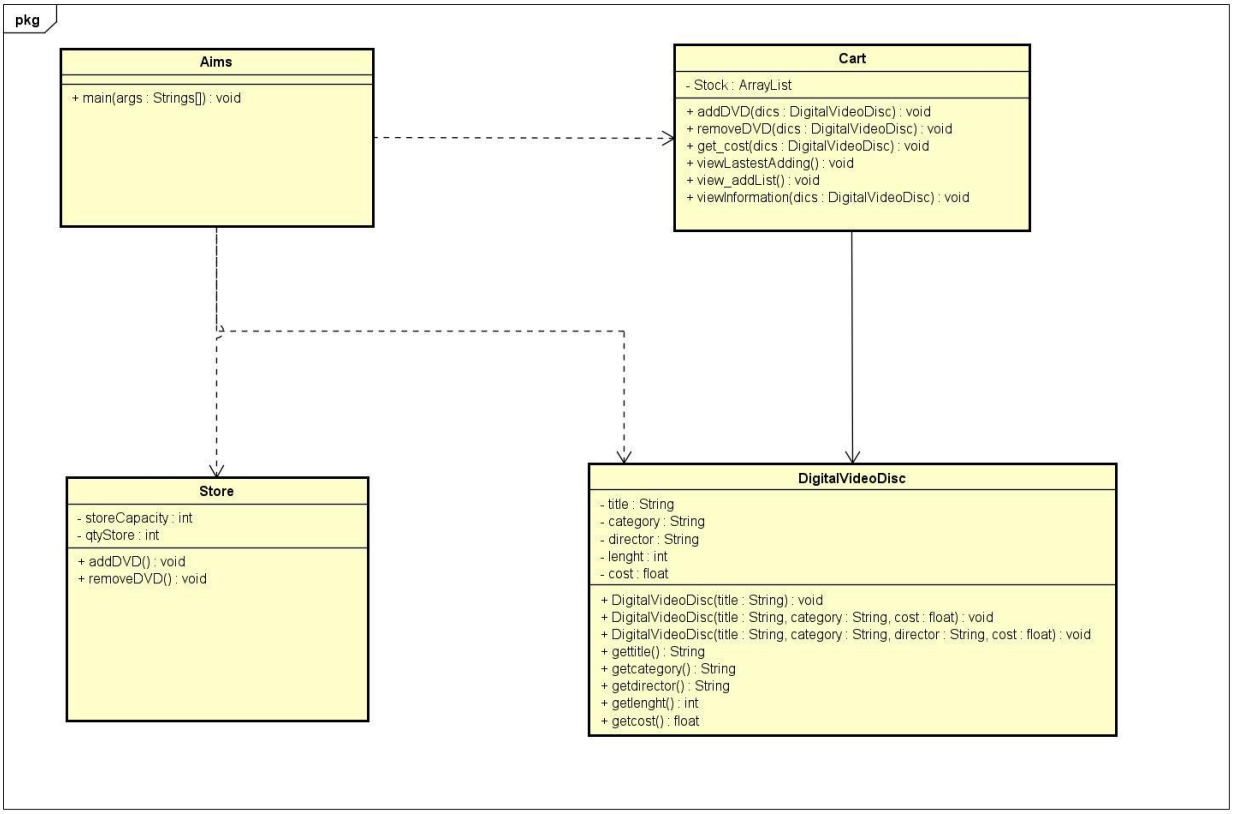
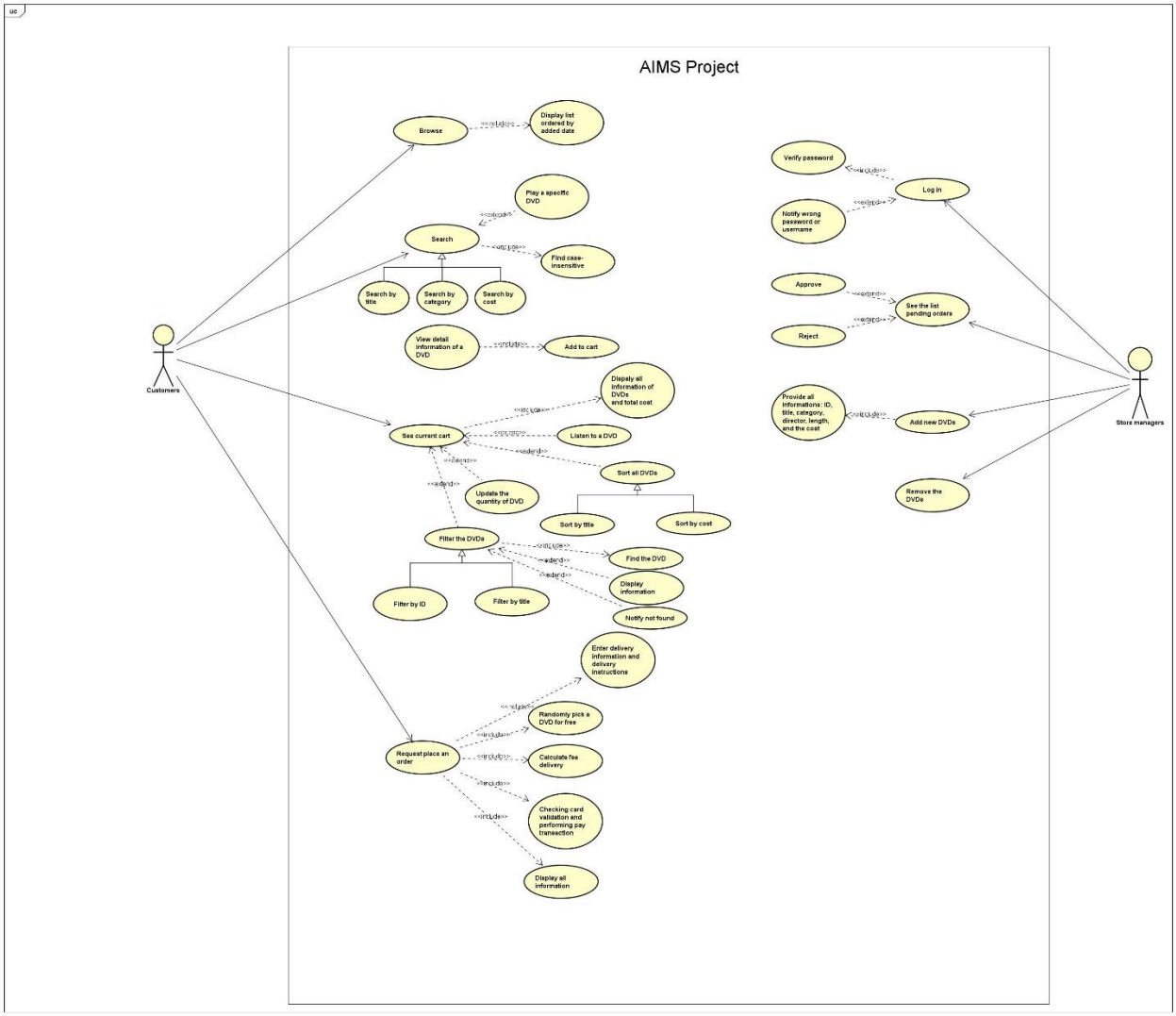
Name: Nguyễn Đức Mạnh

