

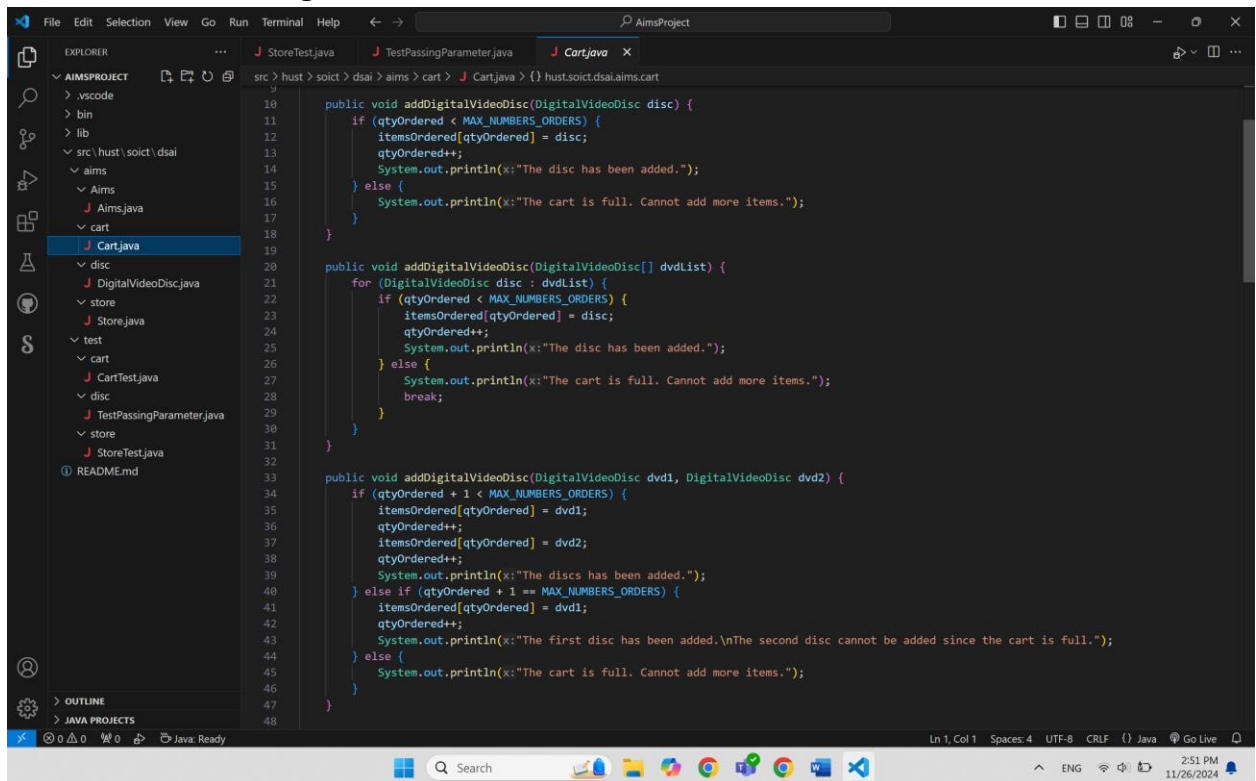
Lab03 Report

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I. Source code

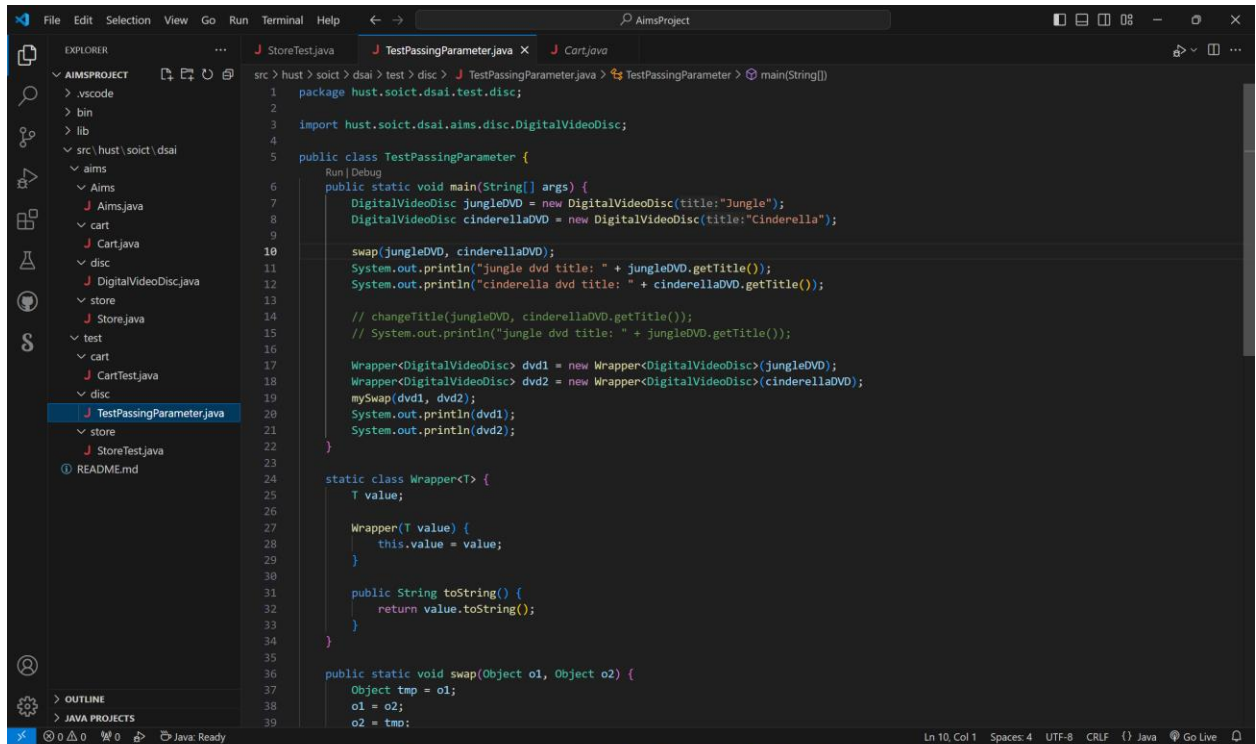
1) Method overloading



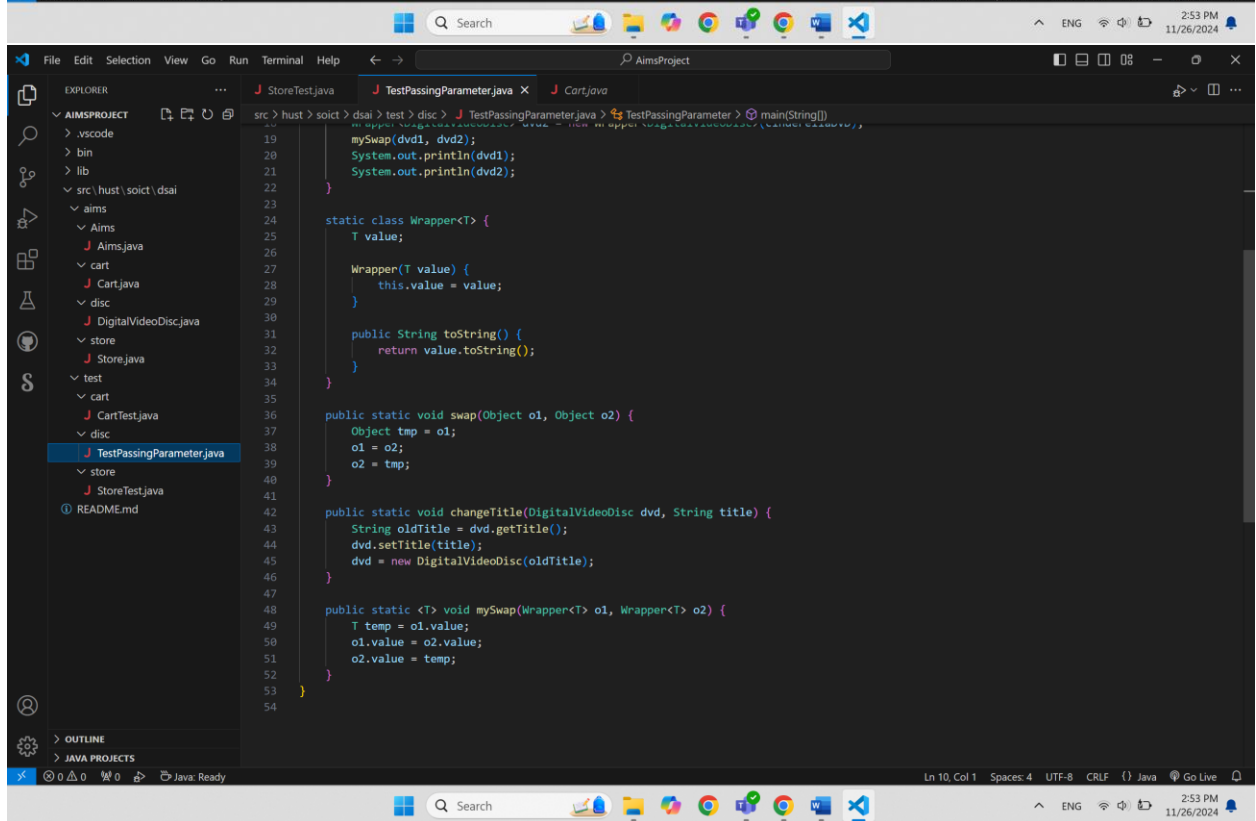
```
src > hust > soict > dsai > aims > cart > J Cart.java > {} hust:soict.dsai.aims.cart

10 public void addDigitalVideoDisc(DigitalVideoDisc disc) {
11     if (qtyOrdered < MAX_NUMBERS_ORDERS) {
12         itemsOrdered[qtyOrdered] = disc;
13         qtyOrdered++;
14         System.out.println(x:"The disc has been added.");
15     } else {
16         System.out.println(x:"The cart is full. Cannot add more items.");
17     }
18 }
19
20 public void addDigitalVideoDisc(DigitalVideoDisc[] dvdList) {
21     for (DigitalVideoDisc disc : dvdList) {
22         if (qtyOrdered < MAX_NUMBERS_ORDERS) {
23             itemsOrdered[qtyOrdered] = disc;
24             qtyOrdered++;
25             System.out.println(x:"The disc has been added.");
26         } else {
27             System.out.println(x:"The cart is full. Cannot add more items.");
28             break;
29         }
30     }
31 }
32
33 public void addDigitalVideoDisc(DigitalVideoDisc dvd1, DigitalVideoDisc dvd2) {
34     if (qtyOrdered + 1 < MAX_NUMBERS_ORDERS) {
35         itemsOrdered[qtyOrdered] = dvd1;
36         qtyOrdered++;
37         itemsOrdered[qtyOrdered] = dvd2;
38         qtyOrdered++;
39         System.out.println(x:"The discs has been added.");
40     } else if (qtyOrdered + 1 == MAX_NUMBERS_ORDERS) {
41         itemsOrdered[qtyOrdered] = dvd1;
42         qtyOrdered++;
43         System.out.println(x:"The first disc has been added.\nThe second disc cannot be added since the cart is full.");
44     } else {
45         System.out.println(x:"The cart is full. Cannot add more items.");
46     }
47 }
48 }
```

2) Passing parameter



```
src > hust > soict > dsai > test > disc > J TestPassingParameter.java > TestPassingParameter > main(String[])
