Lab Title: Implementation of Constructors, Access Specifiers, and Exception Handling

Lab Number: Two '2'

1.1. Objective

- Understand the different types of constructors
- Understand the reference type and value type
- Use Access Specifiers to limit the scope of member attributes and methods
- Get familiar with Getter and Setters
- Exception Handling

2.2. Materials Used

- Text Editor
  - Visual Studio Code

2.3. Theory

- 2.3.1. Constructors:

```
In object-oriented programming, a constructor is a  special method that is
automatically called when an object of a class is created.

The name of a constructor must be the same as the name of the class to which
it belongs.

General syntax of constructor is:
    public class MyClass {
        // Constructor with the same name as the class
        public MyClass() {
            //this is default constructor
            // Constructor logic goes here
        }
        public MyClass(returnType variable1) {
            //this is parameterized constructor
            //Constructor logic goes here
        }

        public MyClass(MyClass ob) {
            //this is copy constructor
            //Constructor logic goes here
        }
        // Other methods and attributes can also be defined in the class
    }
```

- 2.3.2. Access Specifiers:

```
Access specifiers in Java are keywords used to define the visibility and
accessibility of classes, methods, and variables within a program.

There are four access specifiers in Java:
    1. Public Access Specifier
        - accessible from any other class.
    2. Private Access Specifier
        - only accessible within the same class.
    3. Protected Access Specifier
        - accessible within the same class, within the same package, and by
subclasses.

General Syntax on how to use access specifiers in Java Program:
    public class MyClass {
        access-specifier int Variable;

        access-specifier void Method() {
            // Method logic goes here
        }
    }
```

- 2.3.2. Exception Handling:

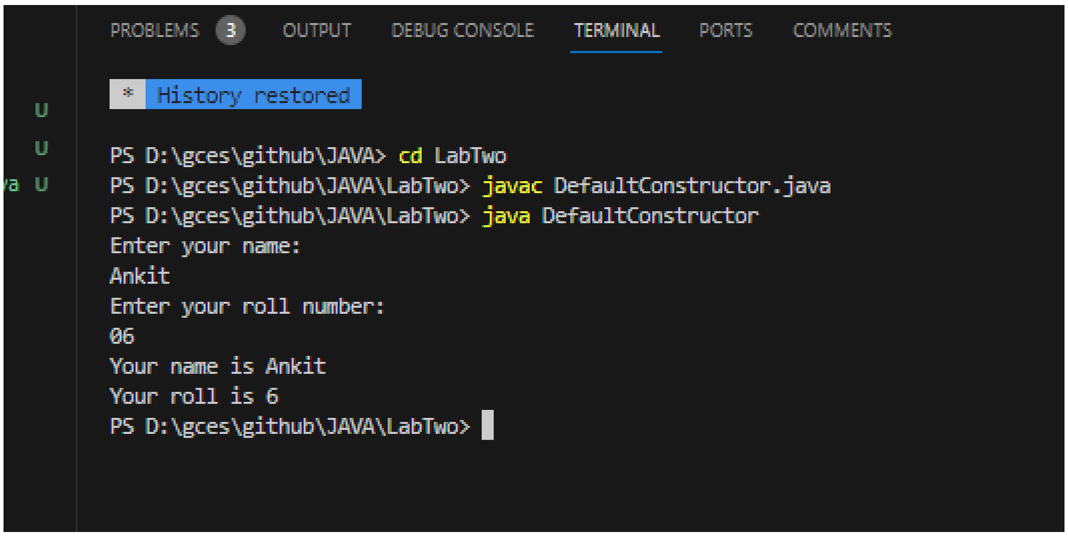
```
Exceptions represent abnormal situations that may arise due to various
reasons, such as runtime errors, unexpected inputs, or external factors.

Exception handling is a mechanism in Java that allows you to deal with
unexpected or exceptional situations that may arise during the execution of
a program.

In Java, exception handling is typically done using try, catch, finally
blocks.

NullPointerException, ArrayIndexOutOfBoundsException are some examples of
exceptions.

This is the general syntax of exception handling:
    try {
    // Code that might throw an exception
    } catch (ExceptionType e) {
        // Code to handle the exception
    } finally {
        // Code that always runs
    }
```