Student ID: 20235525

1. Use-case diagram and class diagram:





2. Working with method overloading:

- New code:

```
public void add_DigitalVideoDisc (DigitalVideoDisc[] dvdlist) {
    for (DigitalVideoDisc disc : dvdlist) {
        if (currentorder < MAX_NUMBER_ORDERED) {
            itemsOrdered[currentorder] = disc;
            currentorder++;
            System.out.println("The disc has been added!");
        } else {
            System.out.println("The cart is full. Cannot add more items!");
        }
    }
}

public void add_DigitalVideoDisc(DigitalVideoDisc dvd1, DigitalVideoDisc dvd2) {
    if (currentorder + 2 <= MAX_NUMBER_ORDERED) {
        itemsOrdered[currentorder] = dvd1;
        currentorder++;
        itemsOrdered[currentorder] = dvd2;
        currentorder++;
        System.out.println("Both disc have been added!");
    } else if (currentorder + 1 <= MAX_NUMBER_ORDERED) {
        itemsOrdered[currentorder] = dvd1;
        currentorder++;
        System.out.println("The first disc has been added! The cart is full for the second disc.");
    } else {
        System.out.println("The cart is full. Cannot add more discs!");
    }
}
```

- Try to add a method ***addDigitalVideoDisc*** which allows to pass an arbitrary number of arguments for dvd. Compare to an array parameter. What do you prefer in this case?

  I would prefer array parameter when I can determine a certain amount of DVD, and I use another way when the number of DVD is unknown.

