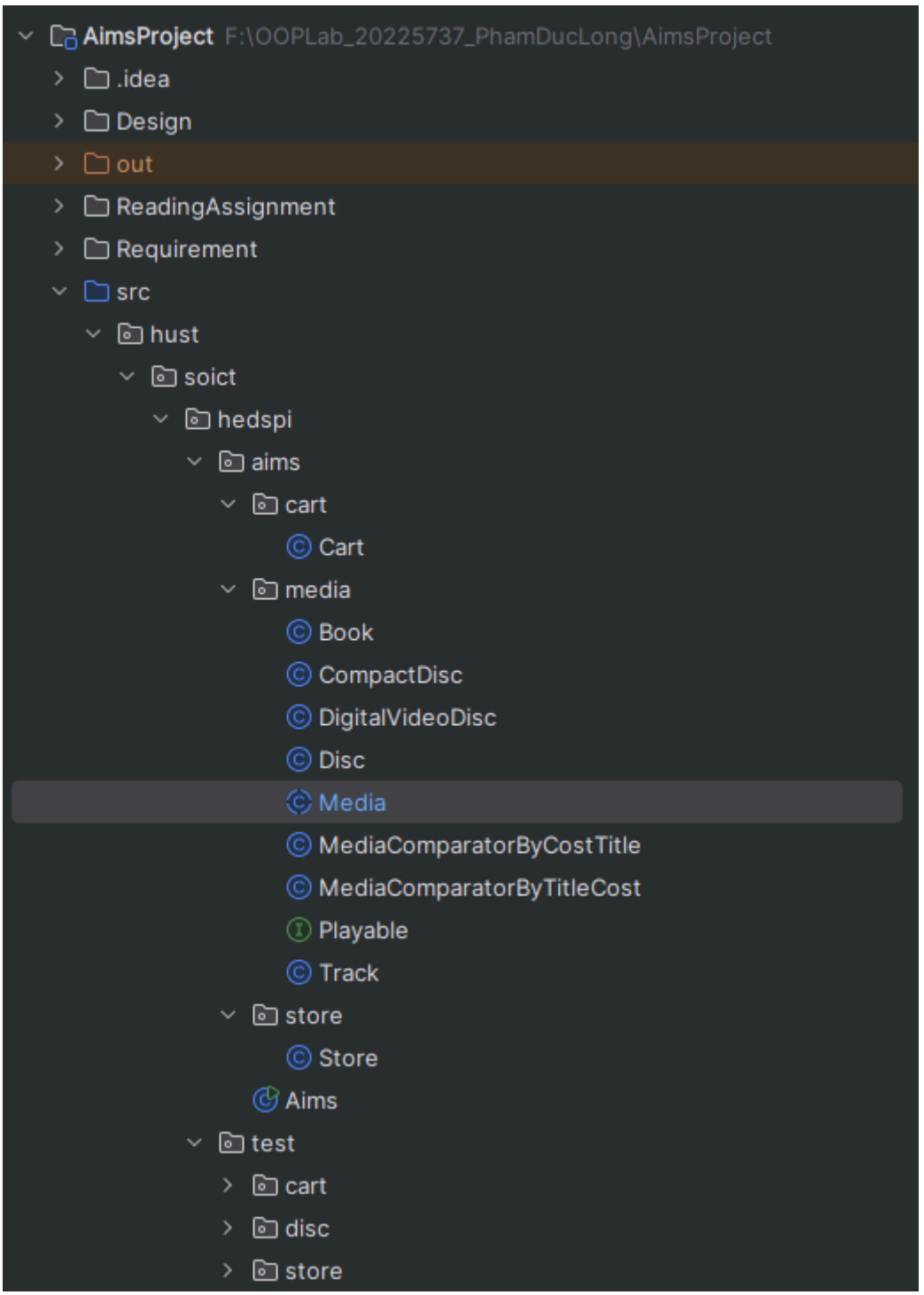
## 8. Update the Store class to work with Media

```java
public class Store {  6 usages  Long Pham +1
    private ArrayList<Media> itemsInStore = new ArrayList<Media>();

    public void addMedia(Media media) {  15 usages  Long Pham +1
        boolean existed = false;
        for (Media item : itemsInStore) {
            if (item.getTitle().equals(media.getTitle())) {
                existed = true;
                break;
            }
        }

        if (!existed) {
            itemsInStore.add(media);
            System.out.println("The media has been added in Store.");
        } else {
            System.out.println("The media is already in the store.");
        }
    }
```