2.4. Programs:

2.4.1. Program1:

```
//purpose: to demonstrate that default constructor is created by compiler if no
constructors are explicitly defined.
//filename: DefaultConstructor.java

import java.util.Scanner;
class Student {
    private int roll;
    private String name;

    public void setData(int roll, String name) {
        this.roll = roll;
        this.name = name;
    }

    public int returnRoll() {
        return this.roll;
    }

    public String returnName() {
        return this.name;
    }
}

public class DefaultConstructor {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Enter your name:");
        String name = scanner.nextLine();
        System.out.println("Enter your roll number:");
        int roll = scanner.nextInt();
        scanner.close();
        Student std = new Student(); // Default Constructor called
        std.setData(roll, name);
        System.out.println("Your name is " + std.returnName());
        System.out.println("Your roll is " + std.returnRoll());
    }
}
```

Output:

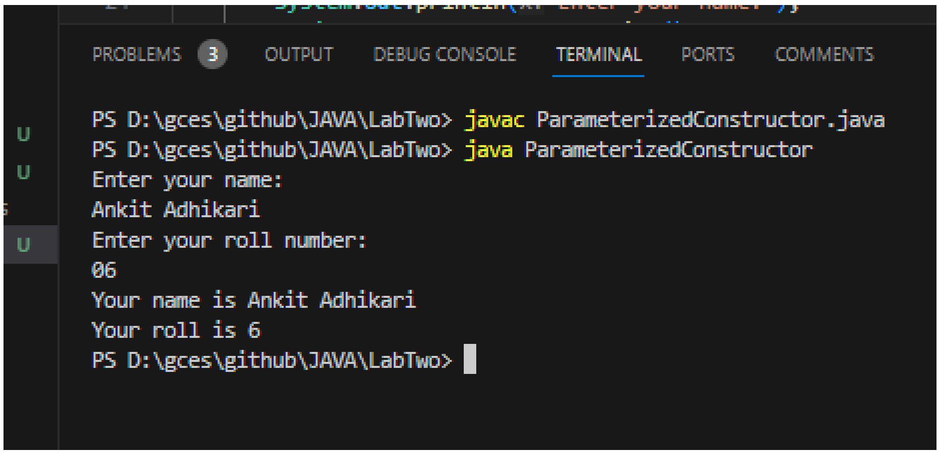


```
* History restored

PS D:\gces\github\JAVA> cd LabTwo
PS D:\gces\github\JAVA\LabTwo> javac DefaultConstructor.java
PS D:\gces\github\JAVA\LabTwo> java DefaultConstructor
Enter your name:
Ankit
Enter your roll number:
06
Your name is Ankit
Your roll is 6
PS D:\gces\github\JAVA\LabTwo>
```

2.4.2. Program2:

```
//FileName: ParameterizedConstructor.java

import java.util.Scanner;
class Students {
    private int roll;
    private String name;

    public Students(int roll, String name) {//body of parameterized constructor
        this.roll = roll;
        this.name = name;
    }

    public int returnRoll() {//function to return roll
        return this.roll;
    }

    public String returnName() {//function to return name
        return this.name;
    }
}


public class ParameterizedConstructor {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Enter your name:");
        String name = scanner.nextLine();
        System.out.println("Enter your roll number:");
        int roll = scanner.nextInt();
        scanner.close();
        Students std = new Students(roll, name); // Parameterized Constructor is
called No default constructor
        System.out.println("Your name is " + std.returnName());
        System.out.println("Your roll is " + std.returnRoll());
        }
    }
```

Output



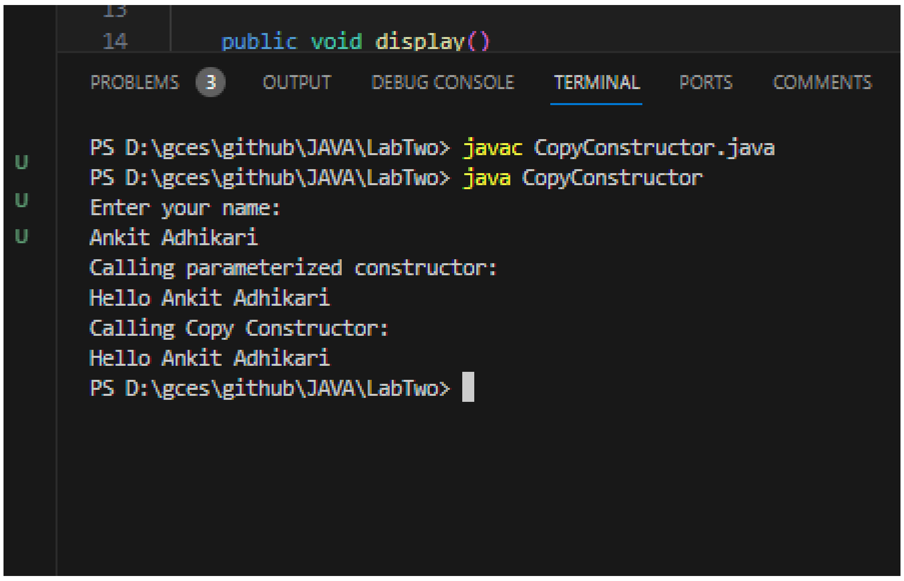
PROBLEMS 3 OUTPUT DEBUG CONSOLE TERMINAL PORTS COMMENTS

```
PS D:\gces\github\JAVA\LabTwo> javac ParameterizedConstructor.java
PS D:\gces\github\JAVA\LabTwo> java ParameterizedConstructor
Enter your name:
Ankit Adhikari
Enter your roll number:
06
Your name is Ankit Adhikari
Your roll is 6
PS D:\gces\github\JAVA\LabTwo>
```

