Object Oriented Programming Lab 3
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1. Screenshot of any new written code

Section 2.1: Method `addDigitalVideoDisc(DigitalVideoDisc[] dvdList)` in `Cart` class:

```
public void addDigitalVideoDisc(DigitalVideoDisc[] dvdList) {
		for(DigitalVideoDisc dvd : dvdList) {
			if(qtyOrdered < MAX_NUMBERS_ORDERED) {
				itemOrdered[qtyOrdered] = dvd;
				qtyOrdered++;
				System.out.println("The DVD has been added.");
			}
			else {
				System.out.println("The cart is almost full!");
			}
		}
		System.out.println();
	}
```

Section 2.2: Method `addDigitalVideoDisc(DigitalVideoDisc dvd1, DigitalVideoDisc dvd2)` in `Cart class`

```
public void addDigitalVideoDisc(DigitalVideoDisc dvd1, DigitalVideoDisc dvd2) {
		if(qtyOrdered < MAX_NUMBERS_ORDERED - 2) {
			itemOrdered[qtyOrdered] = dvd1;
			qtyOrdered++;
			itemOrdered[qtyOrdered] = dvd2;
			qtyOrdered++;
			System.out.println("The two DVDs have been added!");
		}
		else if(qtyOrdered == MAX_NUMBERS_ORDERED - 2) {
			itemOrdered[qtyOrdered] = dvd1;
			qtyOrdered++;
			System.out.println("The first DVD has been added.");
			System.out.println("The  cart  is  almost  full!  Cannot  add  the
second DVD to cart.");
			System.out.println();
		}
		else {
			System.out.println("The cart is almost full!");
			System.out.println();
		}
	}
```

Section 3: Method newSwap(DigitalVideoDisc dvd1, DigitalVideoDisc dvd2) in TestPassingParameter class

```java
public static void newSwap(DigitalVideoDisc dvd1, DigitalVideoDisc dvd2) {
		String dvd1OldTitle = dvd1.getTitle();
		String dvd1OldCategory = dvd1.getCategory();
		String dvd1OldDirector = dvd1.getCategory();
		int dvd1OldLength = dvd1.getId();
		double dvd1OldCost = dvd1.getCost();
		int dvd1OldId = dvd1.getId();

		dvd1.setTitle(dvd2.getTitle());
		dvd1.setCategory(dvd2.getCategory());
		dvd1.setDirector(dvd2.getDirector());
		dvd1.setLength(dvd2.getLength());
		dvd1.setCost(dvd2.getCost());
		dvd1.setId(dvd2.getId());

		dvd2.setTitle(dvd1OldTitle);
		dvd2.setCategory(dvd1OldCategory);
		dvd2.setDirector(dvd1OldDirector);
		dvd2.setLength(dvd1OldLength);
		dvd2.setCost(dvd1OldCost);
		dvd2.setId(dvd1OldId);
	}
```

Section 5: Create new instance attribute id and static attributs nbDigitalVideoDisc for class DigitalVideoDisc to automatically update id when new object of class DigitalVideoDisc is created.

```java
	private int id;
	private static int nbDigitalVideoDiscs = 0;
	public DigitalVideoDisc(String title, String category, String director,
				int length, double cost) {
		this.title = title;
		this.category = category;
		this.director = director;
		this.length = length;
		this.cost = cost;
		this.id = ++nbDigitalVideoDiscs;
	}
```

Section 6:

Method toString() in DigitalVideoDisc class:

```
public String toString() {
		return "DVD" + this.id + " - " + "Title: " + this.title + " - Category: " +
			this.category + " - Director: " + this.director + " - Length: " +
			this.length + " - Price: " + this.cost + "$";
	}
```

Method print() in Cart class:

```
//Method to print the cart
	public void print() {
		System.out.println("****************CART***********************");
		System.out.println("Ordered Items");
		for(int i = 0; i < qtyOrdered; i++) {
			System.out.println((i + 1) + ". " + itemOrdered[i].toString());
		}
		System.out.println("Total cost: " + totalCost() + "$");
		System.out.println("*******************************************");
	}
```

Method isMatch(String keywords) in DigitalVideoDisc class:

```
public boolean isMatch(String keywords) {
		String[] splitKeywords = keywords.toLowerCase().split("\\s+");
		String toLowerTitle = this.title.toLowerCase();

		for(String s : splitKeywords) {
			if(toLowerTitle.contains(s)) {
				return true;
			}
		}
		return false;
	}
```