1 package hust.soict.dsai.test.disc;
2
3 import hust.soict.dsai.aims.disc.DigitalVideoDisc;
4
5 public class TestPassingParameter {
6     public static void main(String[] args) {
7         DigitalVideoDisc jungleDVD = new DigitalVideoDisc(title:"Jungle");
8         DigitalVideoDisc cinderellaDVD = new DigitalVideoDisc(title:"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        Wrapper<DigitalVideoDisc> dvd1 = new Wrapper<DigitalVideoDisc>(jungleDVD);
18        Wrapper<DigitalVideoDisc> dvd2 = new Wrapper<DigitalVideoDisc>(cinderellaDVD);
19        mySwap(dvd1, dvd2);
20        System.out.println(dvd1);
21        System.out.println(dvd2);
22    }
23
24    static class Wrapper<T> {
25        T value;
26
27        Wrapper(T value) {
28            this.value = value;
29        }
30
31        public String toString() {
32            return value.toString();
33        }
34    }
35
36    public static void swap(Object o1, Object o2) {
37        Object tmp = o1;
38        o1 = o2;
39        o2 = tmp;
```



```
src > hust > soict > dsai > test > disc > J TestPassingParameter.java > TestPassingParameter > main(String[])
19 mySwap(dvd1, dvd2);
20 System.out.println(dvd1);
21 System.out.println(dvd2);
22 }
23
24 static class Wrapper<T> {
25     T value;
26
27     Wrapper(T value) {
28         this.value = value;
29     }
30
31     public String toString() {
32         return value.toString();
33     }
34 }
35
36 public static void swap(Object o1, Object o2) {
37     Object tmp = o1;
38     o1 = o2;
39     o2 = tmp;
40 }
41
42 public static void changeTitle(DigitalVideoDisc dvd, String title) {
43     String oldTitle = dvd.getTitle();
44     dvd.setTitle(title);
45     dvd = new DigitalVideoDisc(oldTitle);
46 }
47
48 public static <T> void mySwap(Wrapper<T> o1, Wrapper<T> o2) {
49     T temp = o1.value;
50     o1.value = o2.value;
51     o2.value = temp;
52 }
53
54 }
```