3. Passing parameter:

- True swap method:

```java
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(DigitalVideoDisc dvd1, DigitalVideoDisc dvd2) {
        String tempTitle = dvd1.getTitle();
        dvd1.setTitle(dvd2.getTitle());
        dvd2.setTitle(tempTitle);
    }

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

- Is JAVA a Pass by Value or a Pass by Reference programming language?

  JAVA is a pass-by-value programming language. The dvd1 and dvd2 in the method are copies of the reference to the original dvd1 and dvd2.

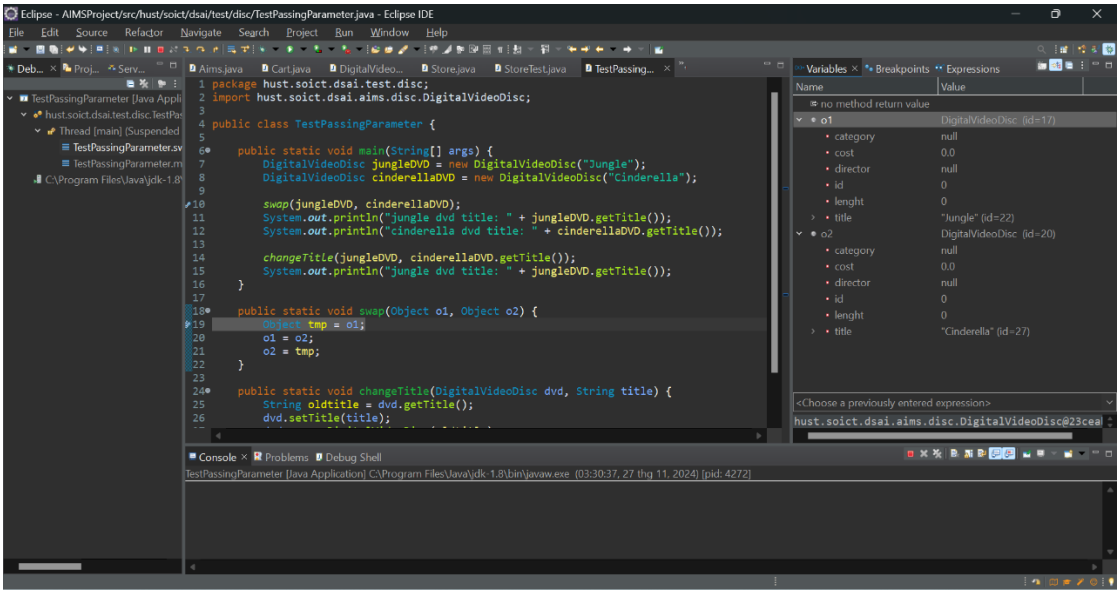
- After the call of **swap(jungleDVD, cinderellaDVD)** why does the title of these two objects still remain?

  The dvd1 and dvd2 in the method are copies of the reference to the original dvd1 and dvd2, therefore the method only swap the copies, not the original object.

- After the call of **changeTitle(jungleDVD, cinderellaDVD.getTitle())** why is the title of the JungleDVD changed?

  The method changeTitle take the address and modify the title at that address, therefore it also change the original dvd.

4. Debug screenshot:


Eclipse - AIMSProject/src/hust/soict/dsai/test/disc/TestPassingParameter.java - Eclipse IDE
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Aims.java Cart.java DigitalVideo... Store.java StoreTest.java TestPassing...
1 package hust.soict.dsai.test.disc;
2 import hust.soict.dsai.aims.disc.DigitalVideoDisc;
3
4 public class TestPassingParameter {
5
6 public static void main(String[] args) {
7 DigitalVideoDisc jungleDVD = new DigitalVideoDisc("Jungle");
8 DigitalVideoDisc cinderellaDVD = new DigitalVideoDisc("Cinderella");
9
10 swap(jungleDVD, cinderellaDVD);
