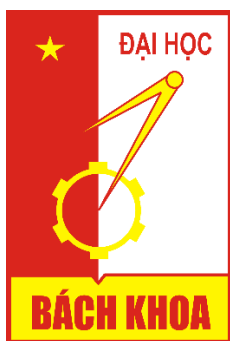


ĐẠI HỌC BÁCH KHOA HÀ NỘI
TRƯỜNG CÔNG NGHỆ THÔNG TIN VÀ TRUYỀN THÔNG



BÁO CÁO THỰC HÀNH
IT3103 – 744528 - 2024.1
BÀI THỰC HÀNH 3

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Hà Nội 11/2024

BÁO CÁO THỰC HÀNH LAB 3

LẬP TRÌNH HƯỚNG ĐỐI TƯỢNG

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1. Working with method overloading

1.1. Overloading by differing types of parameter

1.1.1. Code

```
// Method to add a DigitalVideoDisc to the cart
public void addDigitalVideoDisc(DigitalVideoDisc disc) {
    if (qtyOrdered >= MAX_NUMBERS_ORDERED) {
        System.out.println("Pham Duy Dong - 5608 - The cart is full, cannot add more items.");
    } else {
        itemsOrdered[qtyOrdered] = disc;
        qtyOrdered++;
        System.out.println("Pham Duy Dong - 5608 - The disc has been added to the cart.");
    }
}

public void addDigitalVideoDisc(DigitalVideoDisc[] dvdList) {
    for (DigitalVideoDisc dvd : dvdList) {
        addDigitalVideoDisc(dvd);
    }
}

/*
public void addDigitalVideoDisc(DigitalVideoDisc... dvds) {
    for (DigitalVideoDisc dvd : dvds) {
        addDigitalVideoDisc(dvd);
    }
}
*/
```

Hình 1: Overloading by differing types of parameter

1.1.2. Result

```
package AimsProject;

public class CartTest {
    public static void main(String[] args) {
        // Tạo giỏ hàng
        Cart cart = new Cart();

        // Tạo DVD
        DigitalVideoDisc dvd1 = new DigitalVideoDisc("Animation", "The Lion King", "Roger Allers", 87, 19.95f);
        DigitalVideoDisc dvd2 = new DigitalVideoDisc("Science Fiction", "Star Wars", "George Lucas", 87, 24.95f);
        DigitalVideoDisc dvd3 = new DigitalVideoDisc("Animation", "Aladin", 18.99f);

        // Kiểm tra phương thức thêm 1 DVD
        System.out.println("\n=== Pham Duy Dong - 5608 - Adding a single DVD ===");
        cart.addDigitalVideoDisc(dvd1);

        // Kiểm tra phương thức thêm danh sách DVD
        System.out.println("\n=== Pham Duy Dong - 5608 Adding multiple DVDs (array) ===");
        DigitalVideoDisc[] dvdList = {dvd2, dvd3};
        cart.addDigitalVideoDisc(dvdList);
    }
}
```

```

PS C:\IT3103.744528.2024.1.20225608.PhamDuyDong\Lab02> java AimsProject.CartTest
>>

=== Pham Duy Dong - 5608 - Adding a single DVD ===
Pham Duy Dong - 5608 - The disc has been added to the cart.

=== Pham Duy Dong - 5608 Adding multiple DVDs (array) ===
Pham Duy Dong - 5608 - The disc has been added to the cart.
Pham Duy Dong - 5608 - The disc has been added to the cart.

```

Hình 2: Result of Overloading by differing types of parameter

1.2. Overloading by differing the number of parameters

1.2.1. Code

```

public void addDigitalVideoDisc(DigitalVideoDisc dvd1, DigitalVideoDisc dvd2) {
    if (qtyOrdered + 2 > MAX_NUMBERS_ORDERED) {
        System.out.println("Pham Duy Dong - 5608 - The cart is full, cannot add more items.");
        return;
    }

    itemsOrdered[qtyOrdered] = dvd1;
    qtyOrdered++;
    System.out.println("Pham Duy Dong - 5608 - The disc has been added to the cart.");

    itemsOrdered[qtyOrdered] = dvd2;
    qtyOrdered++;
    System.out.println("Pham Duy Dong - 5608 - The disc has been added to the cart.");
}

