Lab 01: Environment Setup and Java Basics

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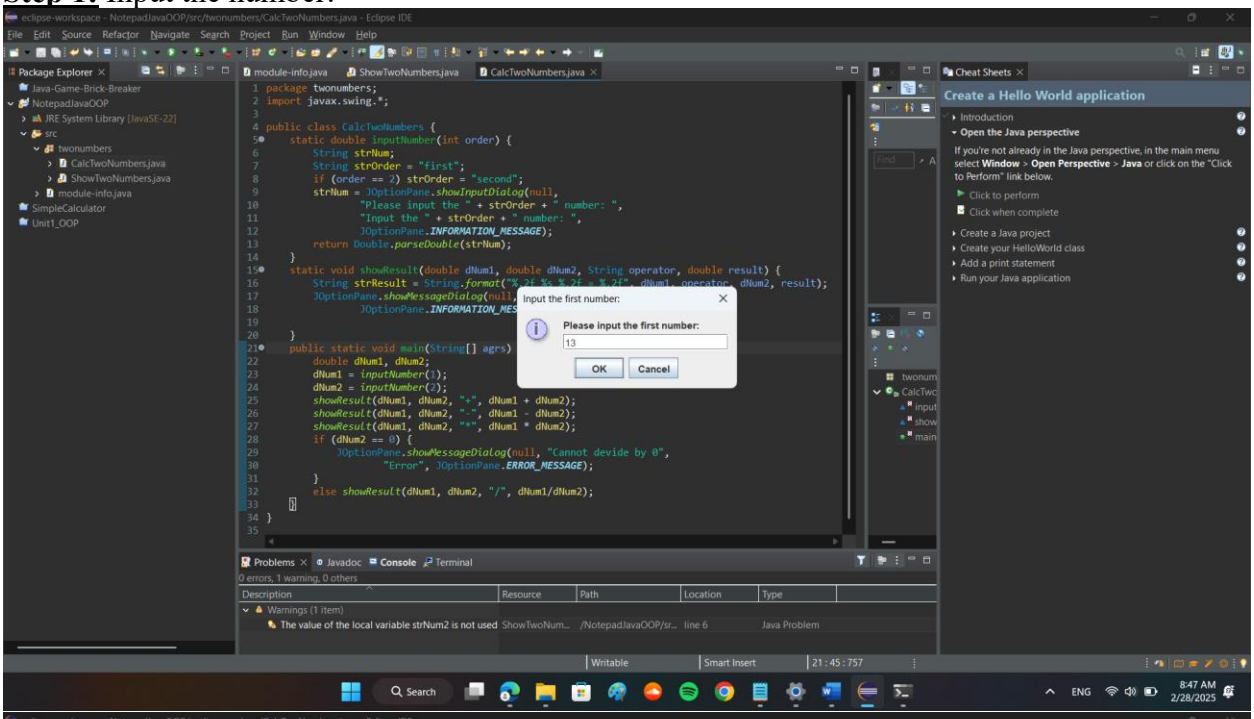
Assignment 2.2.5: **Write a program to calculate sum, difference, product, and quotient of 2 double numbers which are entered by users.**

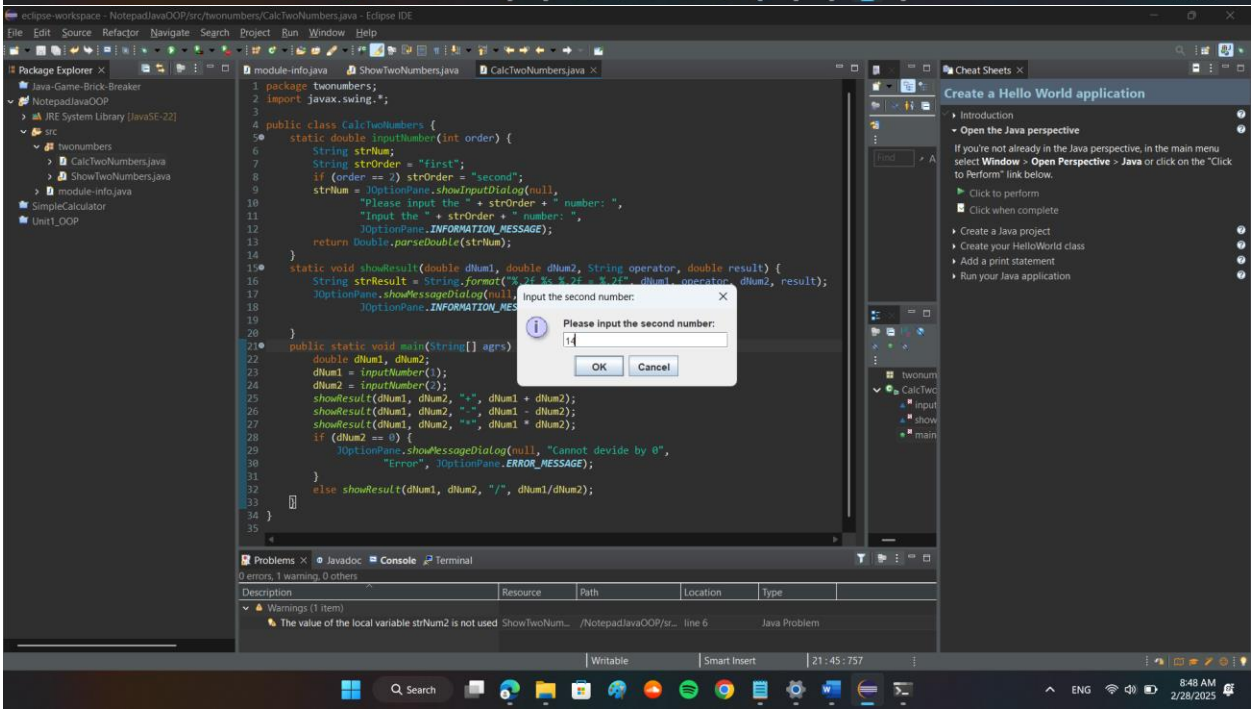
Source code:

```
package twonumbers;
import javax.swing.*;
public class CalcTwoNumbers {
	static double inputNumber(int order) {
		String strNum;
		String strOrder = "first";
		if (order == 2) strOrder = "second";
		strNum = JOptionPane.showInputDialog(null,
				"Please input the " + strOrder + " number: ",
				"Input the " + strOrder + "number: ",
				JOptionPane.INFORMATION_MESSAGE);
		return Double.parseDouble(strNum);
	}
	static void showResult(double dNum1, double dNum2, String operator, double result) {
		String strResult = String.format("%.2f %s %.2f = %.2f",
				dNum1, operator, dNum2, result);
		JOptionPane.showMessageDialog(null, strResult, "Result",
				JOptionPane.INFORMATION_MESSAGE);
	}
	public static void main(String[] agrs) {
		double dNum1, dNum2;
		dNum1 = inputNumber(1);
		dNum2 = inputNumber(2);
		showResult(dNum1, dNum2, "+", dNum1 + dNum2);
		showResult(dNum1, dNum2, "-", dNum1 - dNum2);
		showResult(dNum1, dNum2, "*", dNum1 * dNum2);
		if (dNum2 == 0) {
			JOptionPane.showMessageDialog(null, "Cannot devide by 0",
					"Error", JOptionPane.ERROR_MESSAGE);
		}
		else showResult(dNum1, dNum2, "/", dNum1/dNum2);
	}
}
```