2.4.3. Program 3:

```
//FileName: CopyConstructor.java

import java.util.Scanner;

public class CopyConstructor {
    public String name;

    public CopyConstructor(String name) {
        this.name = name;
    }

    public CopyConstructor(CopyConstructor ob1) {
        this.name = ob1.name;
    }

    public void display()
    {
        System.out.println("Hello " + name);
    }
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Enter your name: ");
        String name = scanner.nextLine();
        scanner.close();
        CopyConstructor ob = new CopyConstructor(name); //Parameterized
constructor
        CopyConstructor ob1 = new CopyConstructor(ob);  //Copy Constructor
        System.out.println("Calling parameterized constructor: ");
        ob.display();
        System.out.println("Calling Copy Constructor: ");
        ob1.display();
        return;
    }
}
```

Output:



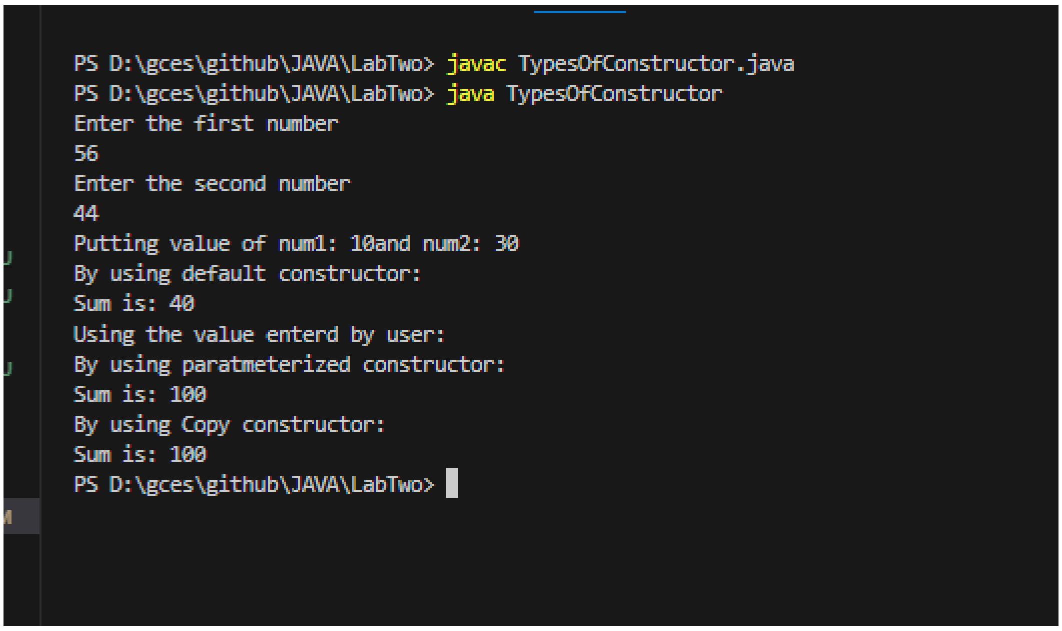
```
PS D:\gces\github\JAVA\LabTwo> javac CopyConstructor.java
PS D:\gces\github\JAVA\LabTwo> java CopyConstructor
Enter your name:
Ankit Adhikari
Calling parameterized constructor:
Hello Ankit Adhikari
Calling Copy Constructor:
Hello Ankit Adhikari
PS D:\gces\github\JAVA\LabTwo>
```