```

Hình 3: Overloading by differing the number of parameters

1.2.2. Result

```

PS C:\IT3103.744528.2024.1.20225608.PhamDuyDong\Lab02> java AimsProject.CartTest
>>

=== Pham Duy Dong - 5608 - Adding a single DVD ===
Pham Duy Dong - 5608 - The disc has been added to the cart.

=== Pham Duy Dong - 5608 Adding multiple DVDs (array) ===
Pham Duy Dong - 5608 - The disc has been added to the cart.
Pham Duy Dong - 5608 - The disc has been added to the cart.

=== Pham Duy Dong - 5608 - Adding two DVDs ===
Pham Duy Dong - 5608 - The disc has been added to the cart.
Pham Duy Dong - 5608 - The disc has been added to the cart.

```

Hình 4: Result of Overloading by differing the number of parameters

2. Passing parameter

2.1. Code

```
package AimsProject;

public class TestPassingParameter {

    public static void main(String[] args) {
        // TODO Auto-generated method stub
        DigitalVideoDisc jungleDVD = new DigitalVideoDisc("Jungle");
        DigitalVideoDisc cinderellaDVD = new DigitalVideoDisc("Cinderella");

        swap(jungleDVD, cinderellaDVD);
        System.out.println("Pham Duy Dong - 5608 - jungle dvd title: " + jungleDVD.getTitle());
        System.out.println("Pham Duy Dong - 5608 - cinderella dvd title: " + cinderellaDVD.getTitle());

        changeTitle(jungleDVD, cinderellaDVD.getTitle());
        System.out.println("Pham Duy Dong - 5608 - 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);
    }
}
```

Hình 5: Passing parameter

2.2. Result

```
PS C:\IT3103.744528.2024.1.20225608.PhạmDuyDong\Lab02> java AimsProject.TestPassingParameter
Pham Duy Dong - 5608 - jungle dvd title: Cinderella
Pham Duy Dong - 5608 - cinderella dvd title: Jungle
Pham Duy Dong - 5608 - jungle dvd title: Jungle
```