Result:

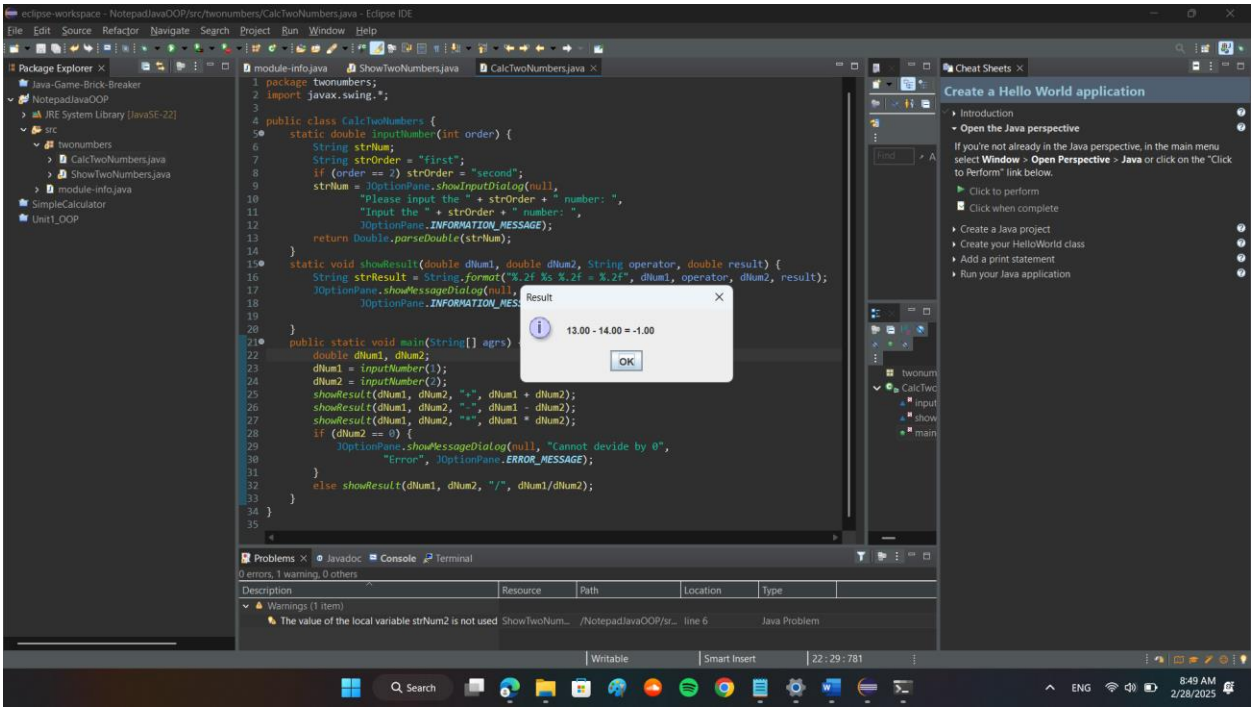
Step 1: Input the number:



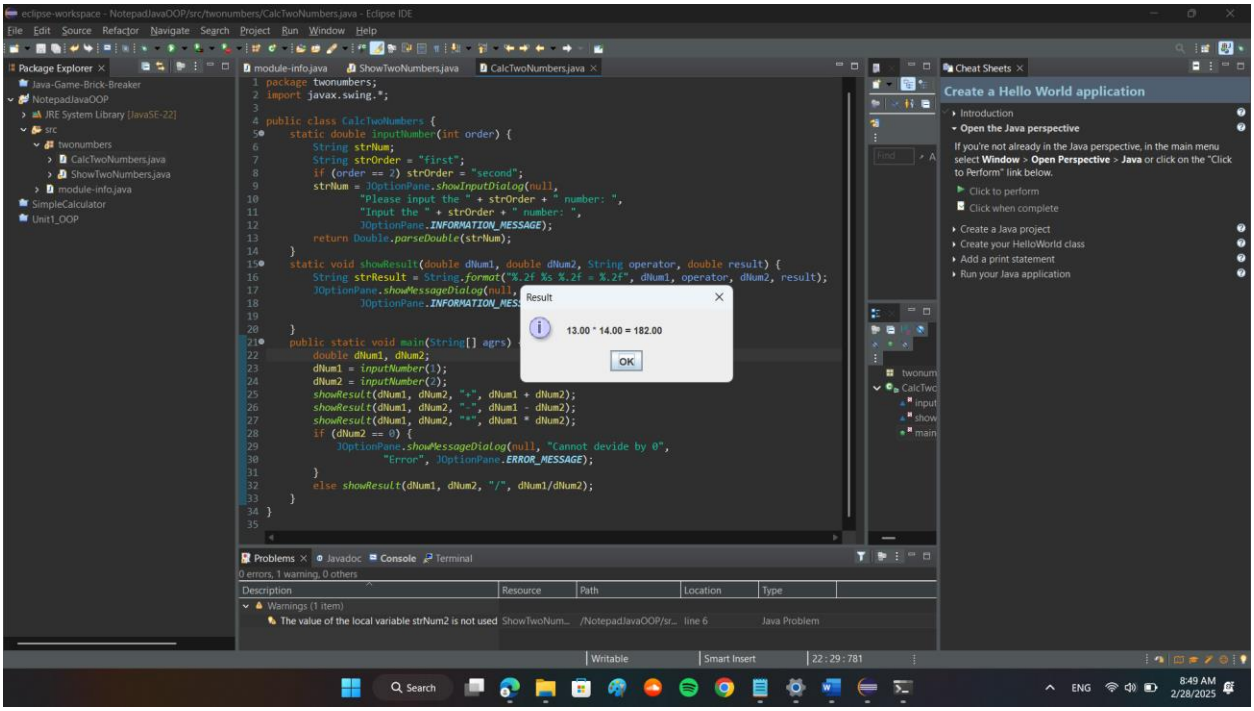


Step 2: Calculate and show the result

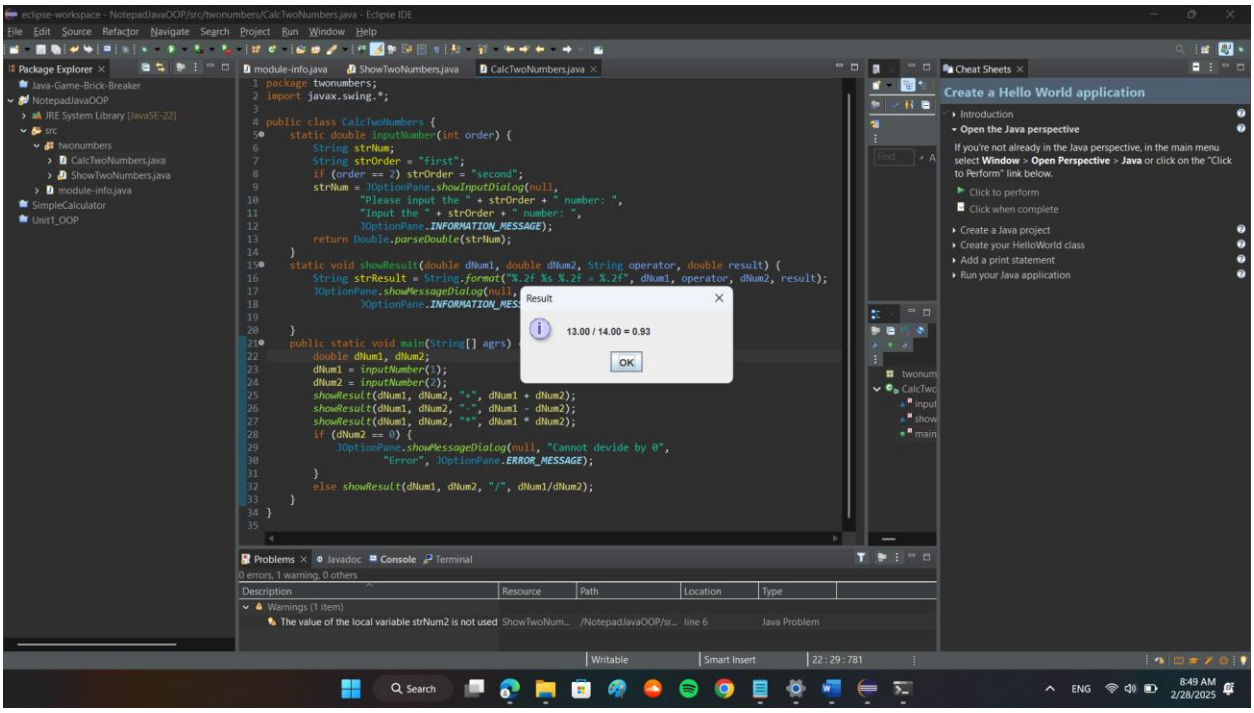
Sum:



Difference:

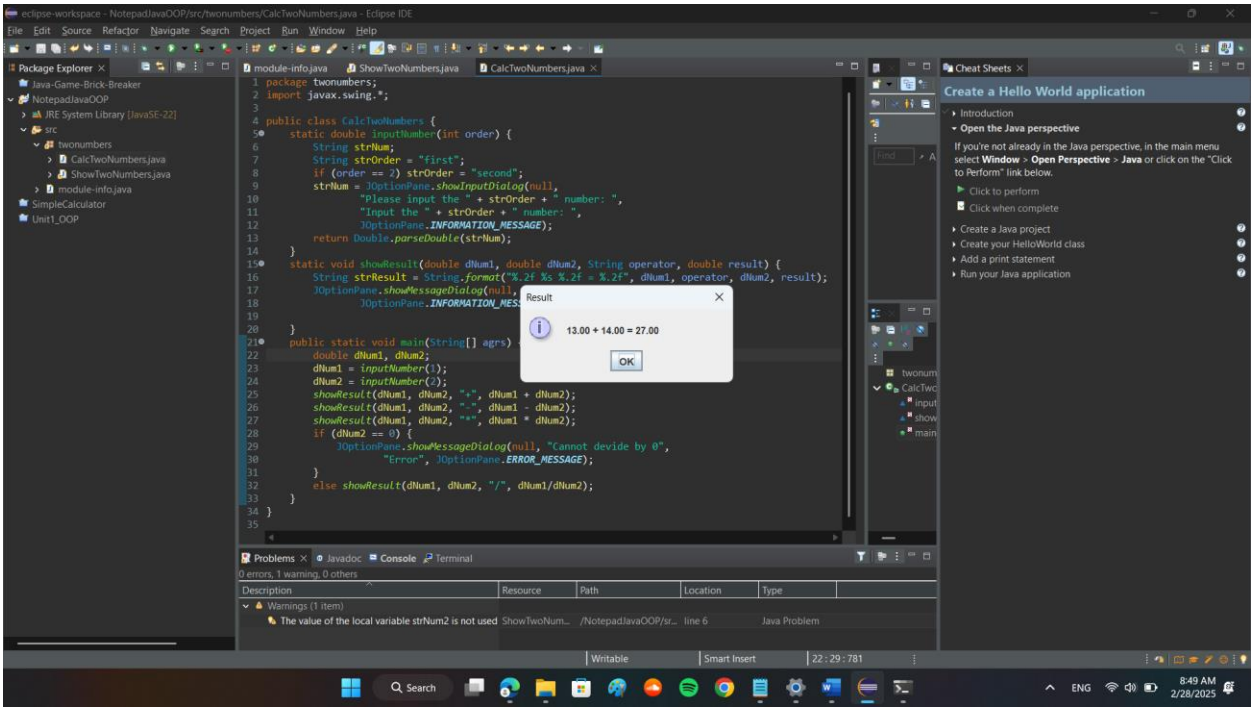


Product:

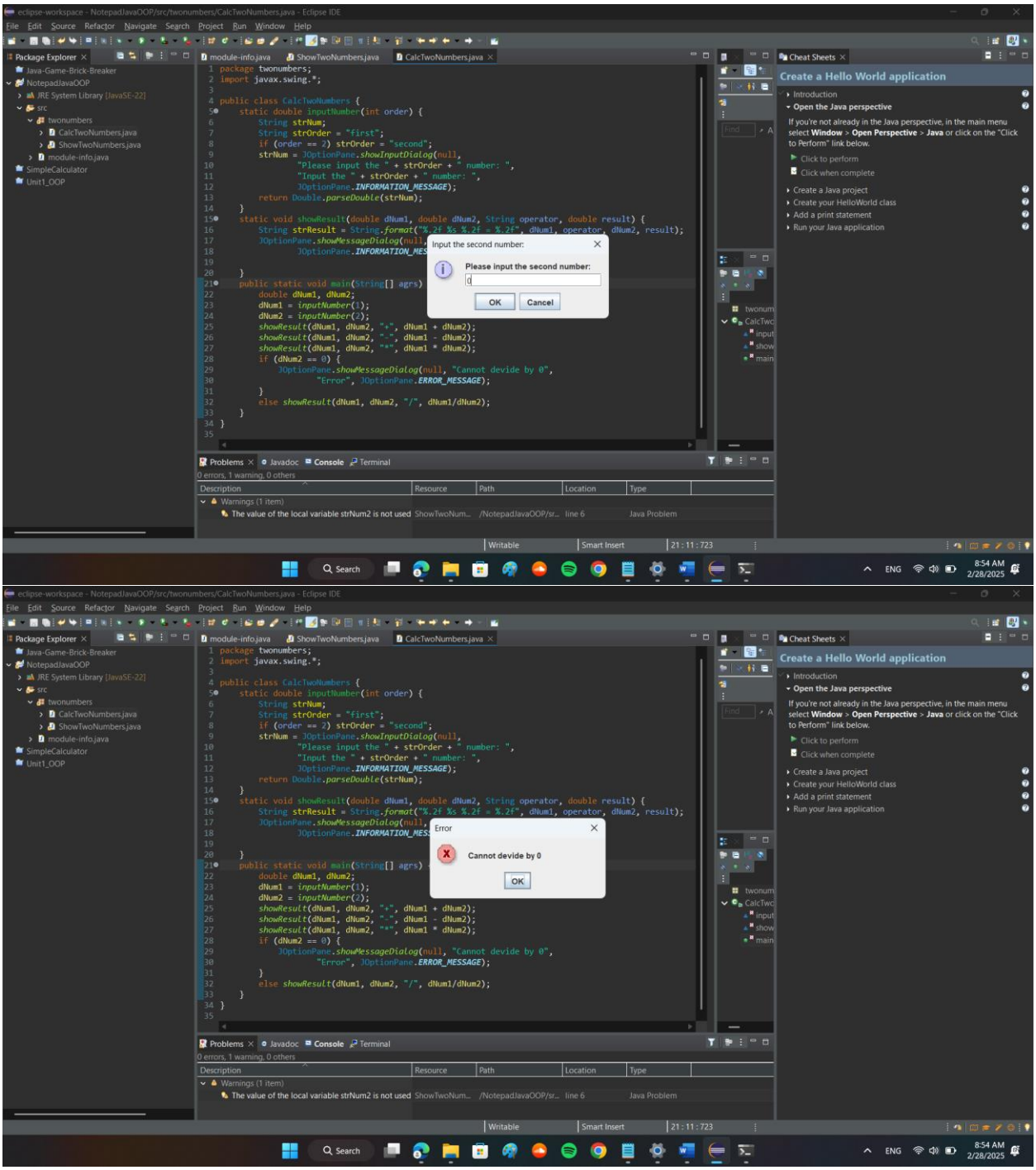


Division:

Test case #1: Divisor is not zero



Test case #2: Divisor is zero



Assignment 2.2.6: **Write a program to solve:**
- The first-degree equation (linear equation) with one variable
- The system of first-degree equations (linear system) with two variables
- The second-degree equation with one variable

Source code:

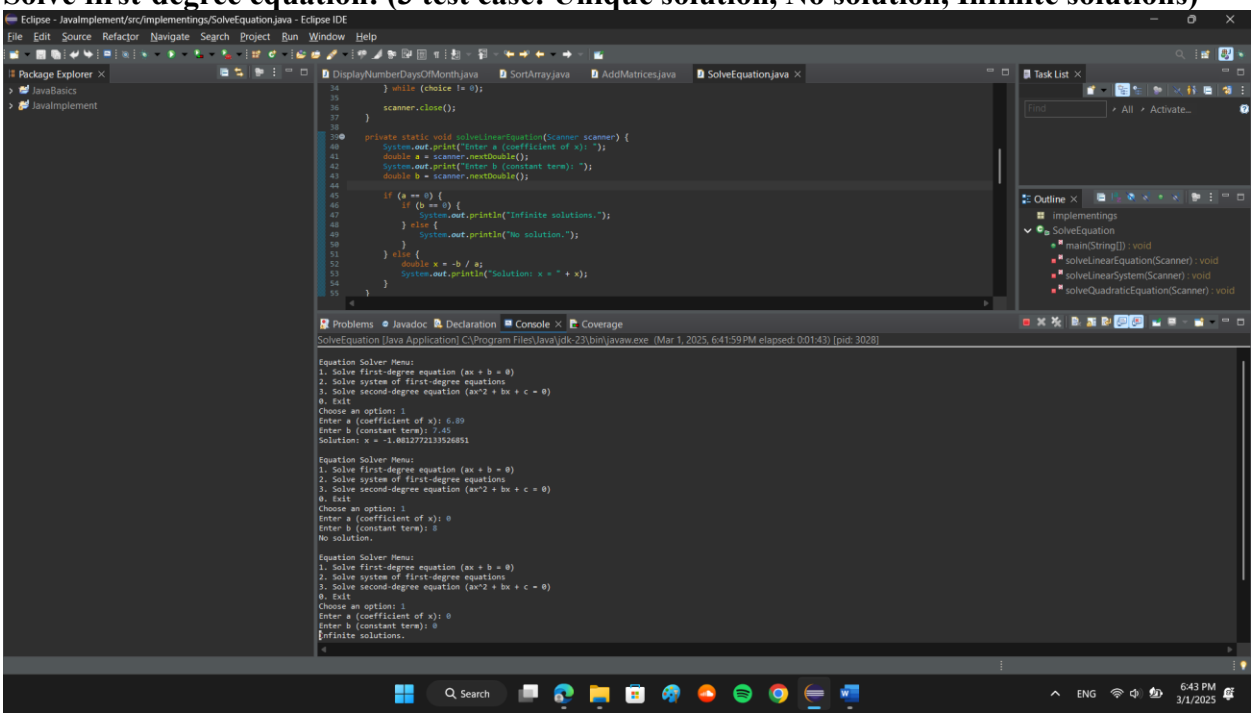
```
package implementings;

import java.util.*;

public class SolveEquation {
        public static void main(String[] args) {
      Scanner scanner = new Scanner(System.in);
      int choice;
      do {
         System.out.println("\nEquation Solver Menu:");
         System.out.println("1. Solve first-degree equation (ax + b = 0)");
         System.out.println("2. Solve system of first-degree equations");
         System.out.println("3. Solve second-degree equation (ax^2 + bx + c = 0)");
         System.out.println("0. Exit");
         System.out.print("Choose an option: ");
         choice = scanner.nextInt();

         switch (choice) {
            case 1:
               solveLinearEquation(scanner);
               break;
            case 2:
               solveLinearSystem(scanner);
               break;
            case 3:
               solveQuadraticEquation(scanner);
               break;
            case 0:
               System.out.println("Exit!");
               break;
            default:
               System.out.println("Invalid option! Try again.");
         }
      } while (choice != 0);

      scanner.close();
   }
```

```
private static void solveLinearEquation(Scanner scanner) {
    System.out.print("Enter a (coefficient of x): ");
    double a = scanner.nextDouble();
    System.out.print("Enter b (constant term): ");
    double b = scanner.nextDouble();

    if (a == 0) {
        if (b == 0) {
            System.out.println("Infinite solutions.");
        } else {
            System.out.println("No solution.");
        }
    } else {
        double x = -b / a;
        System.out.println("Solution: x = " + x);
    }
}

private static void solveLinearSystem(Scanner scanner) {
    System.out.println("Enter coefficients for the system:");
    System.out.print("Enter a1: ");
    double a1 = scanner.nextDouble();
    System.out.print("Enter b1: ");
    double b1 = scanner.nextDouble();
    System.out.print("Enter c1: ");
    double c1 = scanner.nextDouble();
    System.out.print("Enter a2: ");
    double a2 = scanner.nextDouble();
    System.out.print("Enter b2: ");
    double b2 = scanner.nextDouble();
    System.out.print("Enter c2: ");
    double c2 = scanner.nextDouble();

    double D = a1 * b2 - a2 * b1;
    double Dx = c1 * b2 - c2 * b1;
    double Dy = a1 * c2 - a2 * c1;

    if (D == 0) {
        if (Dx == 0 && Dy == 0) {
            System.out.println("Infinite solutions.");
        } else {
            System.out.println("No solution.");
        }
    } else {
        double x = Dx / D;
        double y = Dy / D;
```