11 System.out.println("jungle dvd title: " + jungleDVD.getTitle());
12 System.out.println("cinderella dvd title: " + cinderellaDVD.getTitle());
13
14 changeTitle(jungleDVD, cinderellaDVD.getTitle());
15 System.out.println("jungle dvd title: " + jungleDVD.getTitle());
16 }
17
18 public static void swap(Object o1, Object o2) {
19 Object tmp = o1;
20 o1 = o2;
21 o2 = tmp;
22 }
23
24 public static void changeTitle(DigitalVideoDisc dvd, String title) {
25 String oldtitle = dvd.getTitle();
26 dvd.setTitle(title);
Variables Breakpoints Expressions
Name Value
no method return value
o1 DigitalVideoDisc (id=17)
category null
cost 0.0
director null
id 0
lenght 0
title "Jungle" (id=22)
o2 DigitalVideoDisc (id=20)
category null
cost 0.0
director null
id 0
lenght 0
title "Cinderella" (id=27)
<Choose a previously entered expression>
hust.soict.dsai.aims.disc.DigitalVideoDisc@23cea
Console Problems Debug Shell
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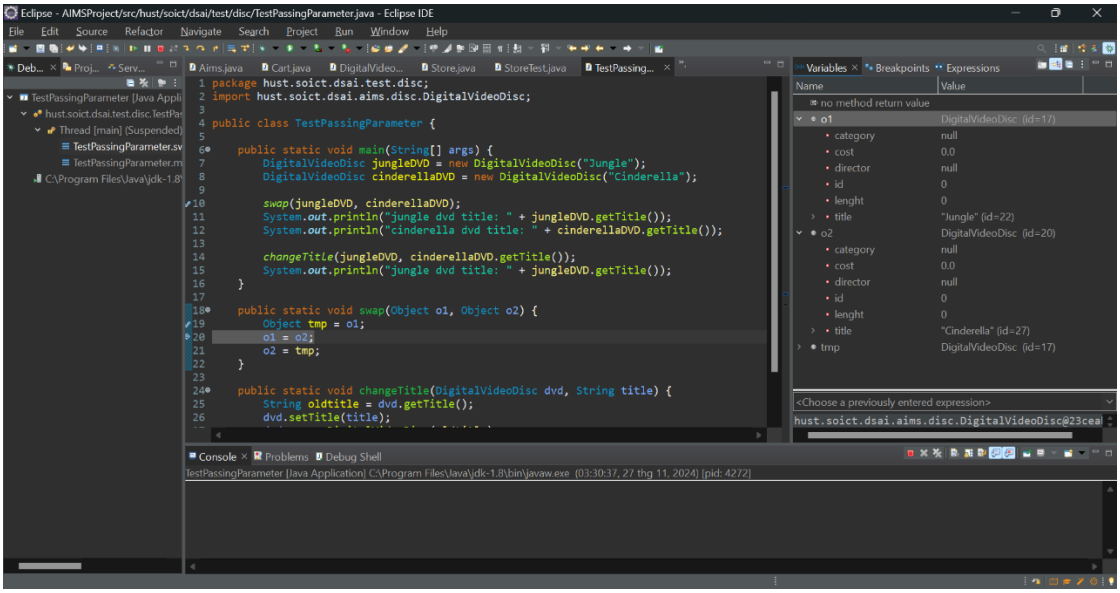
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8 DigitalVideoDisc cinderellaDVD = new DigitalVideoDisc("Cinderella");
9
10 swap(jungleDVD, cinderellaDVD);
11 System.out.println("jungle dvd title: " + jungleDVD.getTitle());
12 System.out.println("cinderella dvd title: " + cinderellaDVD.getTitle());
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14 changeTitle(jungleDVD, cinderellaDVD.getTitle());
15 System.out.println("jungle dvd title: " + jungleDVD.getTitle());
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director null
id 0
lenght 0
title "Jungle" (id=22)
o2 DigitalVideoDisc (id=20)
category null
cost 0.0
director null
id 0
lenght 0
title "Cinderella" (id=27)