Hình 6: Result of Passing parameter

3. Class Member and Instance Member

3.1. Code

```
public class DigitalVideoDisc {
    private String title;
    private String category;
    private String director;          //Pham Duy Dong - 5608
    private int length;
    private float cost;
    // Thuộc tính lớp (static): Theo dõi số lượng DVD đã được tạo
    private static int nbDigitalVideoDiscs = 0;
    // Thuộc tính đối tượng: ID duy nhất của mỗi DVD
    private int id;

    // Constructor 1: Tạo DVD chỉ với title
    public DigitalVideoDisc(String title) {
        this.title = title;
        // Tăng số lượng DVD đã được tạo
        nbDigitalVideoDiscs++;
        // Gán ID cho DVD
        this.id = nbDigitalVideoDiscs;
    }

    // Constructor 2: Tạo DVD với category, title, cost
    public DigitalVideoDisc(String category, String title, float cost) {
        this.category = category;
        this.title = title;
        this.cost = cost;
        nbDigitalVideoDiscs++;
        this.id = nbDigitalVideoDiscs;
    }

    // Constructor 3: Tạo DVD với director, category, title, cost
    public DigitalVideoDisc(String director, String category, String title, float cost) {
        this.director = director;
        this.category = category;
        this.title = title;          //Pham Duy Dong - 5608
        this.cost = cost;
        nbDigitalVideoDiscs++;
        this.id = nbDigitalVideoDiscs;
    }

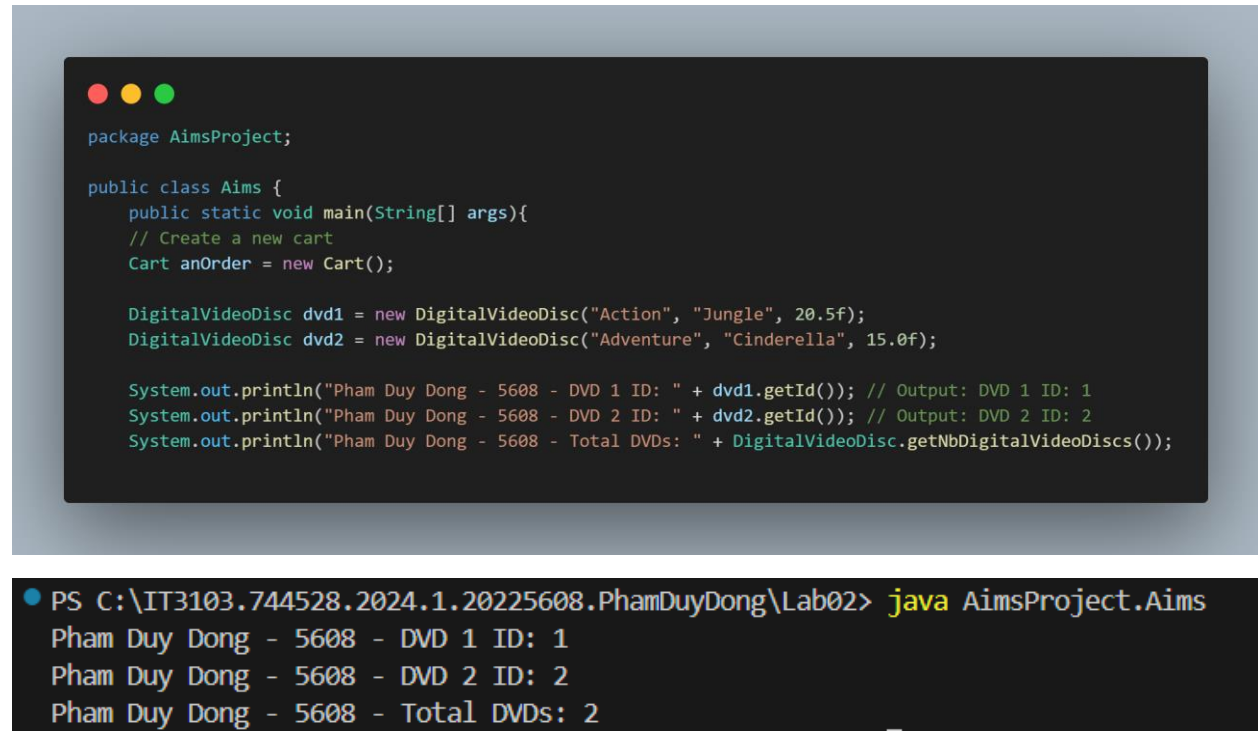
    // Constructor 4: Tạo DVD với tất cả thuộc tính
    public DigitalVideoDisc(String title, String category, String director, int length, float cost) {
        this.title = title;
        this.category = category;
        this.director = director;
        this.length = length;
        this.cost = cost;
        nbDigitalVideoDiscs++;
        this.id = nbDigitalVideoDiscs;
    }

    // Getter cho ID
    public int getId() {
        return id;
    }

    // Getter cho số lượng DVD đã tạo
    public static int getNbDigitalVideoDiscs() {
        return nbDigitalVideoDiscs;
    }
}
```

Hình 7: Class Member and Instance Member

3.2. Result



The image shows a screenshot of a Java IDE. The top part displays the source code for a class named `Aims` in the `AimsProject` package. The code creates two `DigitalVideoDisc` objects, `dvd1` and `dvd2`, and prints their IDs and the total number of DVDs. The bottom part shows the command prompt output when the code is executed, displaying the same information as the code's print statements.

```
package AimsProject;

public class Aims {
    public static void main(String[] args){
        // Create a new cart
        Cart anOrder = new Cart();

        DigitalVideoDisc dvd1 = new DigitalVideoDisc("Action", "Jungle", 20.5f);
        DigitalVideoDisc dvd2 = new DigitalVideoDisc("Adventure", "Cinderella", 15.0f);

        System.out.println("Pham Duy Dong - 5608 - DVD 1 ID: " + dvd1.getId()); // Output: DVD 1 ID: 1
        System.out.println("Pham Duy Dong - 5608 - DVD 2 ID: " + dvd2.getId()); // Output: DVD 2 ID: 2
        System.out.println("Pham Duy Dong - 5608 - Total DVDs: " + DigitalVideoDisc.getNbDigitalVideoDiscs());
    }
}
```

```
PS C:\IT3103.744528.2024.1.20225608.PhamDuyDong\Lab02> java AimsProject.Aims
Pham Duy Dong - 5608 - DVD 1 ID: 1
Pham Duy Dong - 5608 - DVD 2 ID: 2
Pham Duy Dong - 5608 - Total DVDs: 2
```