2.4.4. Program 4

```
//filename: TypesOfConstructor.java

import java.util.Scanner;

public class TypesOfConstructor {
    private int num1;
    private int num2;
    public TypesOfConstructor(int num1, int num2) {//Parameterized constructor
        this.num1 = num1;
        this.num2 = num2;
        System.out.println("Using the value enterd by user:");
    }

    public TypesOfConstructor() {//Default constructor
        num1 = 10;
        num2 = 30;
        System.out.println("Putting value of num1: "+num1+"and num2: "+num2);
    }
    public TypesOfConstructor(TypesOfConstructor ob) {//Copy constructor
        this.num1 = ob.num1;
        this.num2 = ob.num2;
    }

    public int returnSum() {// function to return sum
```

```
        return (num1 + num2 );
    }

    public static void main(String[] args) {
        System.out.println("Enter the first number");
        Scanner scanner = new Scanner(System.in);
        int num1 = scanner.nextInt();
        System.out.println("Enter the second number");
        int num2 = scanner.nextInt();
        TypesOfConstructor obj = new TypesOfConstructor(); // Default constructor
        System.out.println("By using default constructor: \nSum is: "+
obj.returnSum());
        TypesOfConstructor obj2 = new TypesOfConstructor(num1, num2);
//Parameteized Constructor
        System.out.println("By using paratmeterized constructor: \nSum is: "+
obj2.returnSum());
        TypesOfConstructor obj3 = new TypesOfConstructor(obj2); //Copy Constructor
        System.out.println("By using Copy constructor: \nSum is: "+
obj3.returnSum());
        scanner.close();
        return;
    }
}
```

- *Output:*



```
PS D:\gces\github\JAVA\LabTwo> javac TypesOfConstructor.java
PS D:\gces\github\JAVA\LabTwo> java TypesOfConstructor
Enter the first number
56
Enter the second number
44
Putting value of num1: 10and num2: 30
By using default constructor:
Sum is: 40
Using the value enterd by user:
By using paratmeterized constructor:
Sum is: 100
By using Copy constructor:
Sum is: 100
PS D:\gces\github\JAVA\LabTwo>
```

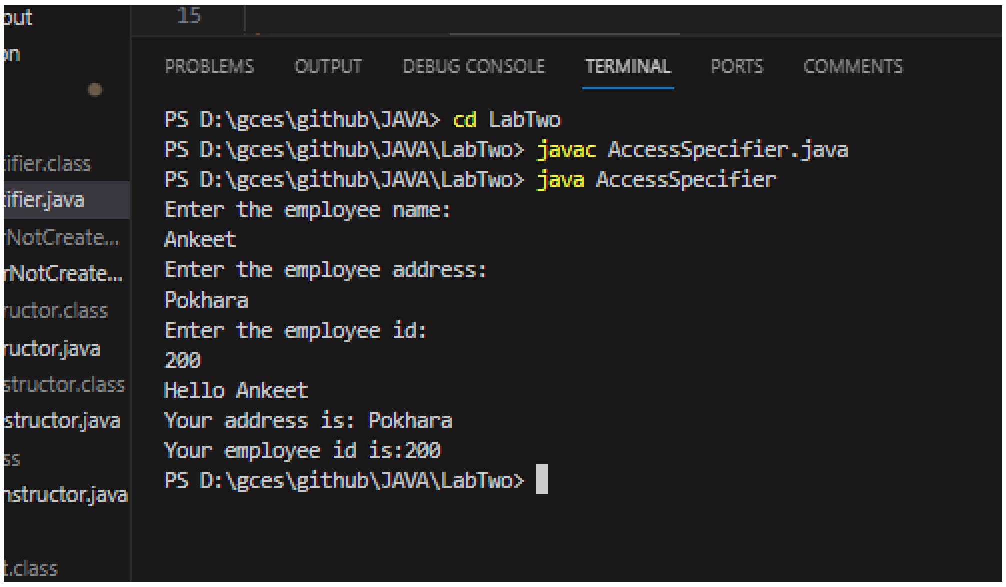
2.4.5. Program 5

```
//filename: AccessSpecifier.java

import java.util.Scanner;
```

```
public class AccessSpecifier {
    private int employeeId;//private data member that stores the employee id
    private String employeeName;//private data member that stores the employee
name
    private String employeeAddress;//private data member that stores the employee
address

    public void setEmployeeId(int employeeId) { // used public access specifier to
set employee id
        this.employeeId = employeeId;
    }

    public void setEmployeeName(String employeeName) {// used public access
specifier to set employee name
        this.employeeName = employeeName;
    }

    public void setEmployeeAddress(String employeeAddress) {// used public access
specifier to set employee address
        this.employeeAddress = employeeAddress;
    }

    public int returnsEmployeeId() {// used public access specifier to return the
private data member employee id
        return this.employeeId;
    }

    public String returnsEmployeeName() {// used public access specifier to return
the private data member employee name
        return this.employeeName;
    }

    public String returnsEmployeeAddress() {// used public access specifier to
return the private data member employee address
        return this.employeeAddress;
    }
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Enter the employee name:");
        String name = scanner.nextLine();
        System.out.println("Enter the employee address:");
        String address = scanner.nextLine();
        System.out.println("Enter the employee id:");
        int employeeId = scanner.nextInt();
        scanner.close();
        AccessSpecifier accessSpecifier = new AccessSpecifier();
        accessSpecifier.setEmployeeAddress(address);//set the address of employee
        accessSpecifier.setEmployeeId(employeeId);//set the employeeid of employee
        accessSpecifier.setEmployeeName(name);//set the name of employee
        System.out.println("Hello
"+accessSpecifier.returnsEmployeeName());//display name of employee
```

```
        System.out.println("Your address is:
"+accessSpecifier.returnsEmployeeAddress());//display address of employee
        System.out.println("Your employee id is:" +
accessSpecifier.returnsEmployeeId());//display employee id of employee
        return;
    }
}
```