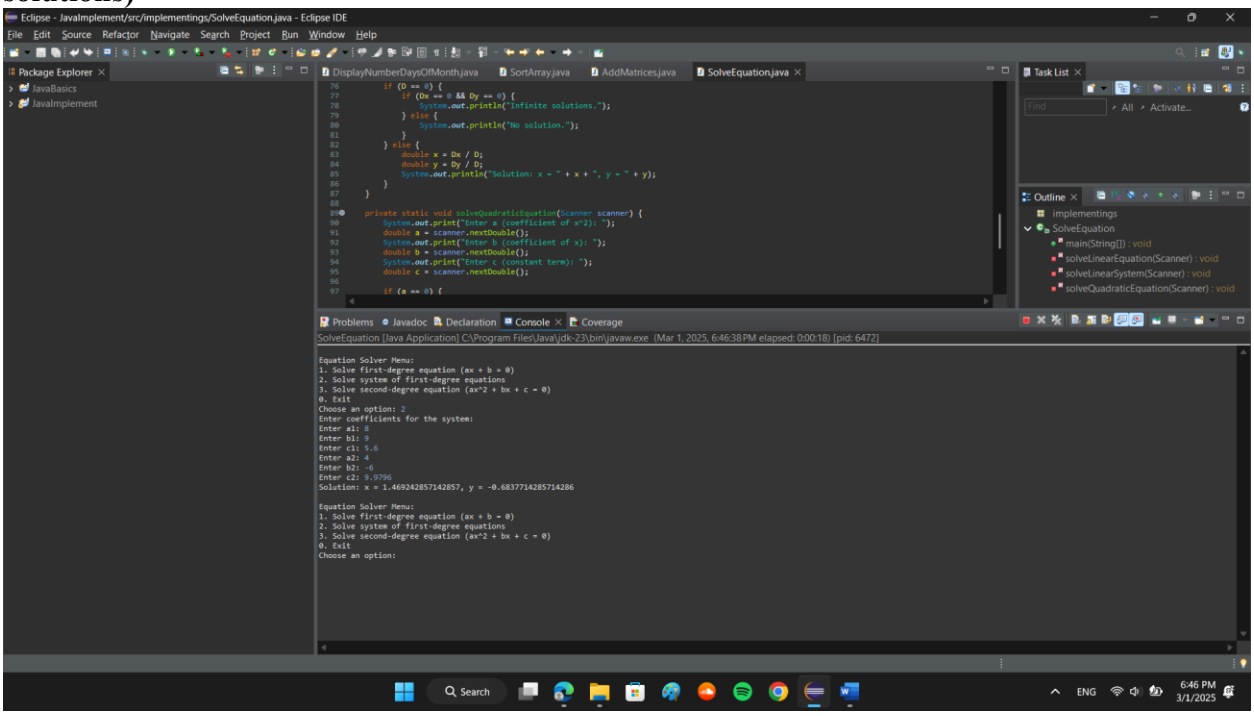
```
            System.out.println("Solution: x = " + x + ", y = " + y);
        }
    }

    private static void solveQuadraticEquation(Scanner scanner) {
        System.out.print("Enter a (coefficient of x^2): ");
        double a = scanner.nextDouble();
        System.out.print("Enter b (coefficient of x): ");
        double b = scanner.nextDouble();
        System.out.print("Enter c (constant term): ");
        double c = scanner.nextDouble();

        if (a == 0) {
            System.out.println("This is not a quadratic equation. Switching to linear equation...");
            solveLinearEquation(scanner);
            return;
        }

        double delta = b * b - 4 * a * c;

        if (delta > 0) {
            double x1 = (-b + Math.sqrt(delta)) / (2 * a);
            double x2 = (-b - Math.sqrt(delta)) / (2 * a);
            System.out.println("Two distinct solutions: x1 = " + x1 + ", x2 = " + x2);
        } else if (delta == 0) {
            double x = -b / (2 * a);
            System.out.println("Double root: x = " + x);
        } else {
            System.out.println("No real solution.");
        }
    }
}
```