Hình 8: Result of Class Member and Instance Member

4. Open the Cart class

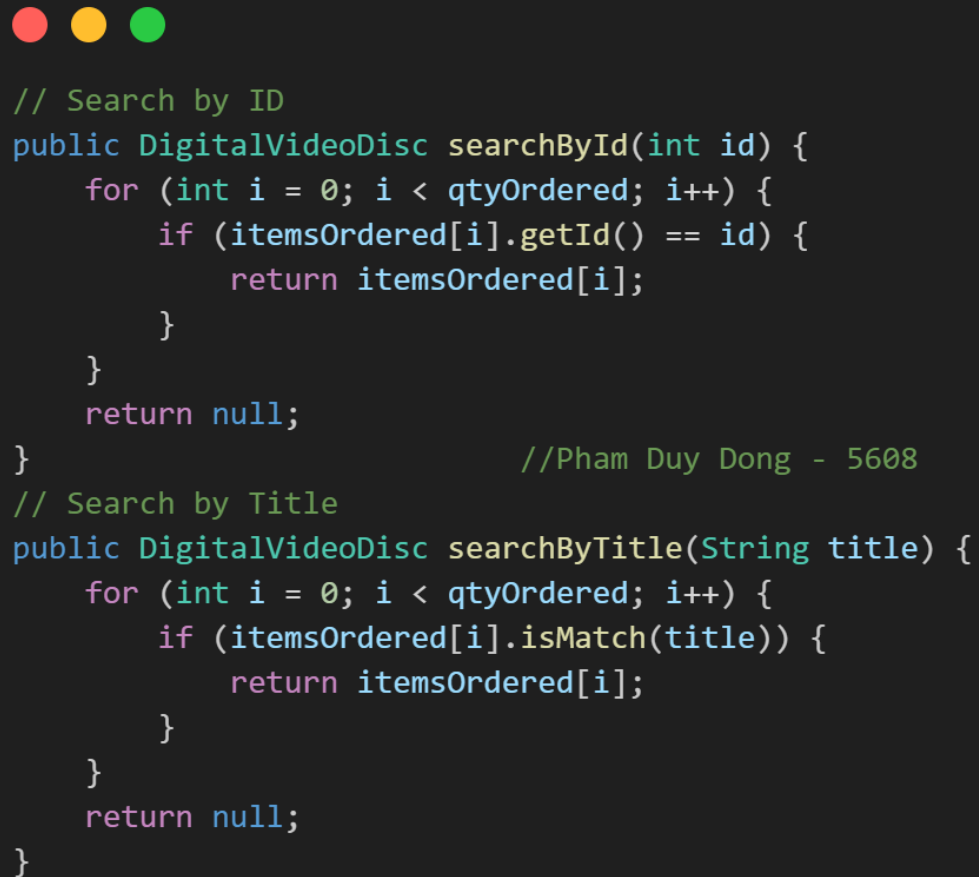
4.1. Code

```
public String toString() {  
    return "DVD - " + title + " - " + category + " - " + director + " - " + length + ": " + cost + " $";  
}
```

```
// Method to print Cart  
public void print() {  
    System.out.println("*****CART*****");  
    System.out.println("Pham Duy Dong - 5608 - Ordered Items:");  
  
    for (int i = 0; i < qtyOrdered; i++) {  
        System.out.println((i + 1) + ". " + itemsOrdered[i].toString());  
    }  
  
    System.out.println("Pham Duy Dong - 5608 - Total cost: " + totalCost() + " $");  
    System.out.println("*****");  
}
```

Hình 9: Method to print the content in Cart

```
public boolean isMatch(String title) {  
    return this.title.equalsIgnoreCase(title);  
}
```



```
// Search by ID
public DigitalVideoDisc searchById(int id) {
    for (int i = 0; i < qtyOrdered; i++) {
        if (itemsOrdered[i].getId() == id) {
            return itemsOrdered[i];
        }
    }
    return null;
}

//Pham Duy Dong - 5608
// Search by Title
public DigitalVideoDisc searchByTitle(String title) {
    for (int i = 0; i < qtyOrdered; i++) {
        if (itemsOrdered[i].isMatch(title)) {
            return itemsOrdered[i];
        }
    }
    return null;
}
```