- *Output*

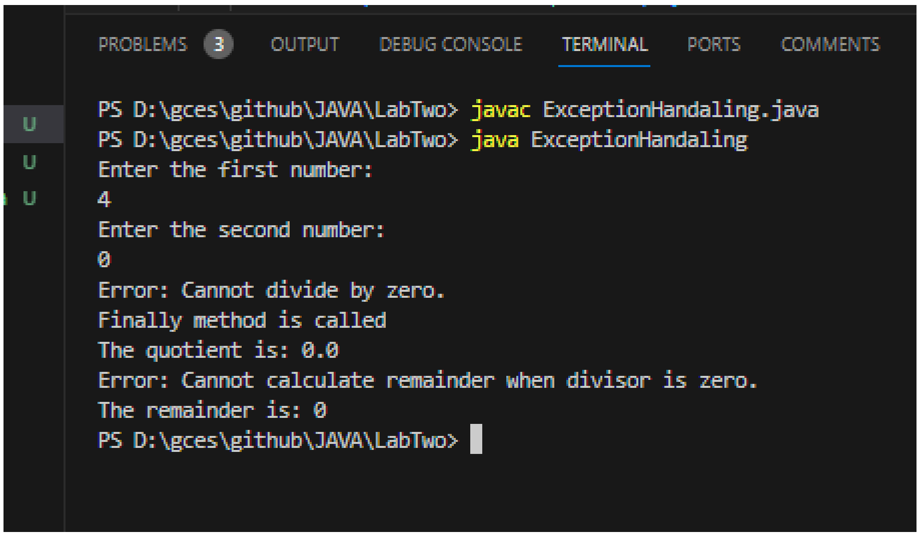


```
PS D:\gces\github\JAVA> cd LabTwo
PS D:\gces\github\JAVA\LabTwo> javac AccessSpecifier.java
PS D:\gces\github\JAVA\LabTwo> java AccessSpecifier
Enter the employee name:
Ankeet
Enter the employee address:
Pokhara
Enter the employee id:
200
Hello Ankeet
Your address is: Pokhara
Your employee id is:200
PS D:\gces\github\JAVA\LabTwo>
```

2.4.6. Program 6

```
//filename: ExceptionHandaling.java
import java.util.Scanner;

public class ExceptionHandaling {
    public static void main(String[] args) {
        int num1, num2;
        Scanner scanner = new Scanner(System.in);

        System.out.println("Enter the first number:");
        num1 = scanner.nextInt();

        System.out.println("Enter the second number:");
        num2 = scanner.nextInt();

        scanner.close();

        Divide divide = new Divide(num1, num2);

        System.out.println("The quotient is: " + divide.returnQuotient());
        System.out.println("The remainder is: " + divide.returnRemainder());
    }
}

class Divide {
    private int num1;
    private int num2;
    private float quotient;

    public Divide(int num1, int num2) {
        this.num1 = num1;
        this.num2 = num2;
    }

    public float returnQuotient() {
        try {
            if (num2 == 0) {
                System.out.println("Error: Cannot divide by zero.");
                return 0;
            }
            quotient = (float) num1 / num2;
        }
        catch (ArithmeticException e) {
            System.out.println("The error is: " + e);
        }
        finally {
            System.out.println("Finally method is called");
        }
        return quotient;
    }

    public int returnRemainder() {
        if (num2 == 0) {
            System.out.println("Error: Cannot calculate remainder when divisor is
zero.");
            return 0;
        }
        return num1 % num2;
    }
}
```