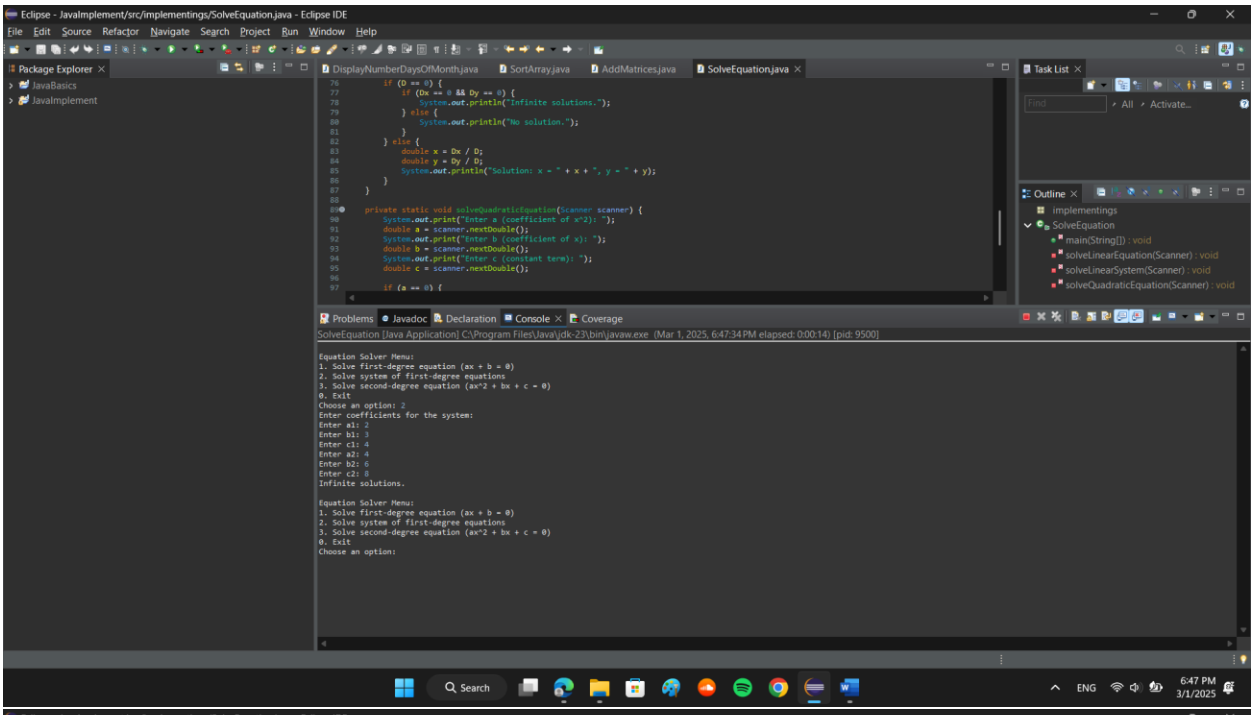
Result:

Solve first-degree equation: (3 test case: Unique solution, No solution, Infinite solutions)



Solve system of first-degree equations: (3 test case: Unique solution, No solution, Infinite solutions)

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Package Explorer
JavaBasics
JavaImplement
DisplayNumberDaysOfMonth.java
SortArray.java
AddMatrices.java
SolveEquation.java
Task List
Outline
implementings
SolveEquation
main(String[]) : void
solveLinearEquation(Scanner) : void
solveLinearSystem(Scanner) : void
solveQuadraticEquation(Scanner) : void
Problems Javadoc Declaration Console Coverage
SolveEquation [Java Application] C:\Program Files\Java\jdk-23\bin\javaw.exe (Mar 1, 2025, 6:47:34 PM elapsed: 0:00:14) [pid: 9500]
Equation Solver Menu:
1. Solve first-degree equation (ax + b = 0)
2. Solve system of first-degree equations
3. Solve second-degree equation (ax^2 + bx + c = 0)
0. Exit
Choose an option: 2
Enter coefficients for the system:
Enter a1: 2
Enter b1: 3
Enter c1: 4
Enter a2: 4
Enter b2: 6
Enter c2: 8
Infinite solutions.
Equation Solver Menu:
1. Solve first-degree equation (ax + b = 0)
2. Solve system of first-degree equations
3. Solve second-degree equation (ax^2 + bx + c = 0)
0. Exit
Choose an option:
Search
ENG