Hình 10: Method to search by ID or Title

```

package AimsProject;

public class CartTest {
    public static void main(String[] args) {
        // Tạo giỏ hàng
        Cart cart = new Cart();

        // Tạo DVD và thêm DVD
        DigitalVideoDisc dvd1 = new DigitalVideoDisc("Animation", "The Lion King", "Roger Allers", 87, 19.95f);
        cart.addDigitalVideoDisc(dvd1);

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

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

        // In thông tin giỏ hàng
        cart.print();

        // Tìm kiếm DVD theo ID
        int searchId = 2; // ID cần tìm
        DigitalVideoDisc foundById = cart.searchById(searchId);
        if (foundById != null) {
            System.out.println("Pham Duy Dong - 5608 - Found by ID: " + foundById.toString());
        } else {
            System.out.println("Pham Duy Dong - 5608 - No DVD found with ID: " + searchId);
        }

        String searchTitle = "Star Wars";
        DigitalVideoDisc foundByTitle = cart.searchByTitle(searchTitle);
        if (foundByTitle != null) {
            System.out.println("Pham Duy Dong - 5608 - Found by Title: " + foundByTitle.toString());
        } else {
            System.out.println("Pham Duy Dong - 5608 - No DVD found with title: " + searchTitle);
        }
    }
}

```

Hình 11: CartTest

4.2. Result

```

PS C:\IT3103.744528.2024.1.20225608.PhamDuyDong\Lab02> java AimsProject.CartTest
Pham Duy Dong - 5608 - The disc has been added to the cart.
Pham Duy Dong - 5608 - The disc has been added to the cart.
Pham Duy Dong - 5608 - The disc has been added to the cart.
*****CART*****
Pham Duy Dong - 5608 - Ordered Items:
1. DVD - Animation - The Lion King - Roger Allers - 87: 19.95 $
2. DVD - Science Fiction - Star Wars - George Lucas - 87: 24.95 $
3. DVD - Aladin - Animation - null - 0: 18.99 $
Pham Duy Dong - 5608 - Total cost: 63.89 $
*****

```

Hình 12: Result of method Print

```
PS C:\IT3103.744528.2024.1.20225608.PhamDuyDong\Lab02> java AimsProject.CartTest
Pham Duy Dong - 5608 - The disc has been added to the cart.
Pham Duy Dong - 5608 - The disc has been added to the cart.
Pham Duy Dong - 5608 - The disc has been added to the cart.
*****CART*****
Pham Duy Dong - 5608 - Ordered Items:
1. DVD - Animation - The Lion King - Roger Allers - 87: 19.95 $
2. DVD - Science Fiction - Star Wars - George Lucas - 87: 24.95 $
3. DVD - Aladin - Animation - null - 0: 18.99 $
Pham Duy Dong - 5608 - Total cost: 63.89 $
*****
Pham Duy Dong - 5608 - Found by ID: DVD - Science Fiction - Star Wars - George Lucas - 87: 24.95 $
Pham Duy Dong - 5608 - No DVD found with title: Star Wars
```

Hình 13: Result of method Search

5. Implement the Store class

5.1. Code

```
package AimsProject;

import java.util.ArrayList;

public class Store {
    private ArrayList<DigitalVideoDisc> itemsInStore;

    // Constructor
    public Store() {
        itemsInStore = new ArrayList<>();
    }

    // Method to add a DVD to the store
    public void addDVD(DigitalVideoDisc dvd) {
        if (itemsInStore.contains(dvd)) {
            System.out.println("Pham Duy Dong - 5608 - DVD \"" + dvd.getTitle() + "\" is already in the store.");
        } else {
            itemsInStore.add(dvd);
            System.out.println("Pham Duy Dong - 5608 - DVD \"" + dvd.getTitle() + "\" has been added to the store.");
        }
    }

    // Method to remove a DVD from the store
    public void removeDVD(DigitalVideoDisc dvd) {
        if (itemsInStore.contains(dvd)) {
            itemsInStore.remove(dvd);
            System.out.println("Pham Duy Dong - 5608 - DVD \"" + dvd.getTitle() + "\" has been removed from the store.");
        } else {
            System.out.println("Pham Duy Dong - 5608 - DVD \"" + dvd.getTitle() + "\" was not found in the store.");
        }
    }

    // Method to display all DVDs in the store
    public void printStore() {
        System.out.println("*****STORE*****");
        if (itemsInStore.isEmpty()) {
            System.out.println("Pham Duy Dong - 5608 - The store is currently empty.");
        } else {
            System.out.println("Pham Duy Dong - 5608 - Items in the store:");
            for (int i = 0; i < itemsInStore.size(); i++) {
                System.out.println((i + 1) + ". " + itemsInStore.get(i).toString());
            }
        }
        System.out.println("*****");
    }
}
```