Output:



```
PS D:\gces\github\JAVA\LabTwo> javac ExceptionHandaling.java
PS D:\gces\github\JAVA\LabTwo> java ExceptionHandaling
Enter the first number:
4
Enter the second number:
0
Error: Cannot divide by zero.
Finally method is called
The quotient is: 0.0
Error: Cannot calculate remainder when divisor is zero.
The remainder is: 0
PS D:\gces\github\JAVA\LabTwo>
```

2.5. Conclusion:

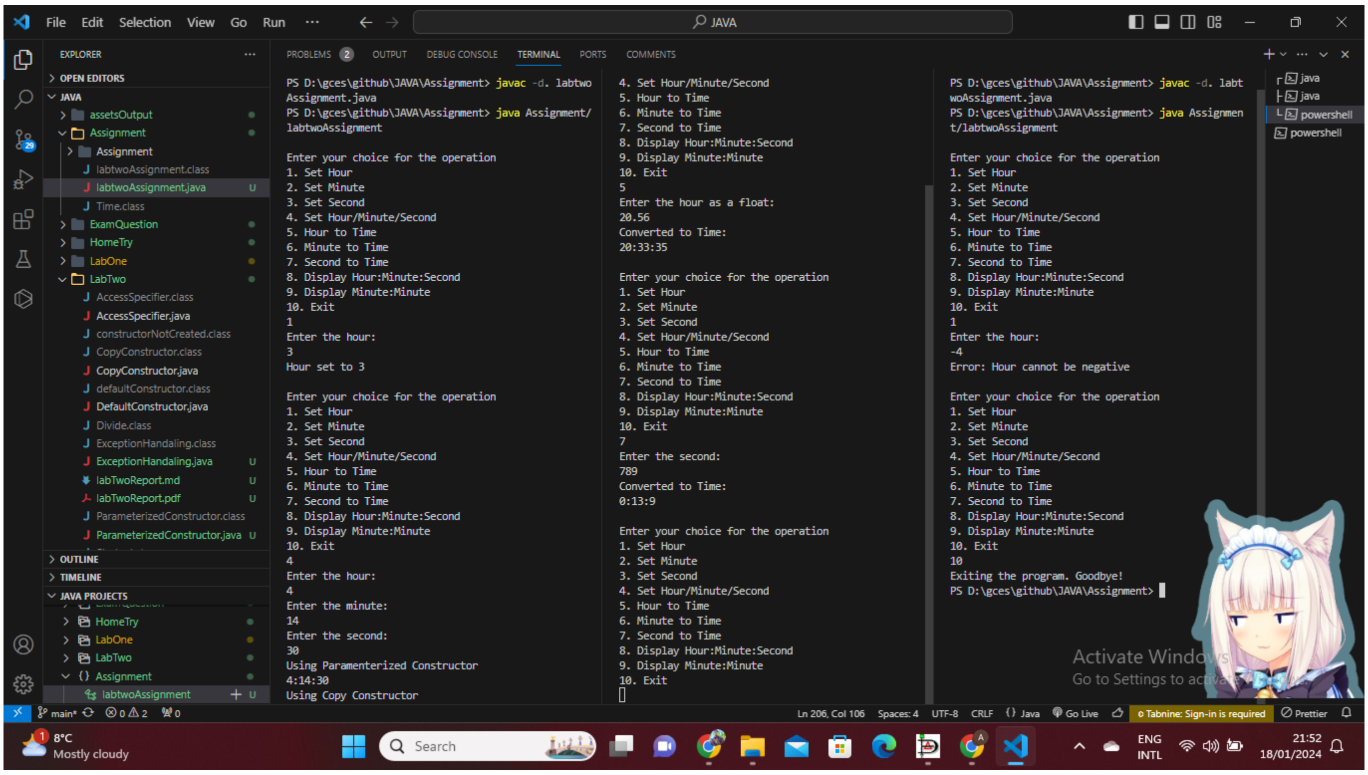
```
In conclusion,
The implementation of constructors establishes a systematic approach to object
initialization, ensuring a coherent state for instances.

Access specifiers, such as public and private, control the visibility of class
members, reinforcing encapsulation and code security. Collectively, these features
contribute to a more structured, reliable, and secure Java program.

Exception handling mechanisms, including try, catch, and finally, enhance the
program's resilience by managing unexpected runtime errors gracefully. The use of
custom exceptions adds specificity to error signaling and handling.
```