3) Use Debug Run

The image displays two screenshots of an IDE (likely IntelliJ IDEA) showing a Java project named 'TestPassingParameter'. The code is in a file named 'TestPassingParameter.java'.

Top Screenshot: The IDE shows the initial state of the program. The 'VARIABLES' panel on the left lists local variables: `args = String[0]@9`, `jungleDVD = DigitalVideoDisc@10`, and `cinderellaDVD = DigitalVideoDisc@11`. The 'BREAKPOINTS' panel shows several breakpoints set at lines 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19. The code in the editor is as follows:

```
1 import hust.soiect.dsai.aims.disc.DigitalVideoDisc;
2
3 public class TestPassingParameter {
4     public static void main(String[] args) {
5         DigitalVideoDisc jungleDVD = new DigitalVideoDisc(title:"Jungle");
6         DigitalVideoDisc cinderellaDVD = new DigitalVideoDisc(title:"Cinderella");
7
8         swap(jungleDVD, cinderellaDVD);
9         jungleDVD = DigitalVideoDisc@10;
10        cinderellaDVD = DigitalVideoDisc@11;
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        Wrapper<DigitalVideoDisc> dvd1 = new Wrapper<DigitalVideoDisc>(jungleDVD);
18        Wrapper<DigitalVideoDisc> dvd2 = new Wrapper<DigitalVideoDisc>(cinderellaDVD);
19        mySwap(dvd1, dvd2);
20    }
21}
```

Bottom Screenshot: The IDE shows the state after the program has executed the `swap` method. The 'VARIABLES' panel now shows: `o1 = DigitalVideoDisc@10` (category = null, cost = 0.000000, director = null, id = 1, length = 0, title = "Jungle") and `o2 = DigitalVideoDisc@11` (category = null, cost = 0.000000, director = null, id = 2, length = 0, title = "Cinderella"). The 'BREAKPOINTS' panel shows breakpoints at lines 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19. The code in the editor is as follows:

```
28 this.value = value;
29
30 public String toString() {
31     return value.toString();
32 }
33
34 public static void swap(Object o1, Object o2) {
35     Object tmp = o1;
36     o1 = o2;
37     o2 = tmp;
38 }
39
40 public static void changeTitle(DigitalVideoDisc dvd, String title) {
41     String oldTitle = dvd.getTitle();
42     dvd.setTitle(title);
43     dvd = new DigitalVideoDisc(oldTitle);
44 }
45 }
```

Visual Studio Code interface showing a Java project. The main editor displays the `TestPassingParameter.java` file, which includes a `swap` method and a `changeTitle` method. The `swap` method is currently selected, and the code is as follows:

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

The `changeTitle` method is also visible:

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

The left sidebar shows the `VARIABLES` pane with the following variables:

- `o1 = DigitalVideoDisc@10`: category = null, cost = 0.000000, director = null, id = 1, length = 0, title = "Jungle"
- `o2 = DigitalVideoDisc@11`: category = null, cost = 0.000000, director = null, id = 2, length = 0, title = "Cinderella"
- `tmp = DigitalVideoDisc@1`: category = null, cost = 0.000000, director = null, id = 1, length = 0, title = "Jungle"

The bottom status bar indicates the file is at line 38, column 1, with 4 spaces, UTF-8 encoding, and CRLF line endings. The Java version is 21.0.4.7-hotspot.

Visual Studio Code interface showing the same Java project, but with the `changeTitle` method selected in the main editor. The code is as follows:

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

The `swap` method is also visible:

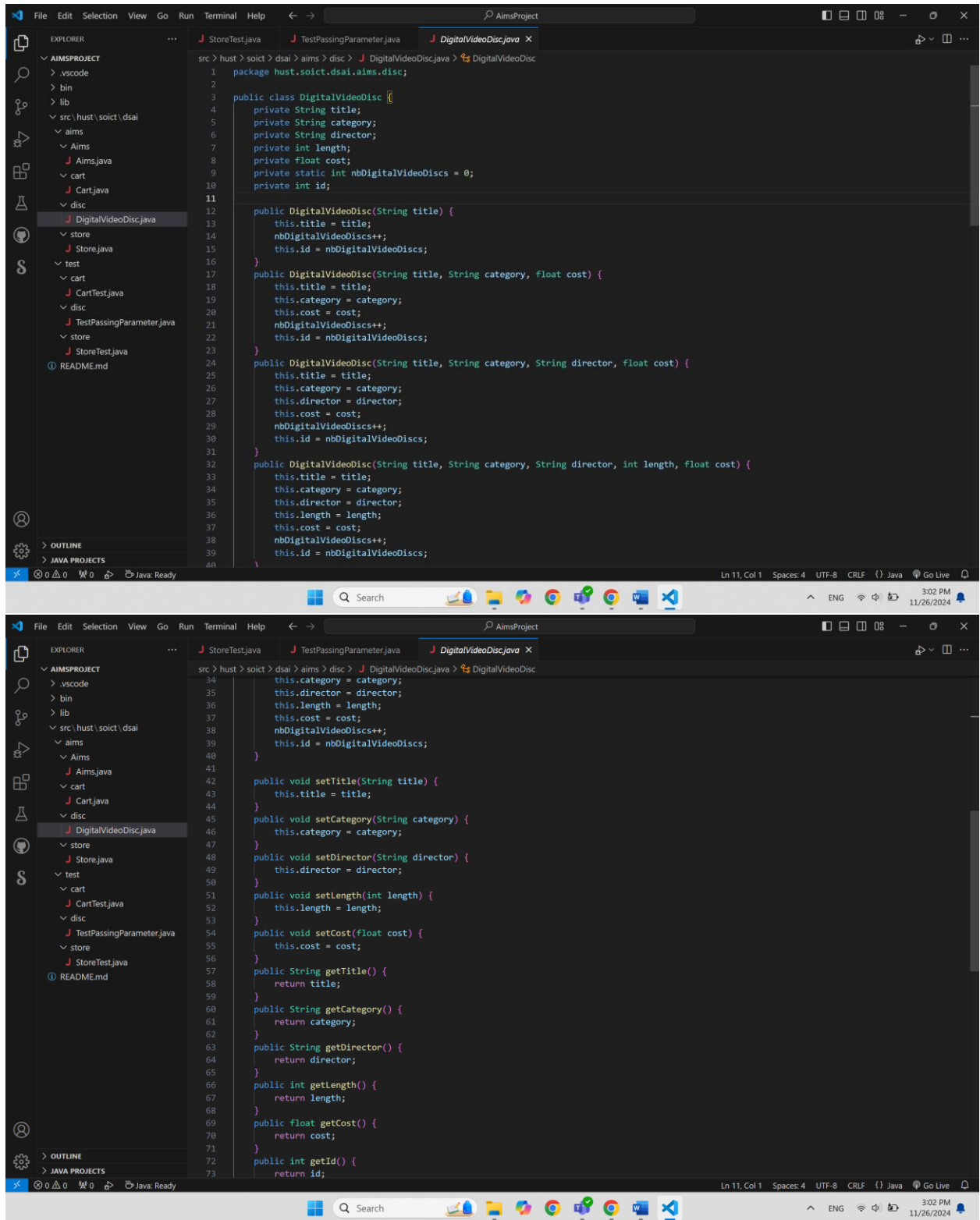
```
public static void swap(Object o1, Object o2) {
    Object tmp = o1;
    o1 = o2;
    o2 = tmp;
}
```

The left sidebar shows the `VARIABLES` pane with the following variables:

- `o1 = DigitalVideoDisc@11`: category = null, cost = 0.000000, director = null, id = 2, length = 0, title = "Cinderella"
- `o2 = DigitalVideoDisc@10`: category = null, cost = 0.000000, director = null, id = 1, length = 0, title = "Jungle"
- `tmp = DigitalVideoDisc@1`: category = null, cost = 0.000000, director = null, id = 1, length = 0, title = "Jungle"

The bottom status bar indicates the file is at line 39, column 1, with 4 spaces, UTF-8 encoding, and CRLF line endings. The Java version is 21.0.4.7-hotspot.

4) Classifier Member and Instance Member



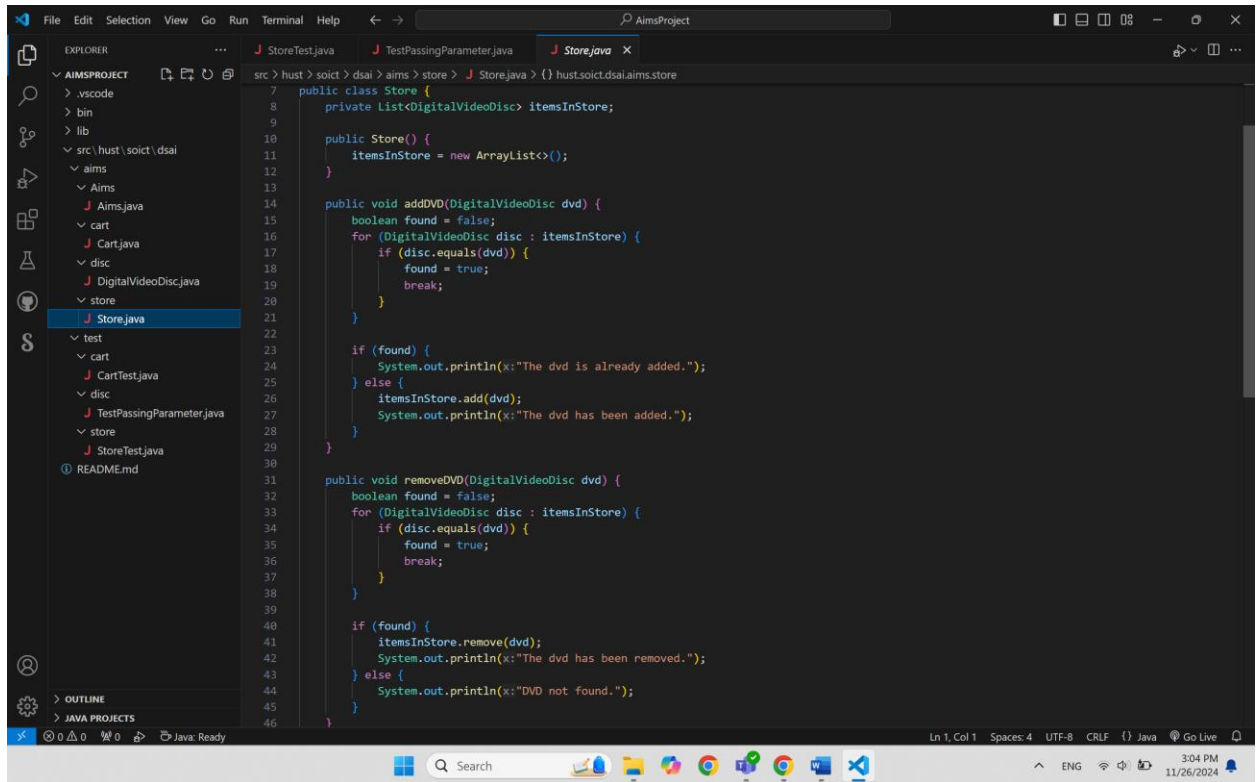
```
1 package hust.soict.dsai.aims.disc;
2
3 public class DigitalVideoDisc {
4     private String title;
5     private String category;
6     private String director;
7     private int length;
8     private float cost;
9     private static int nbDigitalVideoDiscs = 0;
10    private int id;
11
12    public DigitalVideoDisc(String title) {
13        this.title = title;
14        nbDigitalVideoDiscs++;
15        this.id = nbDigitalVideoDiscs;
16    }
17    public DigitalVideoDisc(String title, String category, float cost) {
18        this.title = title;
19        this.category = category;
20        this.cost = cost;
21        nbDigitalVideoDiscs++;
22        this.id = nbDigitalVideoDiscs;
23    }
24    public DigitalVideoDisc(String title, String category, String director, float cost) {
25        this.title = title;
26        this.category = category;
27        this.director = director;
28        this.cost = cost;
29        nbDigitalVideoDiscs++;
30        this.id = nbDigitalVideoDiscs;
31    }
32    public DigitalVideoDisc(String title, String category, String director, int length, float cost) {
33        this.title = title;
34        this.category = category;
35        this.director = director;
36        this.length = length;
37        this.cost = cost;
38        nbDigitalVideoDiscs++;
39        this.id = nbDigitalVideoDiscs;
40    }
41
42    public void setTitle(String title) {
43        this.title = title;
44    }
45    public void setCategory(String category) {
46        this.category = category;
47    }
48    public void setDirector(String director) {
49        this.director = director;
50    }
51    public void setLength(int length) {
52        this.length = length;
53    }
54    public void setCost(float cost) {
55        this.cost = cost;
56    }
57    public String getTitle() {
58        return title;
59    }
60    public String getCategory() {
61        return category;
62    }
63    public String getDirector() {
64        return director;
65    }
66    public int getLength() {
67        return length;
68    }
69    public float getCost() {
70        return cost;
71    }
72    public int getId() {
73        return id;
74    }
75 }
```