tmp DigitalVideoDisc (id=17)
<Choose a previously entered expression>
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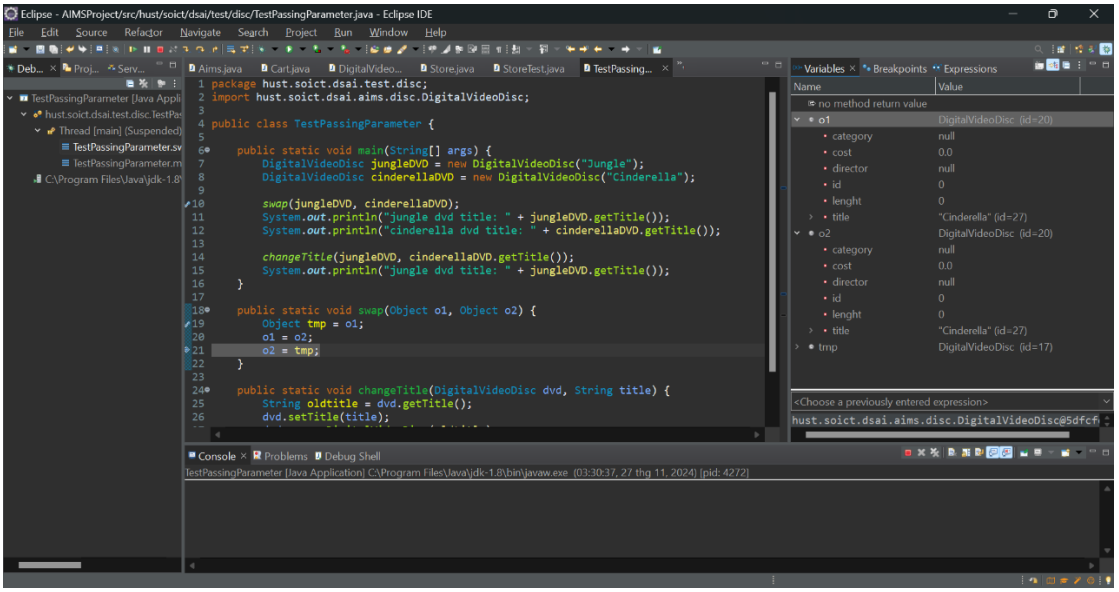
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8 DigitalVideoDisc cinderellaDVD = new DigitalVideoDisc("Cinderella");
9
10 swap(jungleDVD, cinderellaDVD);
11 System.out.println("jungle dvd title: " + jungleDVD.getTitle());
12 System.out.println("cinderella dvd title: " + cinderellaDVD.getTitle());
13
14 changeTitle(jungleDVD, cinderellaDVD.getTitle());
15 System.out.println("jungle dvd title: " + jungleDVD.getTitle());
16 }
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18 public static void swap(Object o1, Object o2) {
19 Object tmp = o1;
20 o1 = o2;
21 o2 = tmp;
22 }
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24 public static void changeTitle(DigitalVideoDisc dvd, String title) {
25 String oldtitle = dvd.getTitle();
26 dvd.setTitle(title);
Variables Breakpoints Expressions
Name Value
no method return value
o1 DigitalVideoDisc (id=20)
category null
cost 0.0
director null
id 0
lenght 0
title "Cinderella" (id=27)
o2 DigitalVideoDisc (id=20)
category null
cost 0.0
director null
id 0
lenght 0
title "Cinderella" (id=27)
tmp DigitalVideoDisc (id=17)
<Choose a previously entered expression>
hust.soict.dsai.aims.disc.DigitalVideoDisc@5dfcf
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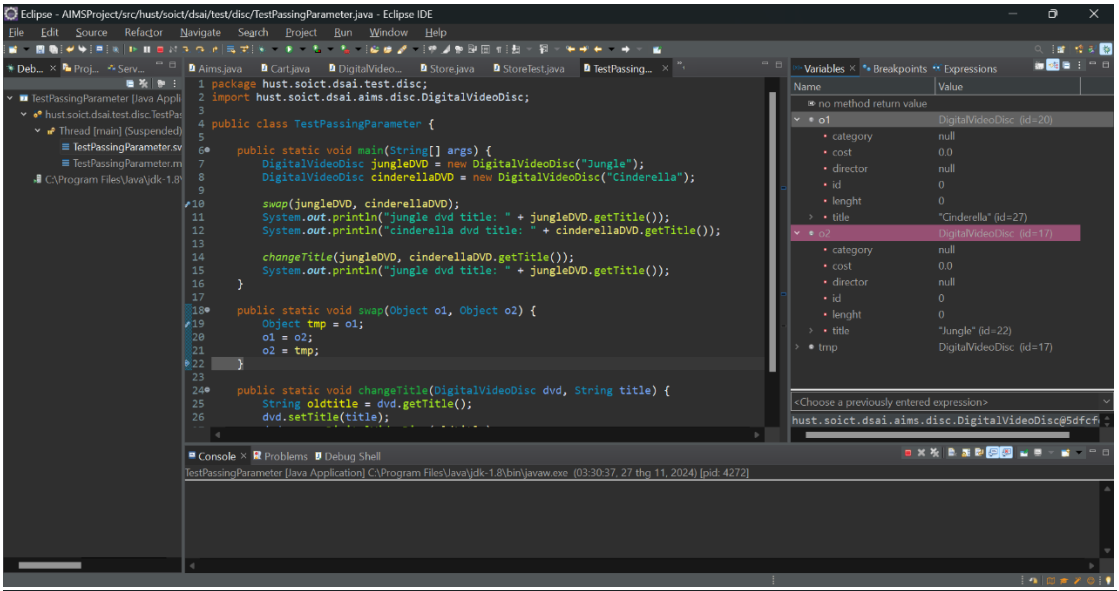
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10 swap(jungleDVD, cinderellaDVD);
11 System.out.println("jungle dvd title: " + jungleDVD.getTitle());
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no method return value
o1 DigitalVideoDisc (id=20)
category null
cost 0.0