Method search(String keywords) in Cart class:

```
//Method to search DVD by title
	public void search(String keywords) {
		int matchItem = 0;
		for(int i = 0; i < qtyOrdered; i++) {
			if(itemOrdered[i].isMatch(keywords)) {
				matchItem++;
				System.out.println(itemOrdered[i].toString());
			}
		}
		if(matchItem == 0) {
			System.out.println("No item found!");
		}
	}
```

Method search(int ID) in Cart class:

```
public void search(int ID) {
            int matchItem = 0;
            for(int i = 0; i < qtyOrdered; i++) {
                  if(itemOrdered[i].getId() == ID) {
                        matchItem++;
                        System.out.println(itemOrdered[i].toString());
                  }
            }
            if(matchItem == 0) {
                  System.out.println("No item found!");
            }
      }
```

Class CartTest to test all the written method:

```
package hust.soict.hedspi.aims.cart;
import hust.soict.hedspi.aims.disc.*;

public class CartTest {
      public static void main(String[] args) {
            //Create a new cart
            Cart cart = new Cart();
            //Create new dvd objects and add them to the cart
            DigitalVideoDisc dvd1 = new DigitalVideoDisc("The Lion King",
                        "Animation", "Roger Allers", 87, 19.95);
            cart.addDigitalVideoDisc(dvd1);
            DigitalVideoDisc dvd2 = new DigitalVideoDisc("Star Wars",
                        "Science Fiction", "Geogre Lucas", 87, 24.95);
            DigitalVideoDisc dvd3 = new DigitalVideoDisc("Aladin",
                        "Animation", 18.99);
            cart.addDigitalVideoDisc(dvd2, dvd3);
            DigitalVideoDisc dvd4 = new DigitalVideoDisc("Frozen",
                        "Animation", 24.99);
            DigitalVideoDisc dvd5 = new DigitalVideoDisc("The Lion King III",
                        "Animation", 30.55);
            DigitalVideoDisc[] list = {dvd4, dvd5};
            cart.addDigitalVideoDisc(list);

            //Test the print method
            cart.print();

            //Test the search method (by title)
            cart.search("lion"); //Two items found
            cart.search("snow"); //No item found

            //Test the search method (by ID)
            cart.search(1); //One item found
            cart.search(9); //No item found
      }
}
```

Section 7:

Class Store:

```
package hust.soict.hedspi.aims.store;
import hust.soict.hedspi.aims.disc.*;

public class Store {
	private DigitalVideoDisc itemInStore[] = new DigitalVideoDisc[20];
	private int qtyItem;
	
	public void addDVD(DigitalVideoDisc dvd) {
		itemInStore[qtyItem] = dvd;
		qtyItem++;
		System.out.println("The dvd has been added.");
		System.out.println();
	}
	
	public void removeDVD(DigitalVideoDisc dvd) {
		int index = -1;
		if(qtyItem < 0) {
			System.out.println("The store is empty.");
			System.out.println();
		}
		else {
			for(int i = 0; i < qtyItem; i++) {
				if(itemInStore[i].equals(dvd)) {
					index = i;
					break;
				}
			}
			if(index == -1) {
				System.out.println("The dvd hasn't in the store yet!");
				System.out.println();
			}
			else {
				for(int i = 0; i < qtyItem - 1; i++) {
					itemInStore[i] = itemInStore[i + 1];
					itemInStore[qtyItem - 1] = null;
					qtyItem--;
				}
				System.out.println("Remove successfully!");
				System.out.println();
			}
		}
	}
}
```

Class StoreTest:

```
package hust.soict.hedspi.aims.store;
import hust.soict.hedspi.aims.disc.*;

public class StoreTest {
      public static void main(String[] args) {
        Store store = new Store();

        DigitalVideoDisc dvd1 = new DigitalVideoDisc("The Lion King");
        DigitalVideoDisc dvd2 = new DigitalVideoDisc("Star Wars");
        DigitalVideoDisc dvd3 = new DigitalVideoDisc("Aladdin");

        // Thêm DVD vào store
        store.addDVD(dvd1);
        store.addDVD(dvd2);
        store.addDVD(dvd3);

        // Xóa DVD khỏi store
        store.removeDVD(dvd2); // Xóa "Star Wars"
        store.removeDVD(new DigitalVideoDisc("Avatar")); // Xóa DVD không tồn tại
      }
}
```