2.6.Assignment:

Code:

```
//filename: labtwoAssignment.java

package Assignment;

import java.util.Scanner;
class InvalidInputException extends Exception {
    public InvalidInputException(String message) {
        super("Error: " + message);
    }
}
class Time {
    private int hour, minute, second;
    private static int count;
    public Time() {
        hour = 0;
        minute = 0;
        second = 0;
        count += 1;
    }

    public Time(int hour, int minute, int second) {
        this.hour = hour;
        this.minute = minute;
        this.second = second;
    }

    public Time(Time ob) {
        this.hour = ob.hour;
        this.minute = ob.minute;
        this.second = ob.second;
    }

    public void hoursToTime(double hourFloat) {
        this.hour = (int) hourFloat % 24;
        double remainingMinutes = (hourFloat - this.hour) * 60;
        this.minute = (int) remainingMinutes % 60;
        double remainingSeconds = (remainingMinutes - this.minute) * 60;
        this.second = (int) remainingSeconds;
    }

    public void minuteToTime(double minute) {
        this.hour = (int) minute / 60;
        this.minute = (int) (minute - (this.hour * 60));
        double remaniningMinute = minute - (this.hour * 60 + this.minute);
        this.second = (int) (remaniningMinute * 60);
    }

    public void secondToTime(int second) {
        this.hour = second / 3600;
        int remainingSecondsAfterHours = second % 3600;

        this.minute = remainingSecondsAfterHours / 60;
        this.second = remainingSecondsAfterHours % 60;
    }

    public int getHour() {
        return (this.hour);
    }

    public int getMinute() {
        return (this.minute);
    }

    public int getSecond() {
        return (this.second);
    }

    public void setHour(double hour) throws InvalidInputException{
        if(hour < 0)
            throw new InvalidInputException("Hour cannot be negative");
        hoursToTime(hour);
    }

    public void setMinute(double minute) throws InvalidInputException {
        if(minute < 0)
            throw new InvalidInputException("Minute cannot be negative");
        minuteToTime(minute);
    }

    public void setSecond(int second) throws InvalidInputException{
        if(second < 0)
            throw new InvalidInputException("Second cannot be negative");
        secondToTime(second);
    }

    public int getCount() {
        return count;
    }

    public void display() {
        System.out.println(this.hour + ":" + this.minute + ":" + this.second);
    }
}

public class labtwoAssignment {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        Time time = new Time();

        int choice;
        do {
            System.out.println("\nEnter your choice for the operation");
            System.out.println(
                    "1. Set Hour\n2. Set Minute\n3. Set Second\n4. Set
Hour/Minute/Second\n5. Hour to Time\n6. Minute to Time\n7. Second to Time\n8.
Display Hour:Minute:Second\n9. Display Minute:Minute\n10. Exit");
            choice = scanner.nextInt();

            switch (choice) {
                case 1:
                    try {
                        System.out.println("Enter the hour:");
                        int hour = scanner.nextInt();
                        time.setHour(hour);
                        System.out.println("Hour set to " + hour);
                    }catch(InvalidInputException e) {
                        System.out.println(e.getMessage());
                    }
                    break;

                case 2:
                    try {
                        System.out.println("Enter the minute:");
                        int minute = scanner.nextInt();
                        time.setMinute(minute);
                        System.out.println("Minute set to " + minute);
                    } catch (InvalidInputException e) {
                        System.out.println(e.getMessage());
                    }
                    break;

                case 3:
                    try {
                        System.out.println("Enter the second:");
                        int second = scanner.nextInt();
                        time.setSecond(second);
                        System.out.println("Second set to " + second);
                    } catch (InvalidInputException e) {
                        System.out.println(e.getMessage());
                    }
                    break;

                case 4:
                    System.out.println("Enter the hour:");
                    int h = scanner.nextInt();
                    System.out.println("Enter the minute:");
                    int m = scanner.nextInt();
                    System.out.println("Enter the second:");
                    int s = scanner.nextInt();
                    System.out.println("Using Paramenterized Constructor");
                    Time ob2 = new Time(h,m,s);
                    ob2.display();
                    Time ob3 = new Time(ob2);
                    System.out.println("Using Copy Constructor");
                    ob3.display();
                    break;

                case 5:
                    System.out.println("Enter the hour as a float:");
                    double hourFloat = scanner.nextDouble();
                    time.hoursToTime(hourFloat);
                    System.out.println("Converted to Time: ");
                    time.display();
                    break;

                case 6:
                    System.out.println("Enter the minute as a float:");
                    double minuteFloat = scanner.nextDouble();
                    time.minuteToTime(minuteFloat);
                    System.out.println("Converted to Time: ");
                    time.display();
                    break;

                case 7:
                    System.out.println("Enter the second:");
                    int sec = scanner.nextInt();
                    time.secondToTime(sec);
                    System.out.println("Converted to Time: ");
                    time.display();
                    break;

                case 8:
                    System.out.println("Displaying Hour:Minute:Second");
                    time.display();
                    break;

                case 9:
                    System.out.println("Displaying Minute:Minute");
                    System.out.println(time.getMinute());
                    break;

                case 10:
                    System.out.println("Exiting the program. Goodbye!");
                    System.exit(0);
                    break;

                default:
                    System.out.println("Invalid choice. Please enter a valid
option.");
            }

        } while (choice != 0);

        System.out.println("Total instances: " + time.getCount());
        scanner.close();
    }
}


// getMessage() is a method which is defined in throwable class which is the base
class of all exceptions
```