director null
id 0
lenght 0
title "Cinderella" (id=27)
o2 DigitalVideoDisc (id=17)
category null
cost 0.0
director null
id 0
lenght 0
title "Jungle" (id=22)
tmp DigitalVideoDisc (id=17)
<Choose a previously entered expression>
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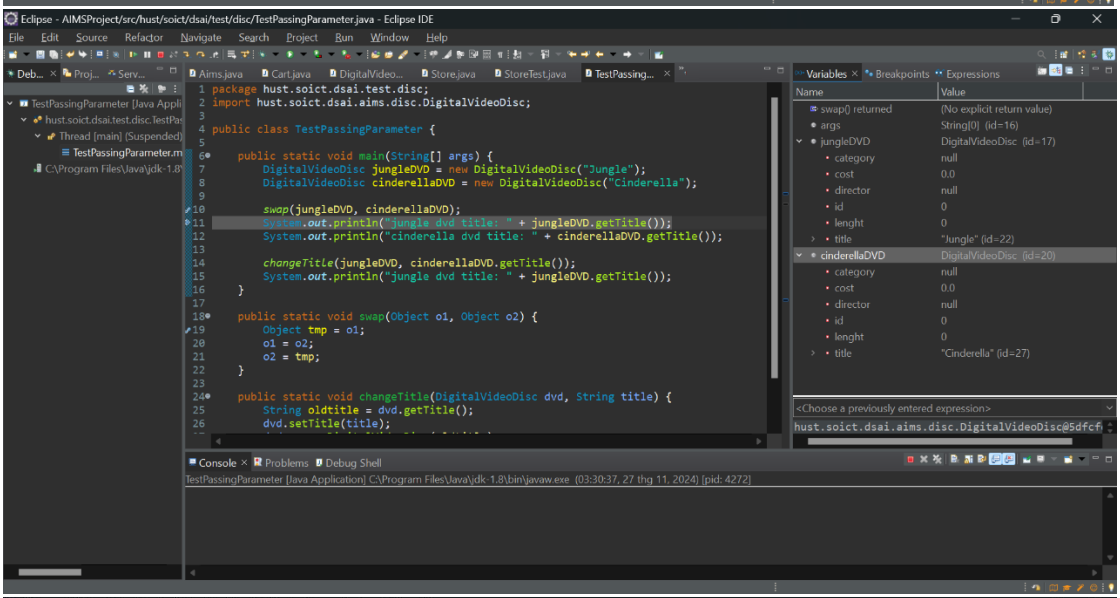
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Name Value
swap() returned (No explicit return value)
args String[0] (id=16)
jungleDVD DigitalVideoDisc (id=17)
category null
cost 0.0
director null
id 0
lenght 0
title "Jungle" (id=22)
cinderellaDVD DigitalVideoDisc (id=20)
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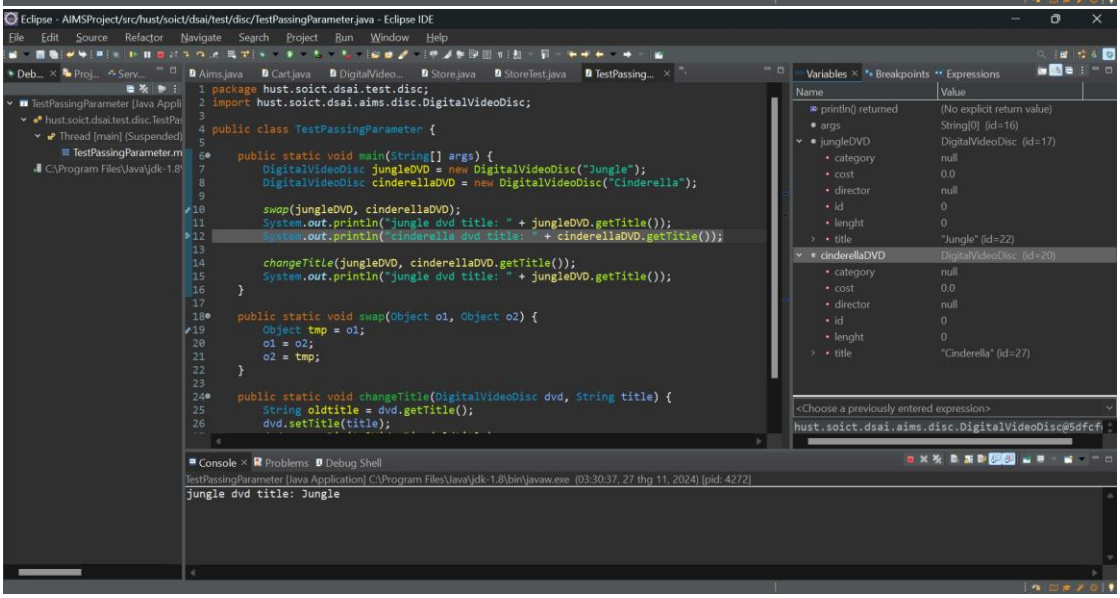
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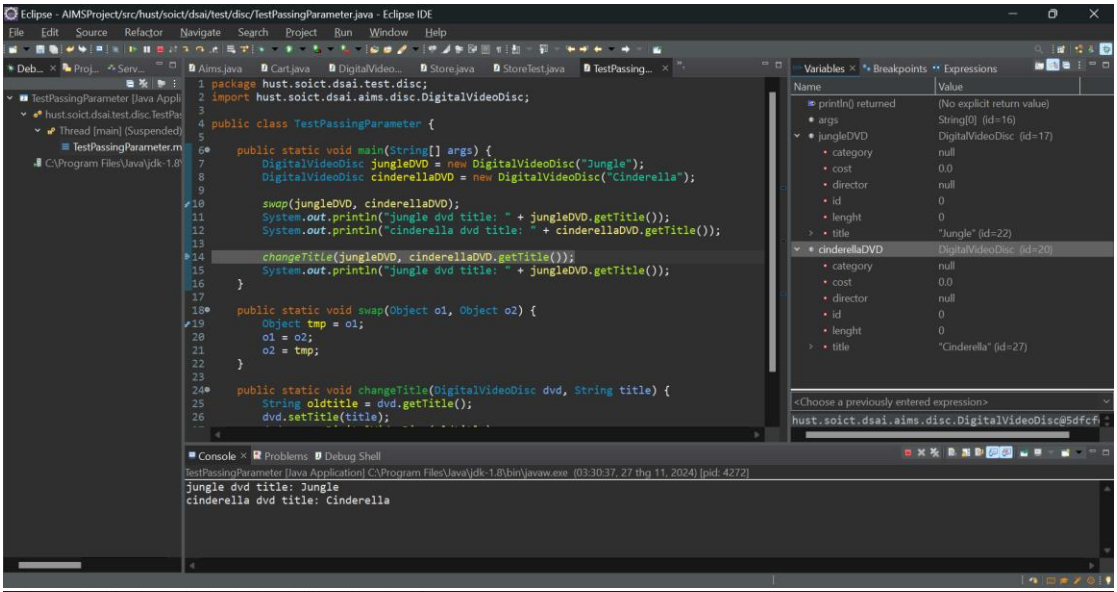
jungle dvd title: Jungle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cost 0.0
director null
id 0
lenght 0
title "Jungle" (id=22)
cinderellaDVD DigitalVideoDisc (id=20)
category null
cost 0.0
director null
id 0
lenght 0
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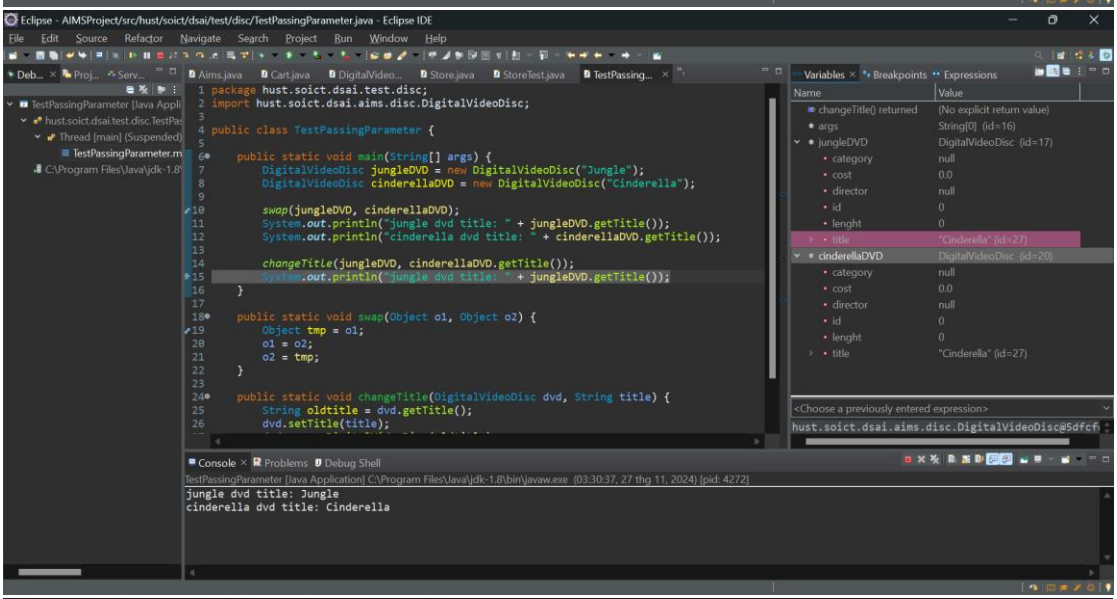
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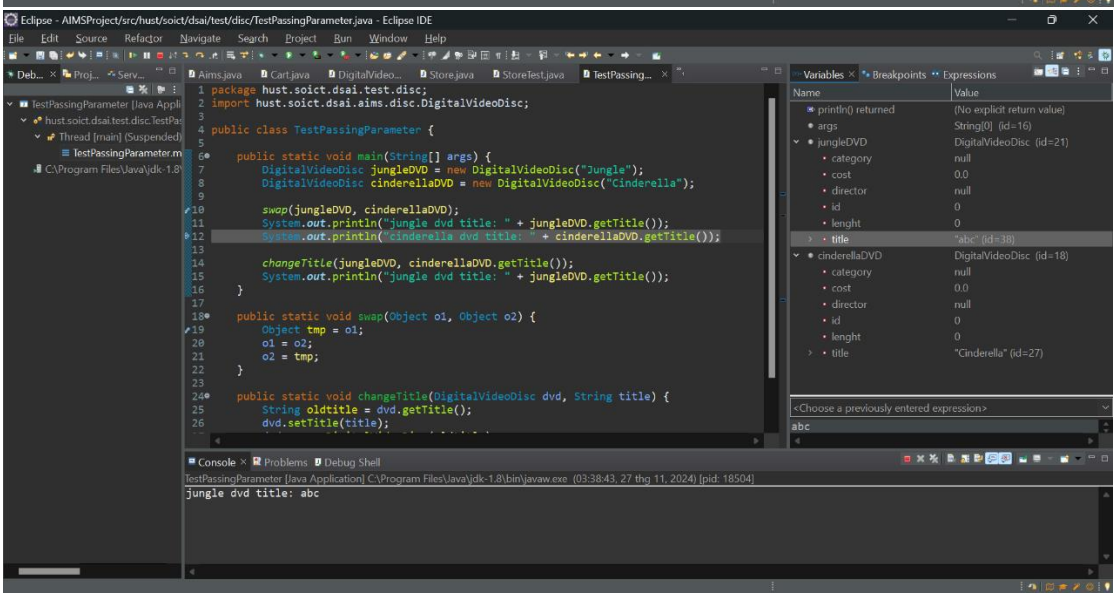
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cost 0.0
director null
id 0
lenght 0
title "abc" (id=38)
cinderellaDVD DigitalVideoDisc (id=18)
category null
cost 0.0
director null
id 0
lenght 0
title "Cinderella" (id=27)
<Choose a previously entered expression>
abc
Console Problems Debug Shell
TestPassingParameter [Java Application] C:\Program Files\Java\jdk-1.8\bin\javaw.exe (03:38:43, 27 thg 11, 2024) [pid: 18504]
jungle dvd title: abc

5. Classifier Member and Instance Member:

```
public class DigitalVideoDisc {
    private String title;
    private String category;
    private String director;
    private int lenght;
    private float cost;
    private int id;

    private static int nbDigitalVideoDiscs = 0;
```

```
public DigitalVideoDisc(String title) {
    super();
    this.title = title;
}

public DigitalVideoDisc(String title, String category, float cost) {
    super();
    this.title = title;
    this.category = category;
    this.cost = cost;
    this.id = nbDigitalVideoDiscs;
    nbDigitalVideoDiscs++;
}

public DigitalVideoDisc(String title, String category, String director, float cost) {
    super();
    this.title = title;
    this.category = category;
    this.director = director;
    this.cost = cost;
    this.id = nbDigitalVideoDiscs;
    nbDigitalVideoDiscs++;
}
```

```
public DigitalVideoDisc(String title, String category, String director, int lenght, float cost) {
    super();
    this.title = title;
    this.category = category;
    this.director = director;
    this.lenght = lenght;
    this.cost = cost;
    this.id = nbDigitalVideoDiscs;
    nbDigitalVideoDiscs++;
}
```

6. Open the Cart class:

- Write a **toString()** method for the **DigitalVideoDisc** class. What should be the return type of this method?

It should be String.

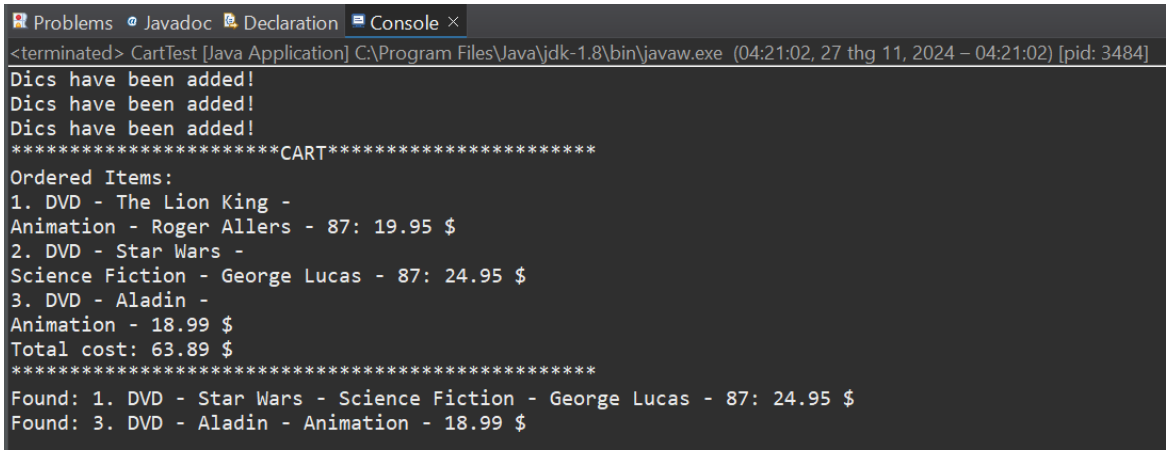
- Print, search, test method and result:

```
public void print() {
    System.out.println("**********CART**********");
    System.out.println("Ordered Items:");

    for (int i = 0; i < currentorder; i++) {
        System.out.print((i + 1) + ". DVD - ");

        if (itemsOrdered[i].getTitle() != null) {
            System.out.println(itemsOrdered[i].getTitle() + " - ");
        }
        if (itemsOrdered[i].getCategory() != null) {
            System.out.print(itemsOrdered[i].getCategory() + " - ");
        }
        if (itemsOrdered[i].getDirector() != null) {
            System.out.print(itemsOrdered[i].getDirector() + " - ");
        }
        if (itemsOrdered[i].getLength() != 0) {
            System.out.print(itemsOrdered[i].getLength() + ": ");
        }
        if (itemsOrdered[i].getCost() != 0) {
            System.out.println(itemsOrdered[i].getCost() + " $");
        }
    }

    System.out.println("Total cost: " + this.totalCost() + " $");
    System.out.println("**********");
}
```

```
public void search(int id) {

    boolean found = false;

    for (int i = 0; i < currentorder; i++) {

        if (itemsOrdered[i].isMatch(id)) {

            System.out.print("Found: " + (i + 1) + ". DVD - ");

            if (itemsOrdered[i].getTitle() != null) {
                System.out.print(itemsOrdered[i].getTitle() + " - ");
            }
            if (itemsOrdered[i].getCategory() != null) {
                System.out.print(itemsOrdered[i].getCategory() + " - ");
            }
            if (itemsOrdered[i].getDirector() != null) {
                System.out.print(itemsOrdered[i].getDirector() + " - ");
            }
            if (itemsOrdered[i].getLength() != 0) {
                System.out.print(itemsOrdered[i].getLength() + ": ");
            }
            if (itemsOrdered[i].getCost() != 0) {
                System.out.println(itemsOrdered[i].getCost() + " $");
            }

            found = true;
        }
    }
    if (found == false) {
        System.out.println("No match is found");
    }
}
```