Hình 14: Store Class

```

package AimsProject;

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

        // Create some DVDs
        DigitalVideoDisc dvd1 = new DigitalVideoDisc("Animation", "The Lion King", "Roger Allers", 87, 19.95f);
        DigitalVideoDisc dvd2 = new DigitalVideoDisc("Science Fiction", "Star Wars", "George Lucas", 87, 24.95f);
        DigitalVideoDisc dvd3 = new DigitalVideoDisc("Animation", "Aladin", 18.99f);

        // Add DVDs to the store
        store.addDVD(dvd1);
        store.addDVD(dvd2);
        store.addDVD(dvd3);

        // Print the store's inventory
        store.printStore();

        // Remove a DVD from the store
        store.removeDVD(dvd1);

        // Try removing a DVD not in the store
        DigitalVideoDisc dvd4 = new DigitalVideoDisc("Action", "Avengers: Endgame", "Anthony Russo", 180, 29.99f);
        store.removeDVD(dvd4);

        // Try adding a duplicate DVD
        store.addDVD(dvd2);

        // Print the store's inventory after modifications
        store.printStore();
    }
}

```

Hình 15: StoreTest

5.2. Result

```

PS C:\IT3103.744528.2024.1.20225608.PhạmDuyDong\Lab02> java AimsProject.StoreTest
Pham Duy Dong - 5608 - DVD "Animation" has been added to the store.
Pham Duy Dong - 5608 - DVD "Science Fiction" has been added to the store.
Pham Duy Dong - 5608 - DVD "Aladin" has been added to the store.
*****STORE*****
Pham Duy Dong - 5608 - Items in the store:
1. DVD - Animation - The Lion King - Roger Allers - 87: 19.95 $
2. DVD - Science Fiction - Star Wars - George Lucas - 87: 24.95 $
3. DVD - Aladin - Animation - null - 0: 18.99 $
*****
Pham Duy Dong - 5608 - DVD "Animation" has been removed from the store.
Pham Duy Dong - 5608 - DVD "Action" was not found in the store.
Pham Duy Dong - 5608 - DVD "Science Fiction" is already in the store.
*****STORE*****
Pham Duy Dong - 5608 - Items in the store:
1. DVD - Science Fiction - Star Wars - George Lucas - 87: 24.95 $
2. DVD - Aladin - Animation - null - 0: 18.99 $
*****

```

Hình 16: Result of StoreTest

6. String, StringBuilder and StringBuffer

6.1. Code

```
package OtherProjects.hust.dsai.garbage;

import java.util.Random;

public class ConcatenationInLoops {
    public static void main(String[] args) {
        Random r = new Random(123);

        // Using "+" operator
        long start = System.currentTimeMillis();
        String s = "";
        for (int i = 0; i < 65536; i++) {
            s += r.nextInt(2);
        }
        System.out.println("Pham Duy Dong - 5608 - Using + operator: " + (System.currentTimeMillis() - start) + " ms");

        // Using StringBuilder
        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("Pham Duy Dong - 5608 - Using StringBuilder: " + (System.currentTimeMillis() - start) + " ms");

        // Using StringBuffer
        r = new Random(123);
        start = System.currentTimeMillis();
        StringBuffer sbuf = new StringBuffer();
        for (int i = 0; i < 65536; i++) {
            sbuf.append(r.nextInt(2));
        }
        s = sbuf.toString();
        System.out.println("Pham Duy Dong - 5608 - Using StringBuffer: " + (System.currentTimeMillis() - start) + " ms");
    }
}
```