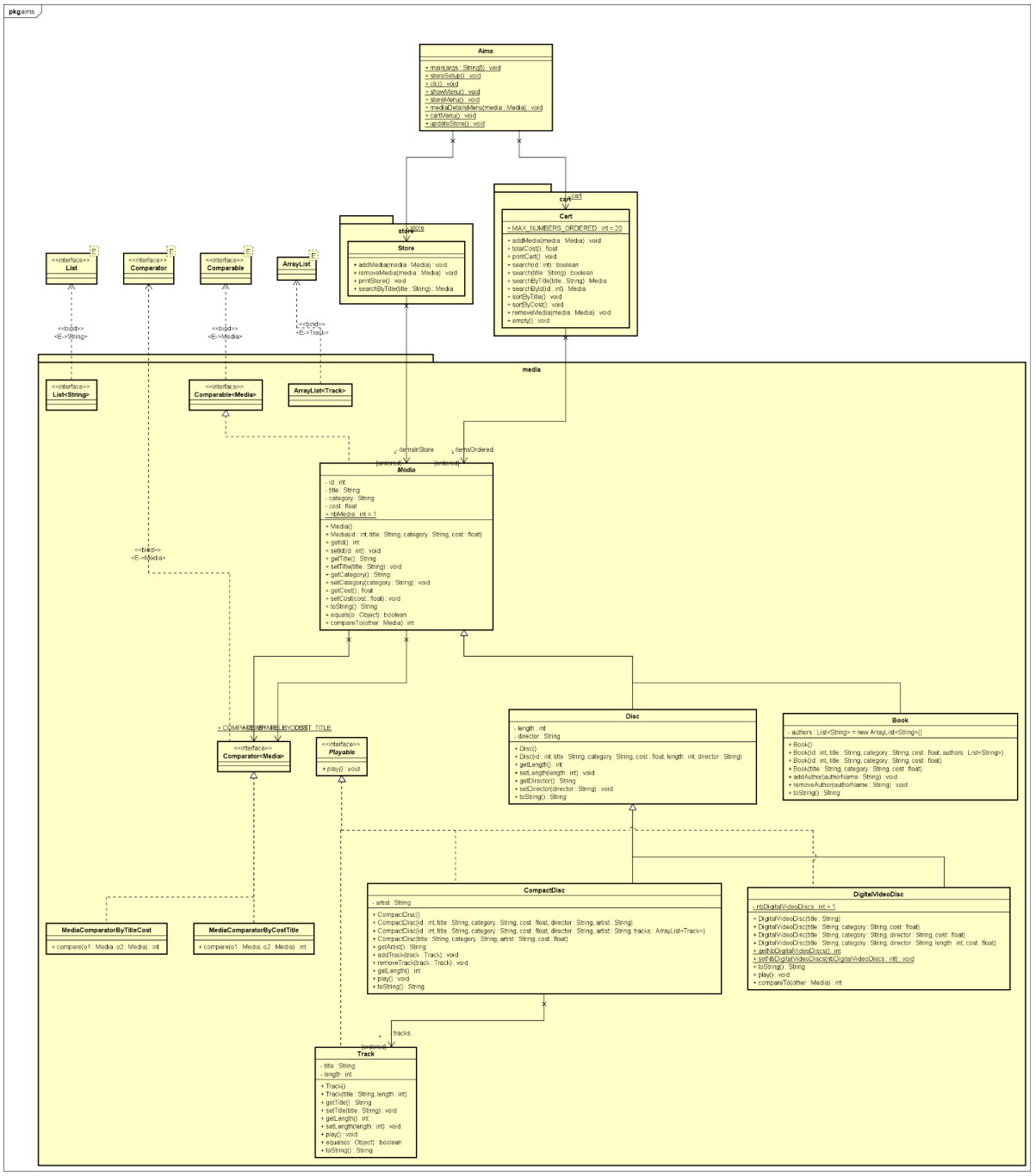
```java
    public void removeMedia(Media media) {  2 usages  Long Pham +1
        boolean existed = false;
        for (Media item : itemsInStore) {
            if (item.getTitle().equals(media.getTitle())) {
                itemsInStore.remove(item);
                System.out.println("The media has been removed from Store.");
                existed = true;
                break;
            }
        }

        if (!existed) {
            System.out.println("The media is not in the store.");
        }
    }

    public void printStore() {  7 usages  Long Pham
        for (Media media : itemsInStore) {
            System.out.println(media.toString());
        }
    }

    public Media searchByTitle(String title) {  4 usages  Long Pham
        for (Media media : itemsInStore) {
            if (media.getTitle().equals(title)) {
                return media;
            }
        }

        return null;
    }
}
```