Section 9:

<u>Class GarbageCreator:</u>

```
package hust.soict.hedspi.garbage;
import java.nio.file.Files;
import java.nio.file.Paths;
import java.io.IOException;

public class GarbageCreator {
    public static void main(String[] args) {
        String filename = "D:/TTUD/Laboratory/Lab1/Exercise1.exe";
        byte[] inputBytes = {0};
        long startTime, endTime;

        try {
            inputBytes = Files.readAllBytes(Paths.get(filename));
            startTime = System.currentTimeMillis();
            String outputString = "";
            for(byte b : inputBytes) {
                outputString += (char) b;
            }
            endTime = System.currentTimeMillis();
            System.out.println((endTime - startTime) + " ms");
        } catch (IOException e) {
            System.out.println("Lỗi khi đọc file: " + e.getMessage());
        }
    }
}
```

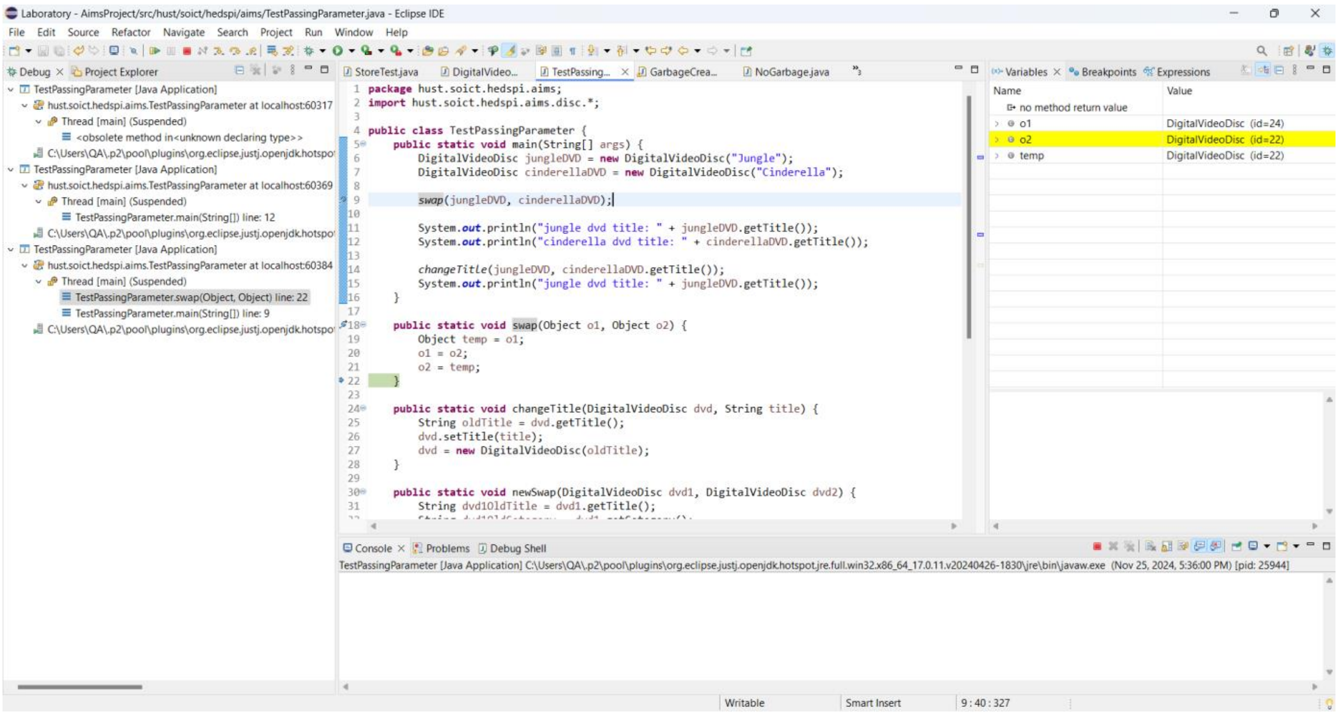
Result: This code can not run successfully because it should let the program hangs or even stop working when we create too much "garbage".