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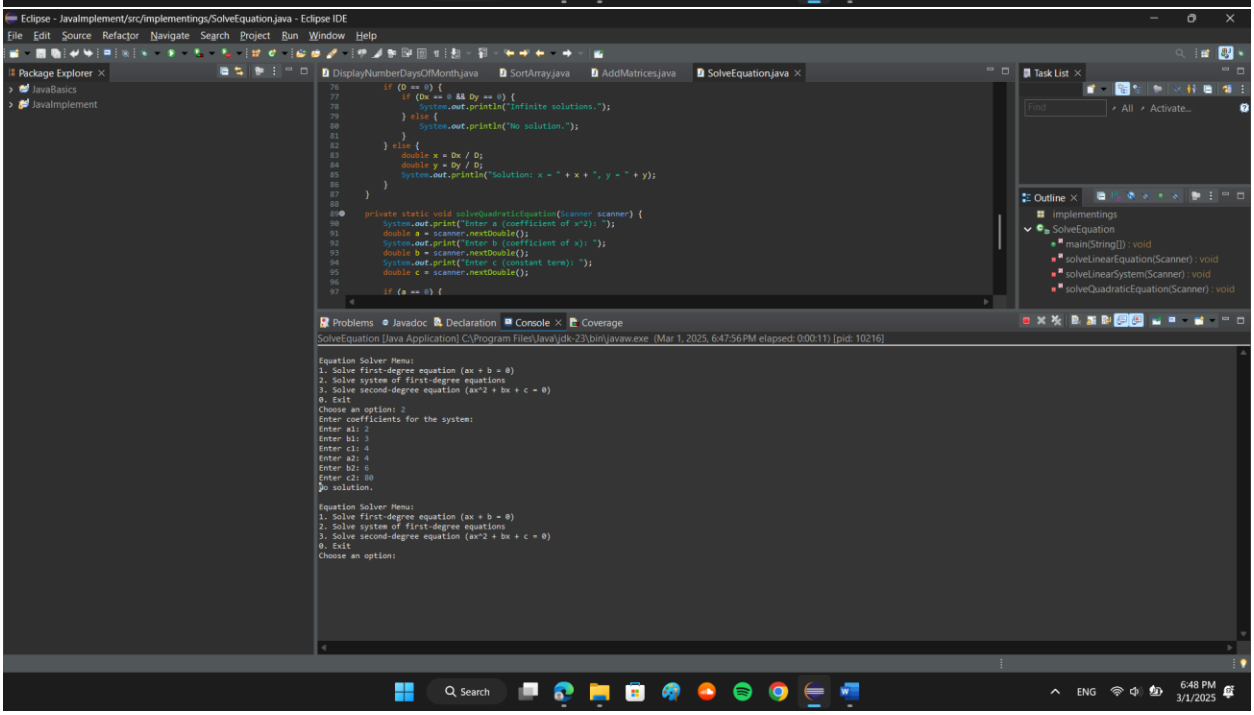
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File Edit Source Refactor Navigate Search Project Run Window Help
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DisplayNumberDaysOfMonth.java
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main(String[]) : void
solveLinearEquation(Scanner) : void
solveLinearSystem(Scanner) : void
solveQuadraticEquation(Scanner) : void
Problems Javadoc Declaration Console Coverage
SolveEquation [Java Application] C:\Program Files\Java\jdk-23\bin\javaw.exe (Mar 1, 2025, 6:47:56 PM elapsed: 0:00:11) [pid: 10216]
Equation Solver Menu:
1. Solve first-degree equation (ax + b = 0)
2. Solve system of first-degree equations
3. Solve second-degree equation (ax^2 + bx + c = 0)
0. Exit
Choose an option: 2
Enter coefficients for the system:
Enter a1: 2
Enter b1: 3
Enter c1: 4
Enter a2: 4
Enter b2: 6
Enter c2: 80
No solution.
Equation Solver Menu:
1. Solve first-degree equation (ax + b = 0)
2. Solve system of first-degree equations
3. Solve second-degree equation (ax^2 + bx + c = 0)
0. Exit
Choose an option:
Search
ENG
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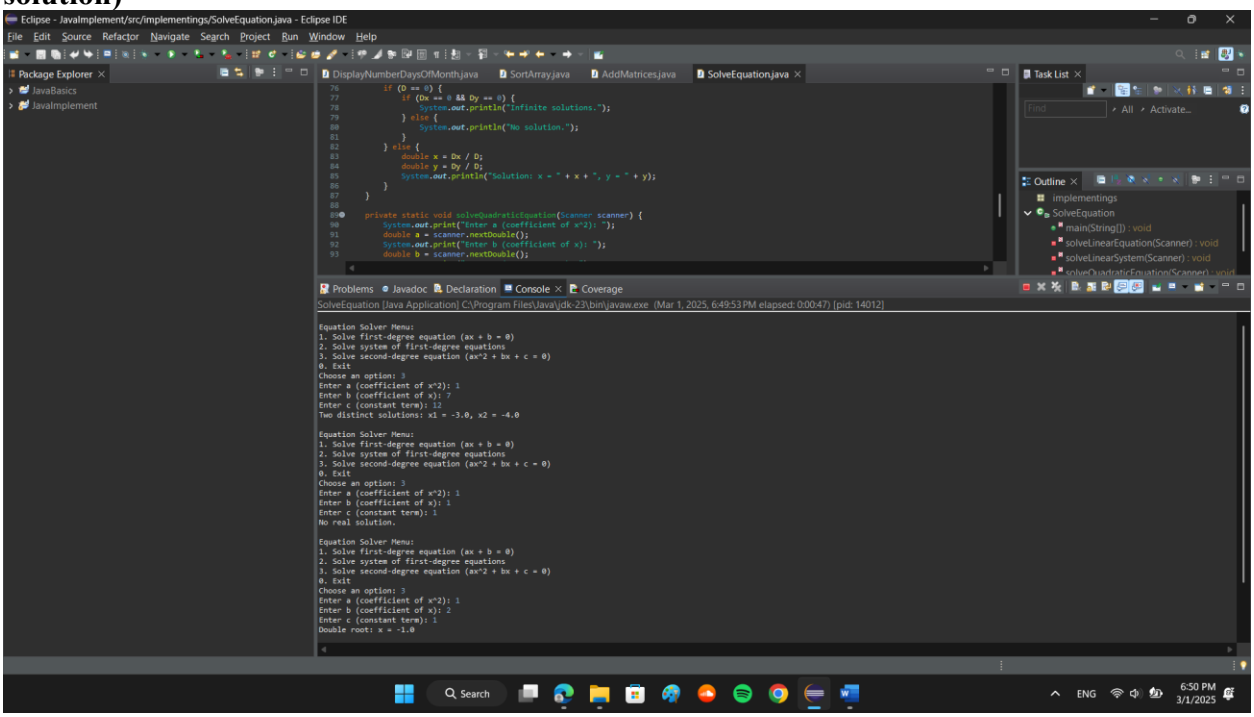
Solve second-degree equation (3 test case: Two distinct solutions, Double roots, No real solution)