## 9. Constructors of whole classes and parent classes

- Cấu trúc project Lab04:




- Class Diagram sau Lab04:




## 10. Unique item in a list

- Media class:

```java
@Override   Long Pham
public boolean equals(Object o) {
    if (this == o) return true;
    if (o == null || getClass() != o.getClass()) return false;
    Media media = (Media) o;
    return Objects.equals(title, media.title);
}
```

- Track class:

```java
@Override   Long Pham
public boolean equals(Object o) {
    if (this == o) return true;
    if (o == null || getClass() != o.getClass()) return false;
    Track track = (Track) o;
    return length == track.length && Objects.equals(title, track.title);
}
```

- Kiểm tra:

```java
        Media book1 = new Book( id: 5,  title: "Book1",  category: "Horror",  cost: 4.5f);
//        anOrder.addMedia(book1);

        Media book2 = new Book( id: 6,  title: "Book1",  category: "Scientific",  cost: 5.5f);
```

```java
if (book1.equals(book2)) System.out.println("Two objects are equal"); // test equals
else System.out.println("Two objects are not equal");
```

```
"C:\Program Files\Java\jdk-1.8\bin\java.exe" ...
Two objects are equal

Process finished with exit code 0
```

- If the passing object is not an instance of Media, what happens?

Nếu đối tượng truyền vào không phải là một instance của Media thì sẽ không thực hiện được phép so sánh.

Nhưng nếu đối tượng truyền là instance con của Media thì ta vẫn sẽ thực hiện được phép so sánh, như ở ví dụ trên.

## 11. Polymorphism with toString() method

```java
List<Media> mediae = new ArrayList<Media>();
ArrayList<Track> tracks = new ArrayList<Track>();
tracks.add(new Track( title: "Track 1",  length: 1));
tracks.add(new Track( title: "Track 2",  length: 2));
Media cd = new CompactDisc( id: 7,  title: "CD2",  category: "Music",  cost: 10.3f,  director: "Director 2",  artist: "Long", tracks);

Media dvd = new DigitalVideoDisc( title: "The Lion King",
         category: "Animation",  director: "Roger Allers",  length: 87,  cost: 19.95f);

List<String> authors = new ArrayList<>();
authors.add("Author 1");
authors.add("Author 2");
Media book = new Book( id: 8,  title: "Book2",  category: "Horror",  cost: 4.5f, authors);

mediae.add(cd);
mediae.add(dvd);
mediae.add(book);

for (Media m : mediae) {
    System.out.println(m.toString());
}
```