Class NoGarbage:

```
package hust.soict.hedspi.garbage;
import java.io.IOException;
import java.nio.file.Files;
import java.nio.file.Paths;

public class NoGarbage {
      public static void main(String[] args) {
        String filename = "D:/TTUD/Laboratory/Lab1/Exercise1.exe";
        byte[] inputBytes = {0};
        long startTime, endTime;

        try {
            inputBytes = Files.readAllBytes(Paths.get(filename));
            startTime = System.currentTimeMillis();
            StringBuffer outputStringBuffer = new StringBuffer();
            for(byte b : inputBytes) {
                outputStringBuffer.append((char)b);
            }
            endTime = System.currentTimeMillis();
            System.out.println((endTime - startTime) + " ms");
        } catch (IOException e) {
            System.out.println("Lỗi khi đọc file: " + e.getMessage());
        }
    }
}
```

Result: The console print out "63ms"

2. Code debugging and result



Laboratory - AimsProject/src/hust/soict/hedspi/aims/TestPassingParameter.java - Eclipse IDE

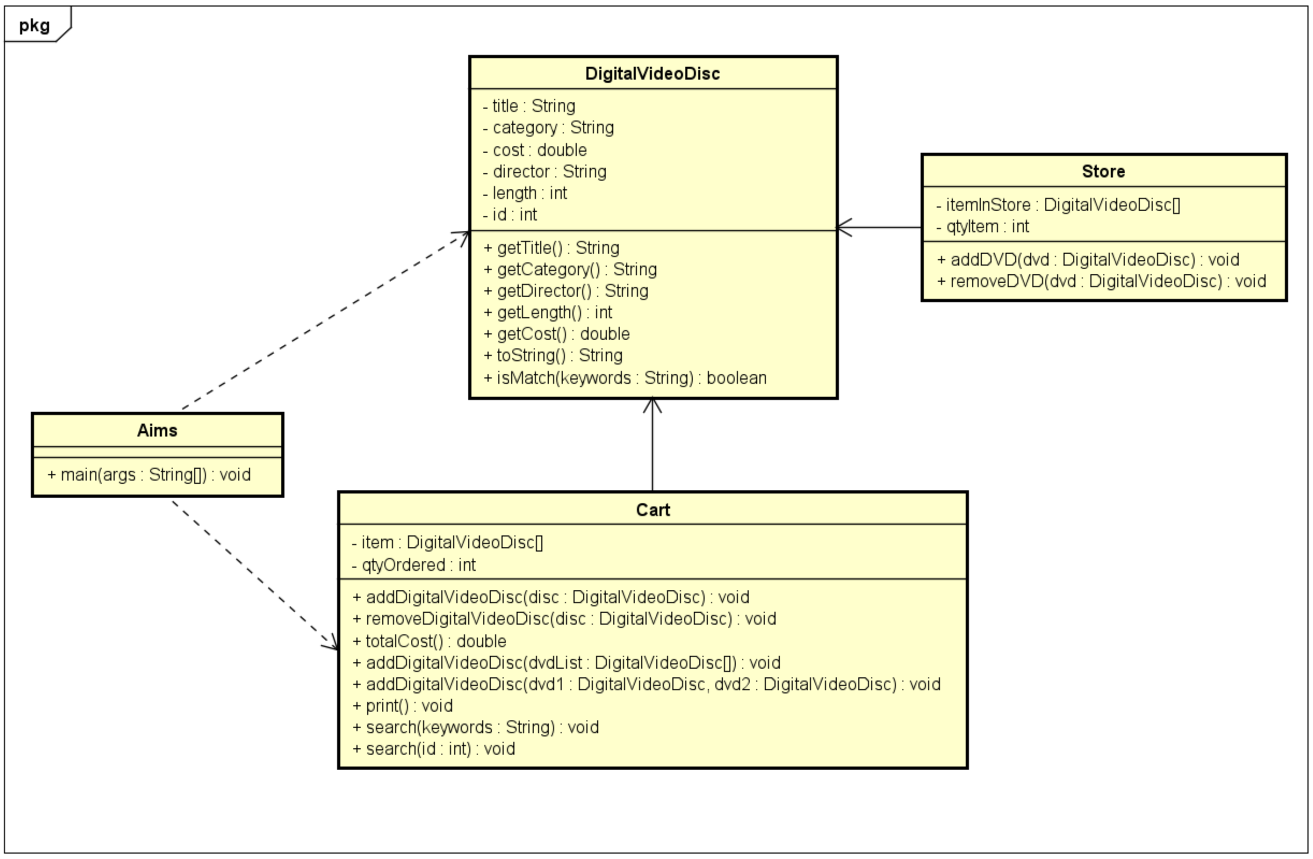
```
TestPassingParameter [Java Application]
    hust.soict.hedspi.aims.TestPassingParameter at localhost:60317
        Thread [main] (Suspended)
            <obsolete method in<unknown declaring type>>
    C:\Users\QA\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspo
TestPassingParameter [Java Application]
    hust.soict.hedspi.aims.TestPassingParameter at localhost:60369
        Thread [main] (Suspended)
            TestPassingParameter.main(String[]) line: 12
    C:\Users\QA\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspo
TestPassingParameter [Java Application]
    hust.soict.hedspi.aims.TestPassingParameter at localhost:60384
        Thread [main] (Suspended)
            TestPassingParameter.swap(Object, Object) line: 22
            TestPassingParameter.main(String[]) line: 9
    C:\Users\QA\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspo
```