Hình 17: Compare StringBuilder and String Buffer

6.2. Result

```
PS C:\IT3103.744528.2024.1.20225608.PhamDuyDong\OtherProjects\hust\soict\dsai\garbage> java .\ConcatenationInLoops.java
Pham Duy Dong - 5608 - Using + operator: 570 ms
Pham Duy Dong - 5608 - Using StringBuilder: 3 ms
Pham Duy Dong - 5608 - Using StringBuffer: 4 ms
```

Hình 18: Result of Comparison



```

package OtherProjects.hust.soict.dsai.garbage;

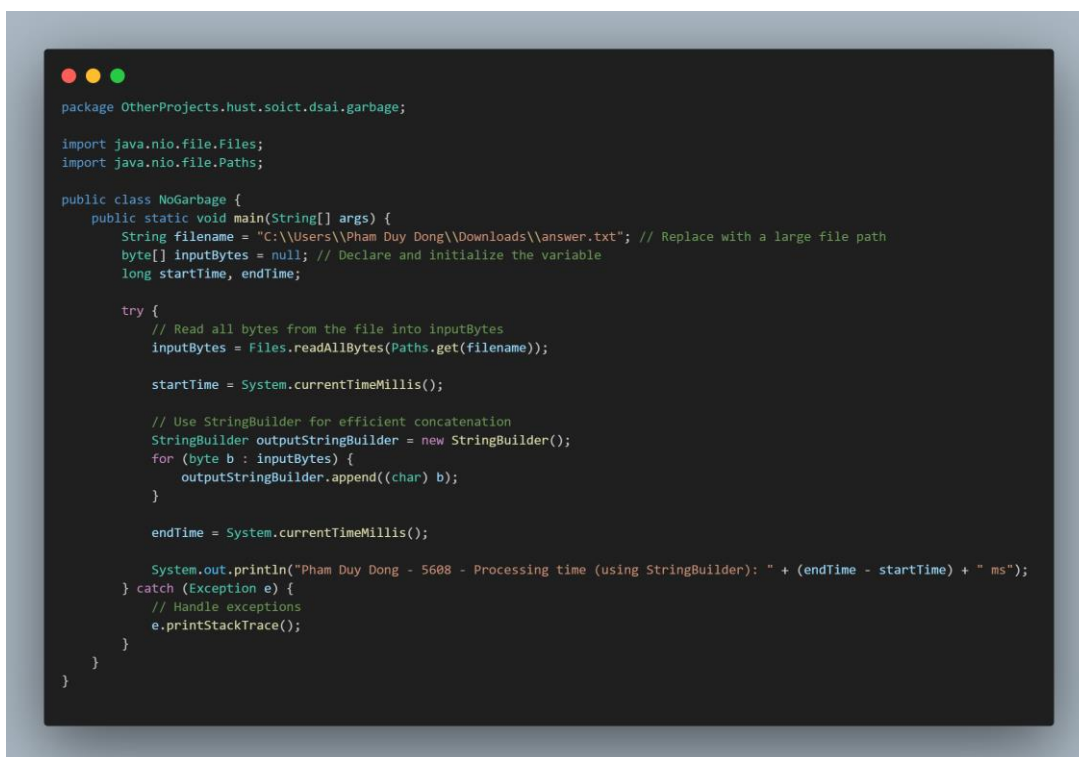
import java.nio.file.Files;
import java.nio.file.Paths;

public class GarbageCreator {
    public static void main(String[] args) {
        String filename = "C:\\Users\\Pham Duy Dong\\Downloads\\answer.txt"; // Replace with a large file path
        byte[] inputBytes = null;
        long startTime, endTime;

        try {
            inputBytes = Files.readAllBytes(Paths.get(filename));
            startTime = System.currentTimeMillis();
            String outputString = "";
            for (byte b : inputBytes) {
                outputString += (char) b; // Inefficient concatenation
            }
            endTime = System.currentTimeMillis();
            System.out.println("Pham Duy Dong - 5608 - Processing time (using +): " + (endTime - startTime) + " ms");
        } catch (Exception e) {
            e.printStackTrace();
        }
    }
}