5) Cart Class

```
File Edit Selection View Go Run Terminal Help
src > hust > soict > dsai > aims > cart > J Cart.java > {} hust:soict.dsai.aims.cart

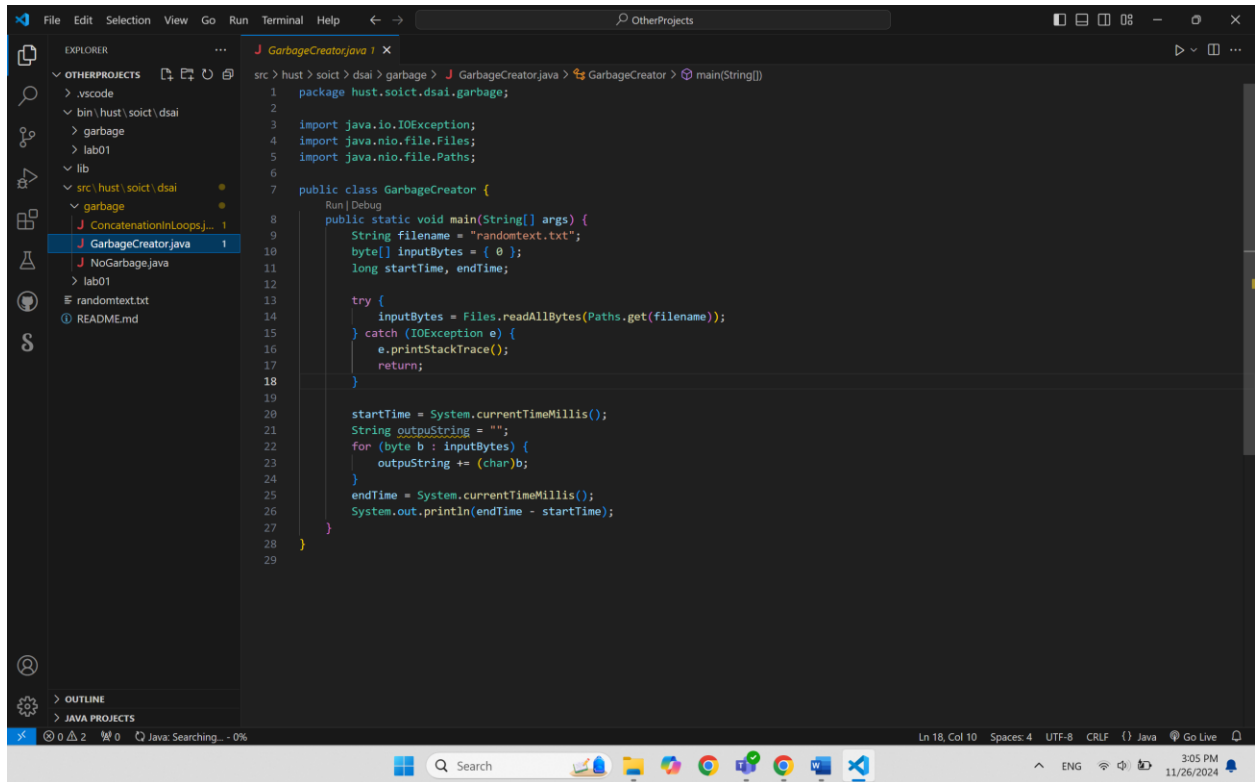
76 public void displayCart() {
77     System.out.println(x:"*****CART*****");
78     System.out.println(x:"Ordered Items:");
79     for (int i = 0; i < qtyOrdered; i++) {
80         System.out.println(String.valueOf(i+1) + ". DVD - " + itemsOrdered[i].toString());
81     }
82     System.out.println("Total cost: " + totalCost());
83     System.out.println(x:"*****");
84 }
85
86 public void searchDVD(int id) {
87     boolean found = false;
88     for (int i = 0; i < qtyOrdered; i++) {
89         if (itemsOrdered[i].getId() == id) {
90             found = true;
91             System.out.println(x:"Disc is found. Displaying information:");
92             System.out.println(itemsOrdered[i].toString());
93             break;
94         }
95     }
96
97     if (!found) {
98         System.out.println(x:"Disc not found.");
99     }
100 }
101
102 public void searchDVD(String title) {
103     boolean found = false;
104     for (int i = 0; i < qtyOrdered; i++) {
105         if (itemsOrdered[i].isMatch(title)) {
106             found = true;
107             System.out.println(x:"Disc is found. Displaying information:");
108             System.out.println(itemsOrdered[i].toString());
109             break;
110         }
111     }
112
113     if (!found) {
114         System.out.println(x:"Disc not found.");
115     }
116 }
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```


6) Store Class

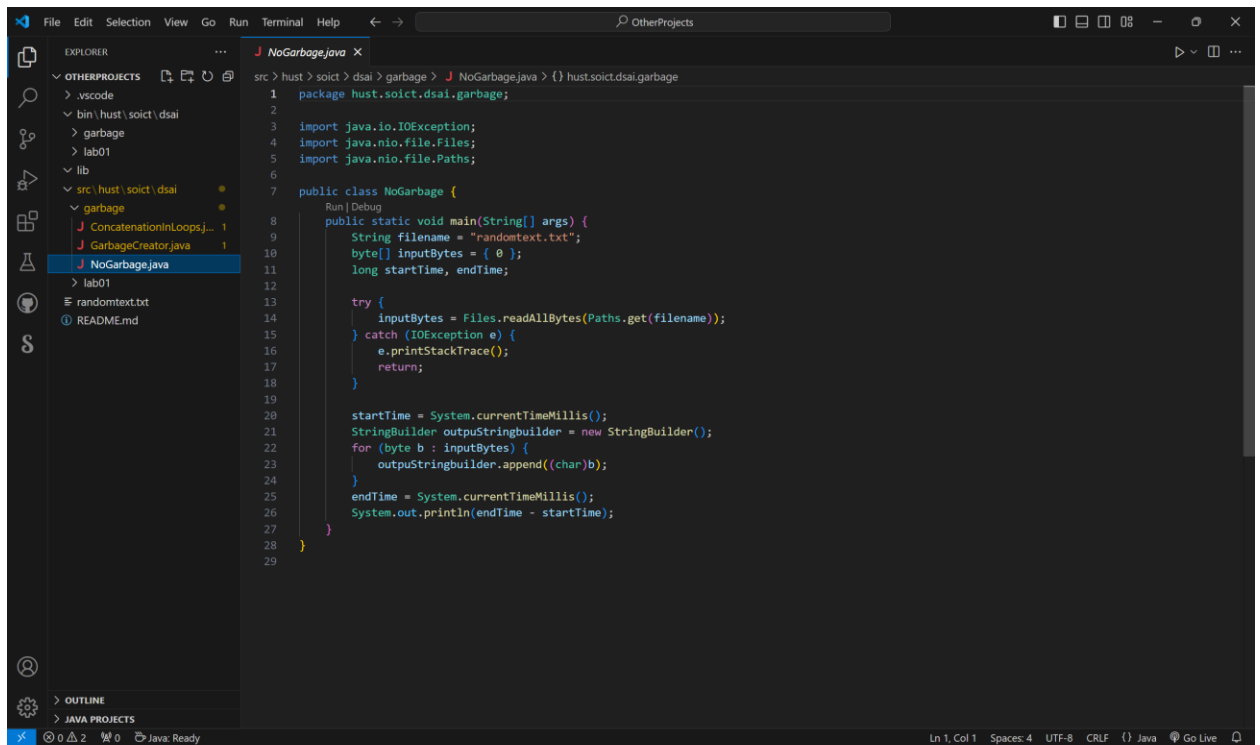