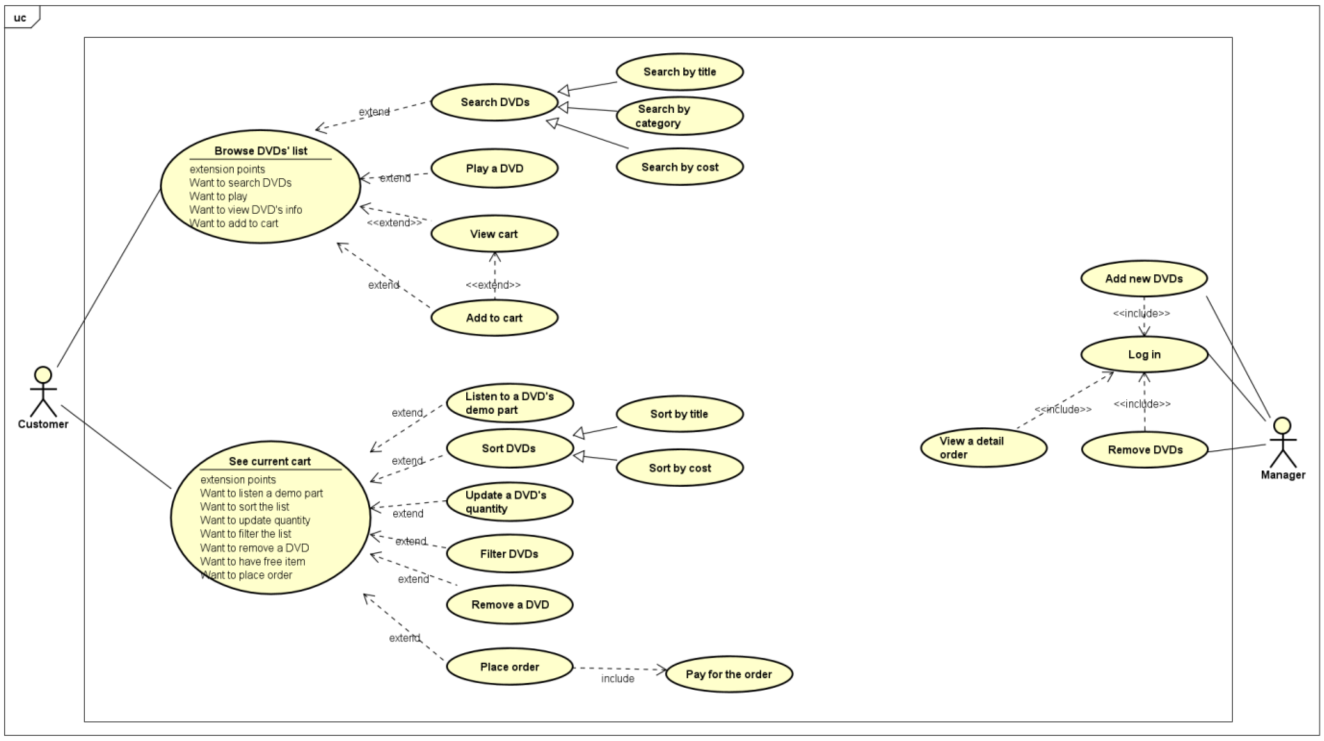
```java
package hust.soict.hedspi.aims;
import hust.soict.hedspi.aims.disc.*;

public class TestPassingParameter {
    public static void main(String[] args) {
        DigitalVideoDisc jungleDVD = new DigitalVideoDisc("Jungle");
        DigitalVideoDisc cinderellaDVD = new DigitalVideoDisc("Cinderella");

        swap(jungleDVD, cinderellaDVD);

        System.out.println("jungle dvd title: " + jungleDVD.getTitle());
        System.out.println("cinderella dvd title: " + cinderellaDVD.getTitle());

        changeTitle(jungleDVD, cinderellaDVD.getTitle());
        System.out.println("jungle dvd title: " + jungleDVD.getTitle());
    }

    public static void swap(Object o1, Object o2) {
        Object temp = o1;
        o1 = o2;
        o2 = temp;
    }

    public static void changeTitle(DigitalVideoDisc dvd, String title) {
        String oldTitle = dvd.getTitle();
        dvd.setTitle(title);
        dvd = new DigitalVideoDisc(oldTitle);
    }

    public static void newSwap(DigitalVideoDisc dvd1, DigitalVideoDisc dvd2) {
        String dvd1OldTitle = dvd1.getTitle();
```