```java
public void search(String title) {

    boolean found = false;

    for (int i = 0; i < currentorder; i++) {

        if (itemsOrdered[i].isMatch(title)) {

            System.out.print("Found: " + (i + 1) + ". DVD - ");

            if (itemsOrdered[i].getTitle() != null) {
                System.out.print(itemsOrdered[i].getTitle() + " - ");
            }
            if (itemsOrdered[i].getCategory() != null) {
                System.out.print(itemsOrdered[i].getCategory() + " - ");
            }
            if (itemsOrdered[i].getDirector() != null) {
                System.out.print(itemsOrdered[i].getDirector() + " - ");
            }
            if (itemsOrdered[i].getLength() != 0) {
                System.out.print(itemsOrdered[i].getLength() + ": ");
            }
            if (itemsOrdered[i].getCost() != 0) {
                System.out.println(itemsOrdered[i].getCost() + " $");
            }

            found = true;
        }
    }
    if (found == false) {
        System.out.println("No match is found");
    }
}
```

```java
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, 19.95f);
        cart.add_DigitalVideoDisc(dvd1);

        DigitalVideoDisc dvd2 = new DigitalVideoDisc("Star Wars",
                "Science Fiction", "George Lucas", 87, 24.95f);
        cart.add_DigitalVideoDisc(dvd2);

        DigitalVideoDisc dvd3 = new DigitalVideoDisc("Aladin",
                "Animation", 18.99f);
        cart.add_DigitalVideoDisc(dvd3);

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

        //To-do: Test the search methods here
        cart.search(1);
        cart.search("Aladin");
    }
```



7. Implement Store class:

```java
public class Store {
    private final int storeCapacity = 1000;
    private DigitalVideoDisc itemsInStore[] = new DigitalVideoDisc[1000];

    private int qtyStore = 0;
    public void addDVD(DigitalVideoDisc disc) {
        if (qtyStore < storeCapacity) {
            itemsInStore[qtyStore] = disc;
            qtyStore++;
            System.out.println("DVD has been added");
        } else {
            System.out.println("Capacity is full");
        }
    }

    public void removeDVD(DigitalVideoDisc disc) {
        boolean found = false;

        for (int i = 0; i < qtyStore; i++) {
            if (itemsInStore[i].equals(disc)) {
                itemsInStore[i] = null;
                found = true;
                for (int j = i; j < qtyStore; j ++) {
                    itemsInStore[j] = itemsInStore[j + 1];
                }
                qtyStore--;
                System.out.println("DVD has been removed");
            }
        }

        if (found == false) {
            System.out.println("Cannot find the DVD to be removed");
        }
    }
}
```

```java
public class StoreTest {
    public static void main(String[] args) {
        //Create a new store
        Store store = new Store();

        //Create new dvd objects
        DigitalVideoDisc dvd1 = new DigitalVideoDisc("The Lion King",
                "Animation", "Roger Allers", 87, 19.95f);

        DigitalVideoDisc dvd2 = new DigitalVideoDisc("Star Wars",
                "Science Fiction", "George Lucas", 87, 24.95f);

        DigitalVideoDisc dvd3 = new DigitalVideoDisc("Aladin",
                "Animation", 18.99f);

        //Test the add and remove method
        store.addDVD(dvd1);
        store.addDVD(dvd2);
        store.removeDVD(dvd3);
        store.addDVD(dvd3);
        store.removeDVD(dvd3);

    }
}
```

8. String, StringBuilder and StringBuffer:

```java
package hust.soict.dsai.garbage;

import java.util.Random;

public class ConcatenationInLoops {
    public static void main(String[] args) {
        Random r = new Random(123);
        long start = System.currentTimeMillis();

        String s = "";
        for (int i = 0; i < 65536; i++)
            s += r.nextInt(2);
        System.out.println(System.currentTimeMillis() - start); // This prints roughly 4500.

        r = new Random(123);
        start = System.currentTimeMillis();
        StringBuilder sb = new StringBuilder();
        for (int i = 0; i < 65536; i++)
            sb.append(r.nextInt(2));
        s = sb.toString();
        System.out.println(System.currentTimeMillis() - start); // This prints 5.
    }
}
```

```java
package hust.soict.dsai.garbage;

import java.io.IOException;

public class GarbageCreator {
    public static void main(String[] args) throws IOException {
        String filepath = "C:\\Users\\ADmin\\Documents\\large_input.txt";
        byte[] inputBytes = {0};
        long startTime, endTime;

        inputBytes = Files.readAllBytes(Paths.get(filepath));
        startTime = System.currentTimeMillis();
        String outputString = "";

        for (byte b : inputBytes) {
            outputString += (char)b;
        }
        endTime = System.currentTimeMillis();
        System.out.println(endTime - startTime);
    }
}
```

```java
package hust.soict.dsai.garbage;

import java.io.IOException;

public class NoGarbage {
    public static void main(String[] args) throws IOException {
        String filepath = "C:\\Users\\ADmin\\Documents\\large_input.txt";
        byte[] inputBytes = {0};
        long startTime, endTime;

        inputBytes = Files.readAllBytes(Paths.get(filepath));
        startTime = System.currentTimeMillis();
        StringBuilder outputString = new StringBuilder();
        for (byte b : inputBytes) {
            outputString.append(b);
        }
        endTime = System.currentTimeMillis();
        System.out.println(endTime - startTime);
    }
}
```