```
7 public class Store {
8     private List<DigitalVideoDisc> itemsInStore;
9
10    public Store() {
11        itemsInStore = new ArrayList<>();
12    }
13
14    public void addDVD(DigitalVideoDisc dvd) {
15        boolean found = false;
16        for (DigitalVideoDisc disc : itemsInStore) {
17            if (disc.equals(dvd)) {
18                found = true;
19                break;
20            }
21        }
22
23        if (found) {
24            System.out.println(x:"The dvd is already added.");
25        } else {
26            itemsInStore.add(dvd);
27            System.out.println(x:"The dvd has been added.");
28        }
29    }
30
31    public void removeDVD(DigitalVideoDisc dvd) {
32        boolean found = false;
33        for (DigitalVideoDisc disc : itemsInStore) {
34            if (disc.equals(dvd)) {
35                found = true;
36                break;
37            }
38        }
39
40        if (found) {
41            itemsInStore.remove(dvd);
42            System.out.println(x:"The dvd has been removed.");
43        } else {
44            System.out.println(x:"DVD not found.");
45        }
46    }
47 }
```

7) String, StringBuilder and StringBuffer



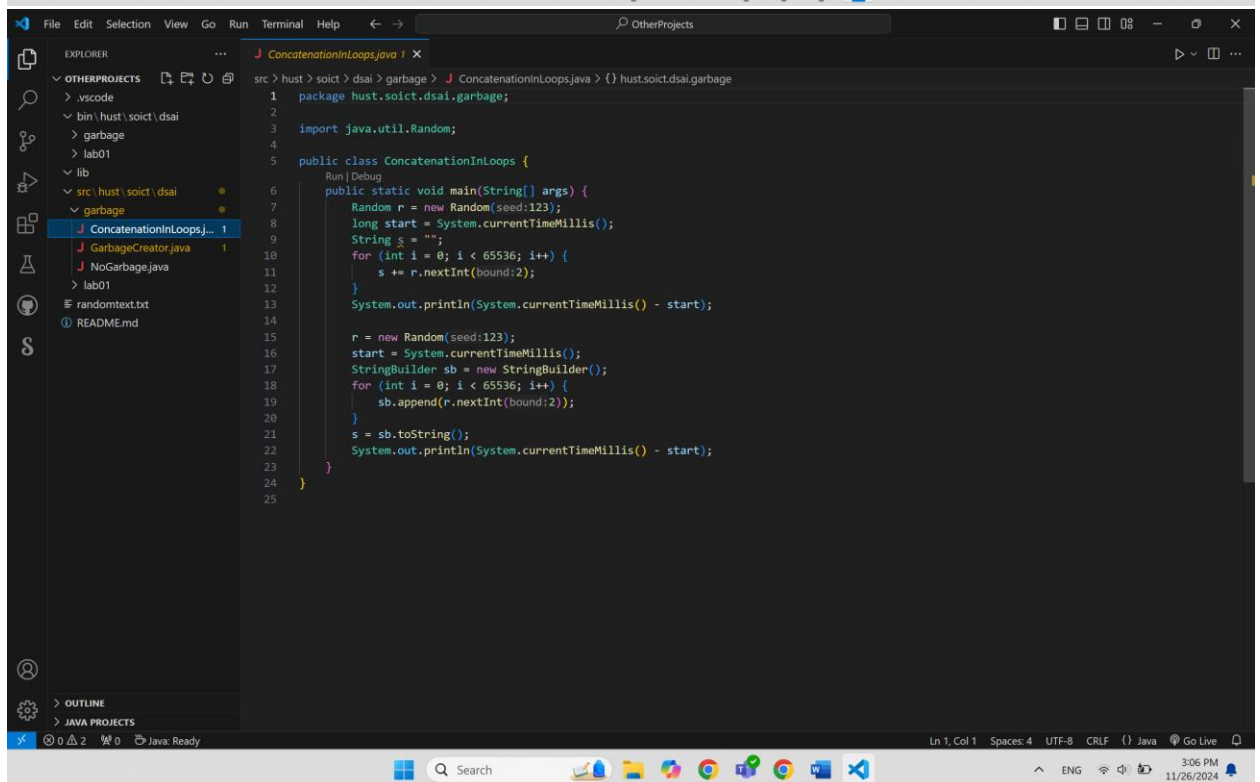
```
src > hust > soict > dsai > garbage > J GarbageCreator.java > GarbageCreator > main(String[])
1 package hust.soict.dsai.garbage;
2
3 import java.io.IOException;
4 import java.nio.file.Files;
5 import java.nio.file.Paths;
6
7 public class GarbageCreator {
8     public static void main(String[] args) {
9         String filename = "randomtext.txt";
10        byte[] inputBytes = { 0 };
11        long startTime, endTime;
12
13        try {
14            inputBytes = Files.readAllBytes(Paths.get(filename));
15        } catch (IOException e) {
16            e.printStackTrace();
17            return;
18        }
19
20        startTime = System.currentTimeMillis();
21        String outputString = "";
22        for (byte b : inputBytes) {
23            outputString += (char)b;
24        }
25        endTime = System.currentTimeMillis();
26        System.out.println(endTime - startTime);
27    }
28 }
29
```

The screenshot shows the Visual Studio Code editor with the file `NoGarbage.java` open. The Explorer sidebar on the left shows the project structure with folders `OTHERPROJECTS`, `bin`, `src`, `lab01`, and `lib`. The file `NoGarbage.java` is selected under `src\hust\soict\dsai\garbage`. The main editor displays the following Java code:

```
src > hust > soict > dsai > garbage > J NoGarbage.java > {} hust:soict.dsai.garbage
1 package hust.soict.dsai.garbage;
2
3 import java.io.IOException;
4 import java.nio.file.Files;
5 import java.nio.file.Paths;
6
7 public class NoGarbage {
8     Run | Debug
9     public static void main(String[] args) {
10         String filename = "randomtext.txt";
11         byte[] inputBytes = { 0 };
12         long startTime, endTime;
13
14         try {
15             inputBytes = Files.readAllBytes(Paths.get(filename));
16         } catch (IOException e) {
17             e.printStackTrace();
18             return;
19         }
20
21         startTime = System.currentTimeMillis();
22         StringBuilder outputStringBuilder = new StringBuilder();
23         for (byte b : inputBytes) {
24             outputStringBuilder.append((char)b);
25         }
26         endTime = System.currentTimeMillis();
27         System.out.println(endTime - startTime);
28     }
29 }
```

The status bar at the bottom indicates the cursor is at line 1, column 1, with 4 spaces, UTF-8 encoding, CRLF line endings, and the Java language. The system clock shows 3:05 PM on 11/26/2024.



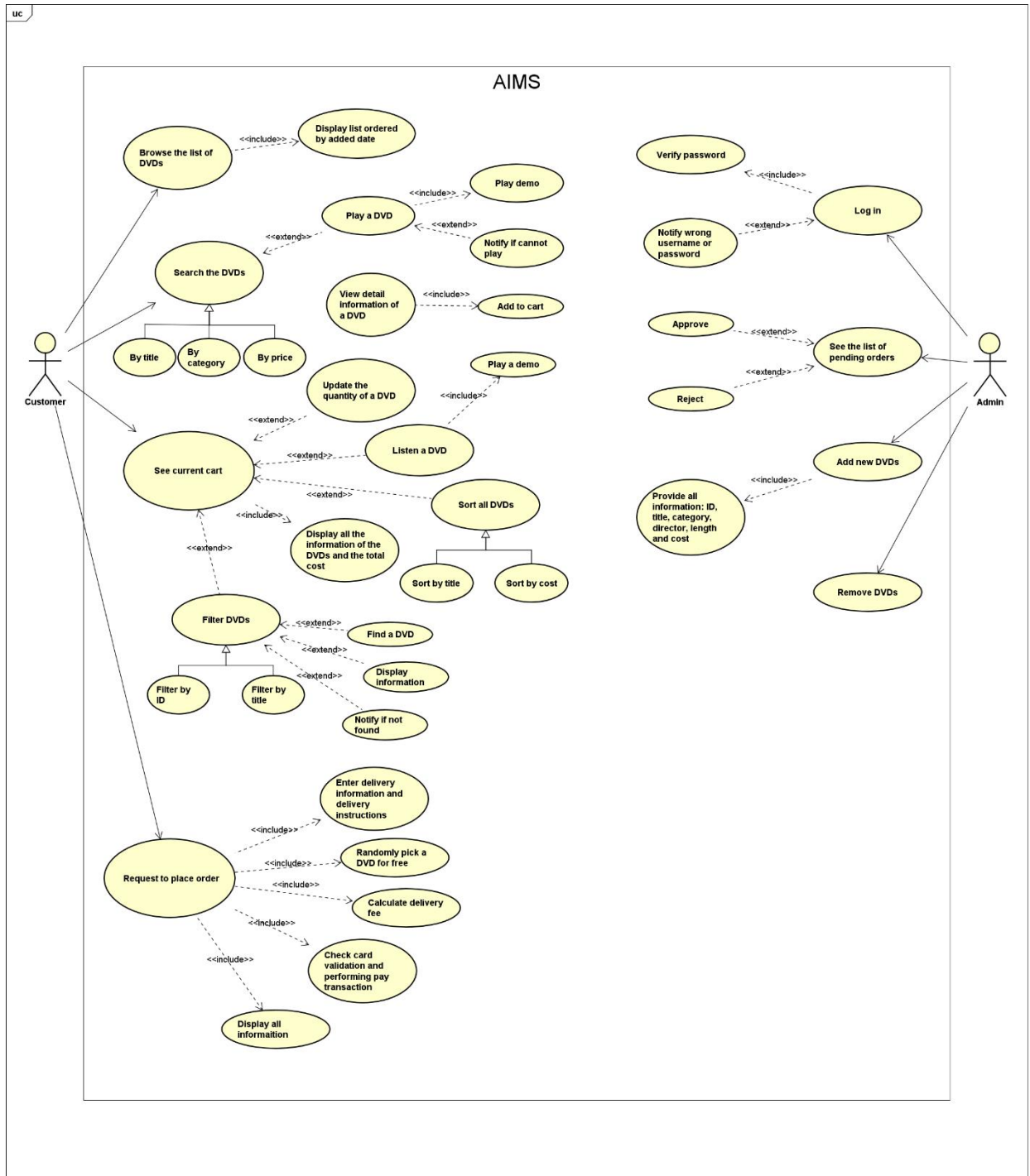
The screenshot shows the Visual Studio Code editor with the file `ConcatenationInLoops.java` open. The Explorer sidebar on the left shows the project structure with folders `OTHERPROJECTS`, `bin`, `src`, `lab01`, and `lib`. The file `ConcatenationInLoops.java` is selected under `src\hust\soict\dsai\garbage`. The main editor displays the following Java code:

```
src > hust > soict > dsai > garbage > J ConcatenationInLoops.java > {} hust:soict.dsai.garbage
1 package hust.soict.dsai.garbage;
2
3 import java.util.Random;
4
5 public class ConcatenationInLoops {
6     Run | Debug
7     public static void main(String[] args) {
8         Random r = new Random(seed:123);
9         long start = System.currentTimeMillis();
10         String s = "";
11         for (int i = 0; i < 65536; i++) {
12             s += r.nextInt(bound:2);
13         }
14         System.out.println(System.currentTimeMillis() - start);
15
16         r = new Random(seed:123);
17         start = System.currentTimeMillis();
18         StringBuilder sb = new StringBuilder();
19         for (int i = 0; i < 65536; i++) {
20             sb.append(r.nextInt(bound:2));
21         }
22         s = sb.toString();
23         System.out.println(System.currentTimeMillis() - start);
24     }
25 }
```

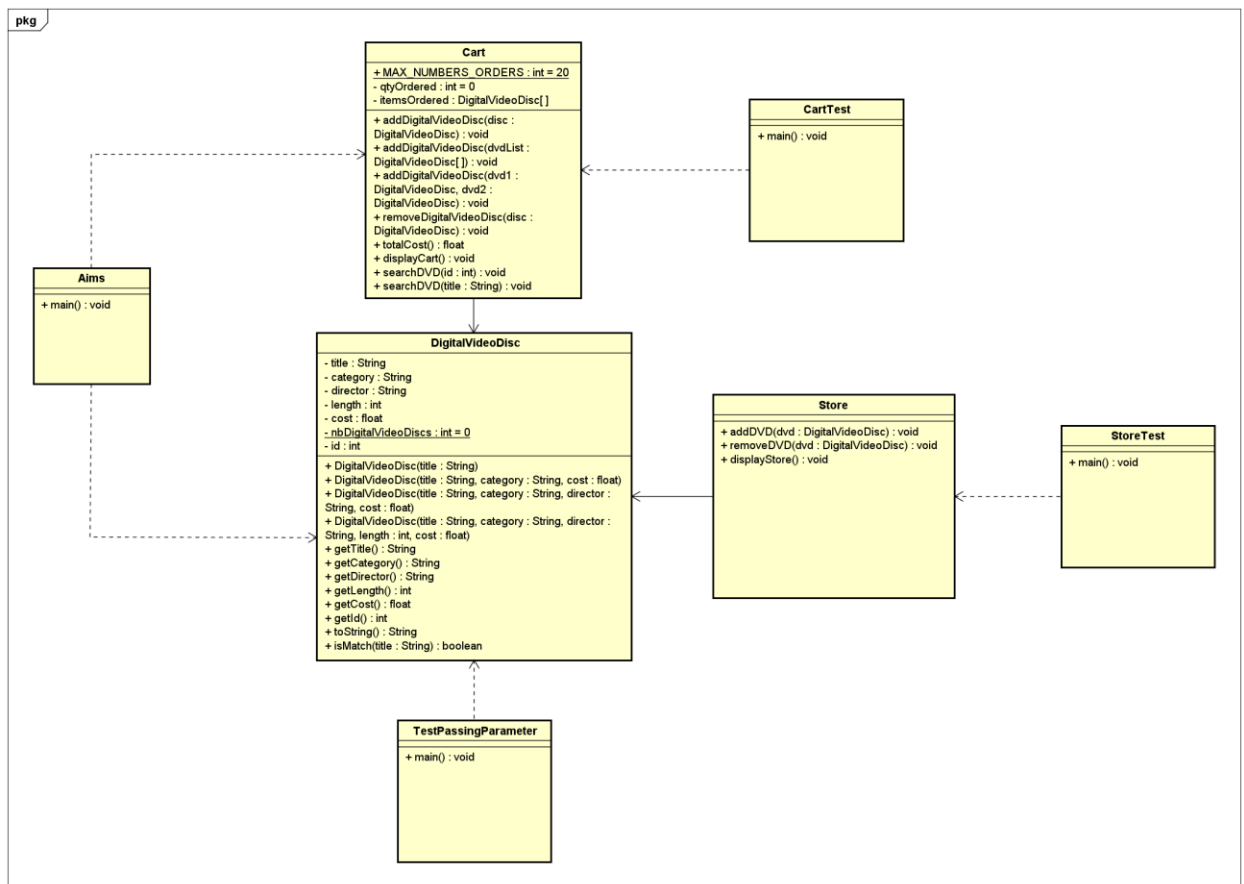
The status bar at the bottom indicates the cursor is at line 1, column 1, with 4 spaces, UTF-8 encoding, CRLF line endings, and the Java language. The system clock shows 3:05 PM on 11/26/2024.

II. Updated diagram

1) Use Case



2) Class diagram



III. Answer questions

- 1) After the call of **swap(jungleDVD, cinderellaDVD)** why does the title of these two objects still remain?
- 2) After the call of **changeTitle(jungleDVD, cinderellaDVD.getTitle())** why is the title of the JungleDVD changed?
- 3) **Is JAVA a Pass by Value or a Pass by Reference programming language?**

Java is a pass by value programming language, so after the call of **swap(jungleDVD, cinderellaDVD)**, this method only swaps the copies of the references, not the actual references, hence these two objects still remain. In the second method, the dvd parameter is a reference to the same DigitalVideoDisc object as jungle DVD, hence when you use method setTitle, it change the title of that actual object.

Conclusion, Java is a pass by value programming language.