- Kết quả:

```
"C:\Program Files\Java\jdk-1.8\bin\java.exe" ...
CompactDisc: id = 7 - title = 'CD2' - category = 'Music' - cost = 10.3 - length = 3 - director = 'Director 2' - artist = 'Long' - tracks = [Track: title = 'Track 1' - length = 1, Track: title = 'Track 2' - length = 2]
DigitalVideoDisc: id = 1 - title = 'The Lion King' - category = 'Animation' - cost = 19.95 - length = 87 - director = 'Roger Allers'
Book: id = 8 - title = 'Book2' - category = 'Horror' - cost = 4.5 - (List of) authors = [Author 1, Author 2]

Process finished with exit code 0
```

*CompactDisc: id = 7 - title = 'CD2' - category = 'Music' - cost = 10.3 - length = 3 - director = 'Director 2' - artist = 'Long' - tracks = [Track: title = 'Track 1' - length = 1, Track: title = 'Track 2' - length = 2]*

*DigitalVideoDisc: id = 1 - title = 'The Lion King' - category = 'Animation' - cost = 19.95 - length = 87 - director = 'Roger Allers'*

*Book: id = 8 - title = 'Book2' - category = 'Horror' - cost = 4.5 - (List of) authors = [Author 1, Author 2]*

- Giải thích: Mặc dù trong class Media cũng đã có phương thức toString() nhằm hiển thị ra các thuộc tính và giá trị của các thuộc tính:

```java
@Override  4 overrides  Long Pham
public String toString() {
    return "Media: " +
            "id=" + id +
            " - title='" + title + '\'' +
            " - category='" + category + '\'' +
            " - cost=" + cost;
}
```

Nhưng toString() cũng được override để hiển thị chi tiết các thuộc tính hơn trong các lớp CD, DVD và Book. Do đó java sẽ sử dụng toString() trong các lớp này:

- DVD:

```java
@Override  Long Pham
public String toString() {
    return "DigitalVideoDisc: " +
            "id = " + getId() +
            " - title = '" + getTitle() + '\'' +
            " - category = '" + getCategory() + '\'' +
            " - cost = " + getCost() +
            " - length = " + getLength() +
            " - director = '" + getDirector() + '\'';
}
```

- CD:

```java
@Override  Long Pham
public String toString() {
    return "CompactDisc: " +
            "id = " + getId() +
            " - title = '" + getTitle() + '\'' +
            " - category = '" + getCategory() + '\'' +
            " - cost = " + getCost() +
            " - length = " + getLength() +
            " - director = '" + getDirector() + '\'' +
            " - artist = '" + artist + '\'' +
            " - tracks = " + tracks;
}
```

- Book:

```java
@Override  Long Pham +1
public String toString() {
    return "Book: " +
            "id = " + getId() +
            " - title = '" + getTitle() + '\'' +
            " - category = '" + getCategory() + '\'' +
            " - cost = " + getCost() +
            " - (List of) authors = " + authors;
}
```

**12. Sort media in the cart**

- MediaComparatorByCostTitle:

```java
public class MediaComparatorByCostTitle implements Comparator<Media> {

    @Override  Long Pham
    public int compare(Media o1, Media o2) {
        int costComparison = Float.compare(o2.getCost(), o1.getCost());
        if (costComparison != 0) {
            return costComparison;
        }

        return o1.getTitle().compareTo(o2.getTitle());
    }
}
```