```

Hình 19: GarbageCreator



```

package OtherProjects.hust.soict.dsai.garbage;

import java.nio.file.Files;
import java.nio.file.Paths;

public class NoGarbage {
    public static void main(String[] args) {
        String filename = "C:\\Users\\Pham Duy Dong\\Downloads\\answer.txt"; // Replace with a large file path
        byte[] inputBytes = null; // Declare and initialize the variable
        long startTime, endTime;

        try {
            // Read all bytes from the file into inputBytes
            inputBytes = Files.readAllBytes(Paths.get(filename));

            startTime = System.currentTimeMillis();

            // Use StringBuilder for efficient concatenation
            StringBuilder outputStringBuilder = new StringBuilder();
            for (byte b : inputBytes) {
                outputStringBuilder.append((char) b);
            }

            endTime = System.currentTimeMillis();

            System.out.println("Pham Duy Dong - 5608 - Processing time (using StringBuilder): " + (endTime - startTime) + " ms");
        } catch (Exception e) {
            // Handle exceptions
            e.printStackTrace();
        }
    }
}

```

Hình 20: NoGarbage

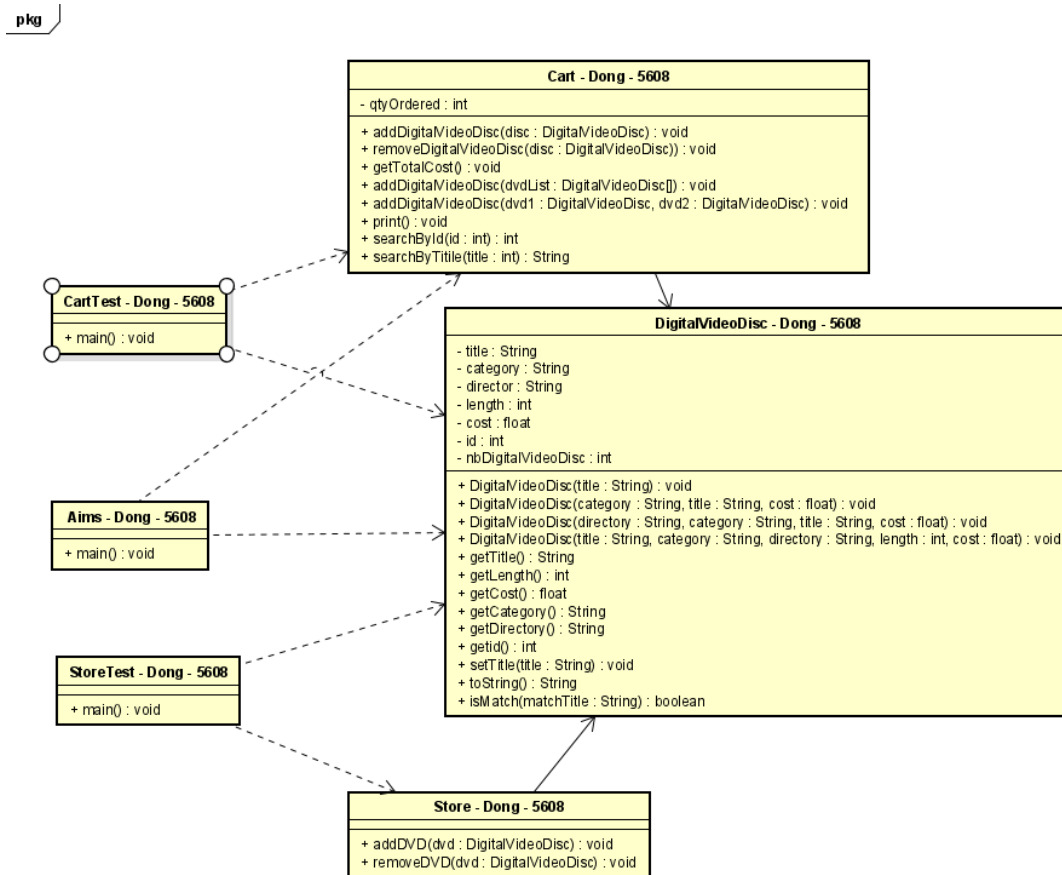
```

PS C:\IT3103.744528.2024.1.20225608.PharmDuyDong\OtherProjects\hust\soict\dsai\garbage> java NoGarbage.java
Pham Duy Dong - 5608 - Processing time (using StringBuilder): 1 ms

```

Hình 21: Result of using NoGarbage is much more quicklier than GarbageCreator

7. Class Diagram



Hình 22: Class Diagram