Name	Value
no method return value	
o1	DigitalVideoDisc (id=24)
o2	DigitalVideoDisc (id=22)
temp	DigitalVideoDisc (id=22)

```
TestPassingParameter [Java Application] C:\Users\QA\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspot.jre.full.win32.x86_64_17.0.11.v20240426-1830\jre\bin\javaw.exe  (Nov 25, 2024, 5:36:00 PM) [pid: 25944]
```

3. Images of the updated use-case diagram and class diagram


pkg
DigitalVideoDisc
- title : String
- category : String
- cost : double
- director : String
- length : int
- id : int
+ getTitle() : String
+ getCategory() : String
+ getDirector() : String
+ getLength() : int
+ getCost() : double
+ toString() : String
+ isMatch(keywords : String) : boolean
Store
- itemInStore : DigitalVideoDisc[]
- qtyItem : int
+ addDVD(dvd : DigitalVideoDisc) : void
+ removeDVD(dvd : DigitalVideoDisc) : void
Aims
+ main(args : String[]) : void
Cart
- item : DigitalVideoDisc[]
- qtyOrdered : int
+ addDigitalVideoDisc(disc : DigitalVideoDisc) : void
+ removeDigitalVideoDisc(disc : DigitalVideoDisc) : void
+ totalCost() : double
+ addDigitalVideoDisc(dvdList : DigitalVideoDisc[]) : void
+ addDigitalVideoDisc(dvd1 : DigitalVideoDisc, dvd2 : DigitalVideoDisc) : void
+ print() : void
+ search(keywords : String) : void
+ search(id : int) : void



4. Answer the questions

Question 1: Is JAVA a Pass by Value or a Pass by Reference programming language?
Java is strictly **pass-by-value**

Question 2: After the call of `swap(jungleDVD, cinderellaDVD)` why does the title of these two objects still remain?
`jungleDVD --> Object A ("Jungle Book")`
`cinderellaDVD --> Object B ("Cinderella")`
Before the swap method:

- `o1` (local copy) points to `Object A`.
- `o2` (local copy) points to `Object B`.

Inside the swap method:

- temp points to `Object A`.
- `o1` is updated to point to `Object B`.
- `o2` is updated to point to `Object A`.

After the swap method ends:

- The original references `jungleDVD` and `cinderellaDVD` remain unchanged:
  - `jungleDVD` still points to `Object A`.
  - `cinderellaDVD` still points to `Object B`.

Question 3: After the call of `changeTitle(jungleDVD, cinderellaDVD.getTitle())` why is the title of the `JungleDVD` changed?
When `changeTitle` is called, the **value of the reference to `jungleDVD`** is passed into the method. This means the method's parameter `dvd` is a new variable that holds a copy of the reference pointing to the same object as `jungleDVD`.
Inside the method, the statement `String oldTitle = dvd.getTitle();` retrieves the current title of the `jungleDVD` object.

The next line, `dvd.setTitle(title);`, updates the title field of the object that dvd refers to. Since dvd and `jungleDVD` both point to the same object, the title change is reflected in the `jungleDVD` object.
The line `dvd = new DigitalVideoDisc(oldTitle);` creates a new `DigitalVideoDisc` object with the original title stored in `oldTitle`.
However, this reassignment only affects the **local variable dvd** inside the method. It no longer points to the same object as `jungleDVD`. The original `jungleDVD` reference in the calling method is not affected by this reassignment.