Output:



```
PS D:\gces\github\JAVA\Assignment> javac -d. labtwo
Assignment.java
PS D:\gces\github\JAVA\Assignment> java Assignment/
labtwoAssignment

Enter your choice for the operation
1. Set Hour
2. Set Minute
3. Set Second
4. Set Hour/Minute/Second
5. Hour to Time
6. Minute to Time
7. Second to Time
8. Display Hour:Minute:Second
9. Display Minute:Minute
10. Exit
1
Enter the hour:
3
Hour set to 3

Enter your choice for the operation
1. Set Hour
2. Set Minute
3. Set Second
4. Set Hour/Minute/Second
5. Hour to Time
6. Minute to Time
7. Second to Time
8. Display Hour:Minute:Second
9. Display Minute:Minute
10. Exit
4
Enter the hour:
4
Enter the minute:
14
Enter the second:
30
Using Paramenterized Constructor
4:14:30
Using Copy Constructor
```

```
4. Set Hour/Minute/Second
5. Hour to Time
6. Minute to Time
7. Second to Time
8. Display Hour:Minute:Second
9. Display Minute:Minute
10. Exit
5
Enter the hour as a float:
20.56
Converted to Time:
20:33:35

Enter your choice for the operation
1. Set Hour
2. Set Minute
3. Set Second
4. Set Hour/Minute/Second
5. Hour to Time
6. Minute to Time
7. Second to Time
8. Display Hour:Minute:Second
9. Display Minute:Minute
10. Exit
7
Enter the second:
789
Converted to Time:
0:13:9

Enter your choice for the operation
1. Set Hour
2. Set Minute
3. Set Second
4. Set Hour/Minute/Second
5. Hour to Time
6. Minute to Time
7. Second to Time
8. Display Hour:Minute:Second
9. Display Minute:Minute
10. Exit
```

```
PS D:\gces\github\JAVA\Assignment> javac -d. labt
woAssignment.java
PS D:\gces\github\JAVA\Assignment> java Assignmen
t/labtwoAssignment

Enter your choice for the operation
1. Set Hour
2. Set Minute
3. Set Second
4. Set Hour/Minute/Second
5. Hour to Time
6. Minute to Time
7. Second to Time
8. Display Hour:Minute:Second
9. Display Minute:Minute
10. Exit
1
Enter the hour:
-4
Error: Hour cannot be negative

Enter your choice for the operation
1. Set Hour
2. Set Minute
3. Set Second
4. Set Hour/Minute/Second
5. Hour to Time
6. Minute to Time
7. Second to Time
8. Display Hour:Minute:Second
9. Display Minute:Minute
10. Exit
10
Exiting the program. Goodbye!
PS D:\gces\github\JAVA\Assignment>
```