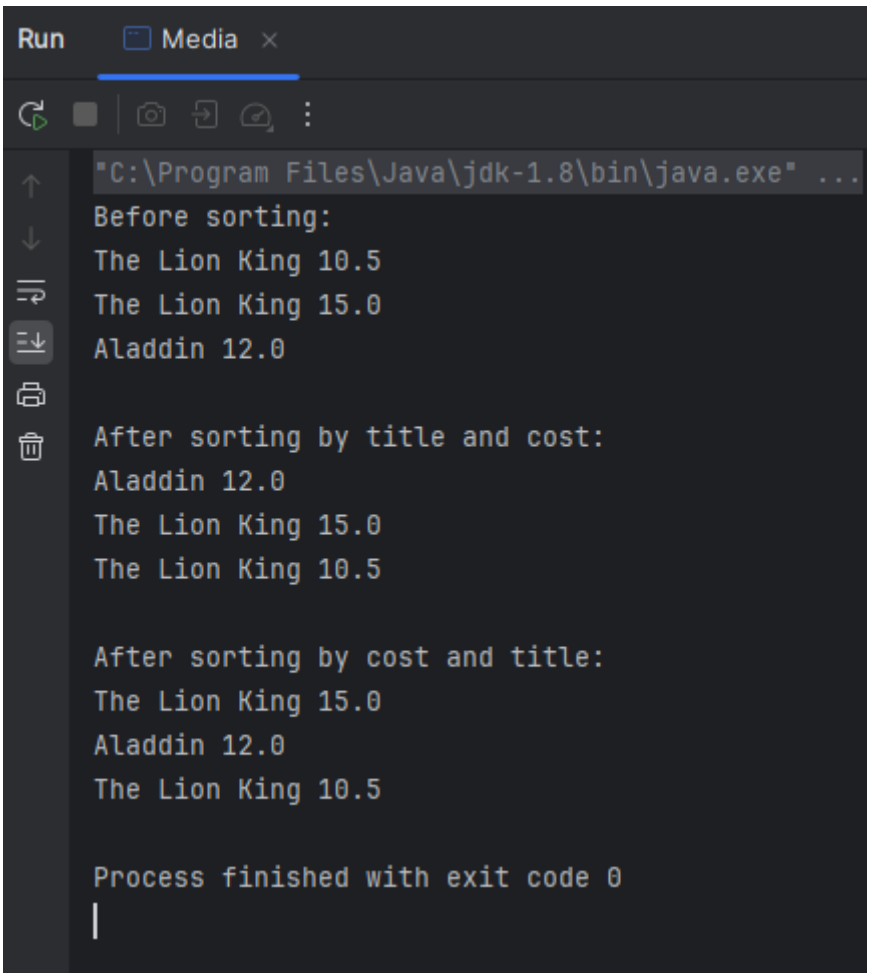
- MediaComparatorByTitleCost:

```java
public class MediaComparatorByTitleCost implements Comparator<Media> {

    @Override  Long Pham
    public int compare(Media o1, Media o2) {
        int titleComparison = o1.getTitle().compareTo(o2.getTitle());
        if (titleComparison != 0) {
            return titleComparison;
        }

        return Float.compare(o2.getCost(), o1.getCost());
    }
}
```

- Chạy thử:

```java
public static void main(String[] args) {  new *
    ArrayList<Media> mediaList = new ArrayList<>();
    mediaList.add(new DigitalVideoDisc( title: "The Lion King",  category: "Animation",  cost: 10.5f));
    mediaList.add(new DigitalVideoDisc( title: "The Lion King",  category: "Animation",  cost: 15.0f));
    mediaList.add(new DigitalVideoDisc( title: "Aladdin",  category: "Animation",  cost: 12.0f));

    System.out.println("Before sorting:");
    for (Media media : mediaList) {
        System.out.println(media.title + " " + media.cost);
    }

    Collections.sort(mediaList, Media.COMPARE_BY_TITLE_COST);
    System.out.println("\nAfter sorting by title and cost:");
    for (Media media : mediaList) {
        System.out.println(media.title + " " + media.cost);
    }

    Collections.sort(mediaList, Media.COMPARE_BY_COST_TITLE);
    System.out.println("\nAfter sorting by cost and title:");
    for (Media media : mediaList) {
        System.out.println(media.title + " " + media.cost);
    }
}
```

- Kết quả:




Các câu hỏi phần này đã được em trả lời trong file answer.txt, hoặc thầy (và anh trợ giảng có thể xem trực tiếp trên docs, ở thanh bên trái ạ)

**13. Create a complete console application in the Aims class**

- Do phần này khá dài nên em xin phép để trên github ạ.