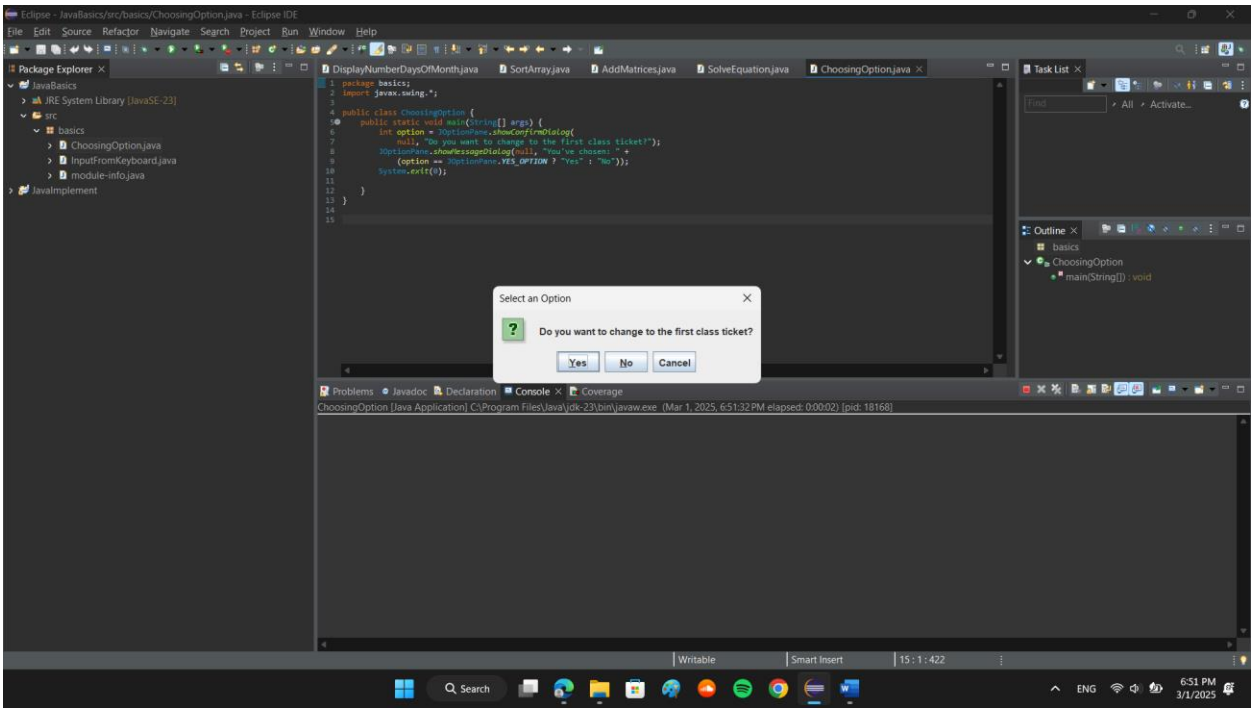


Assignment 6.1: **Write, compile and run the ChoosingOption program**

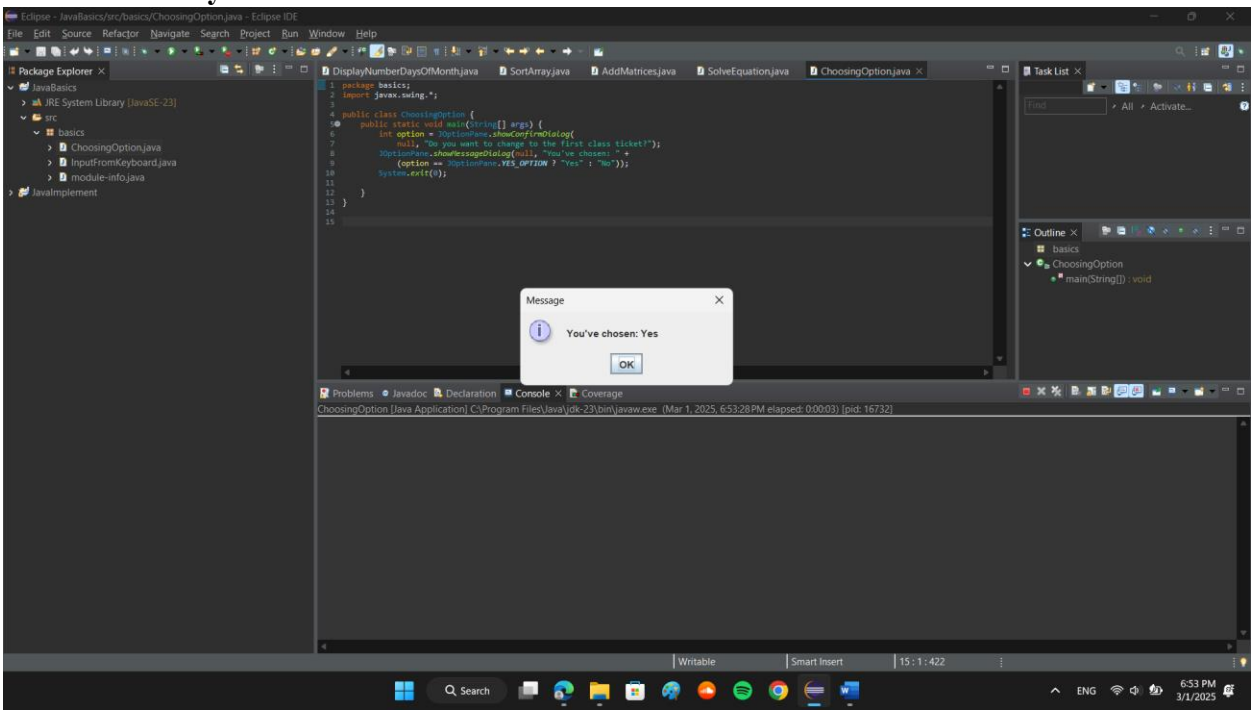
Source code:

```
package basics;
import javax.swing.*;

public class ChoosingOption {
   public static void main(String[] args) {
      int option = JOptionPane.showConfirmDialog(
         null, "Do you want to change to the first class ticket?");
      JOptionPane.showMessageDialog(null, "You've chosen: " +
         (option == JOptionPane.YES_OPTION ? "Yes" : "No"));
      System.exit(0);

   }
}
```

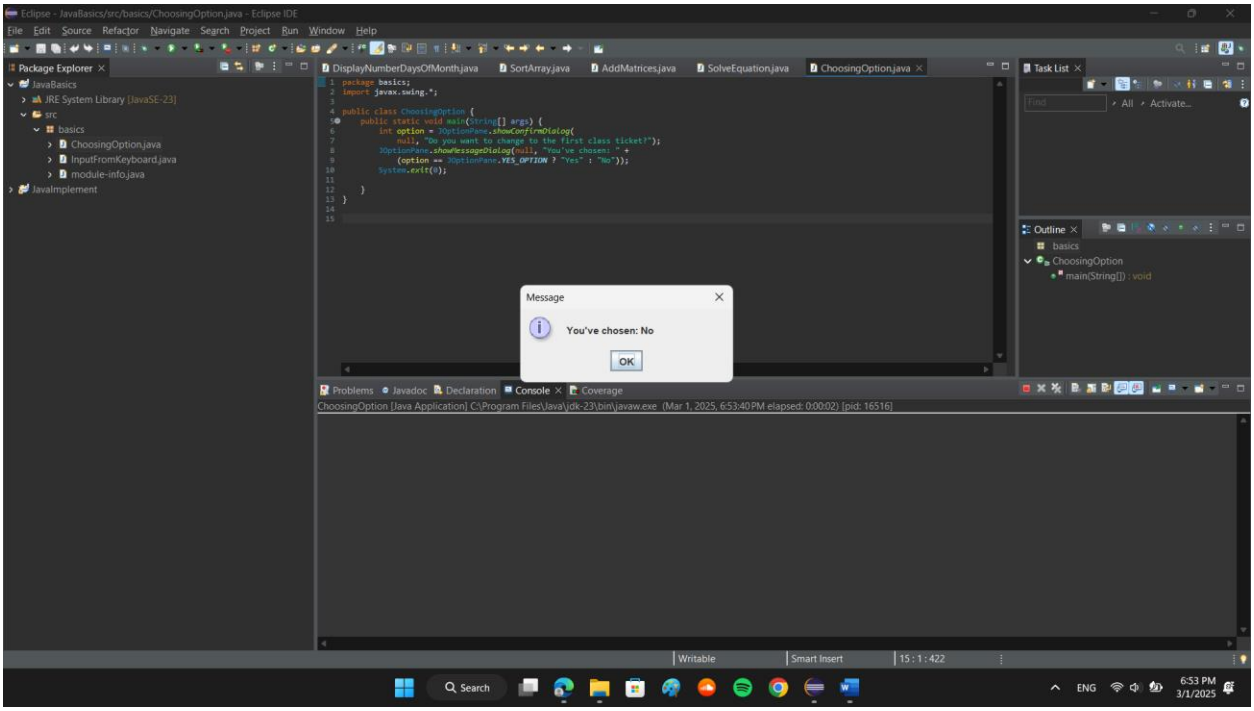
Result:



When choose “yes”:



When choose “no/cancel”:

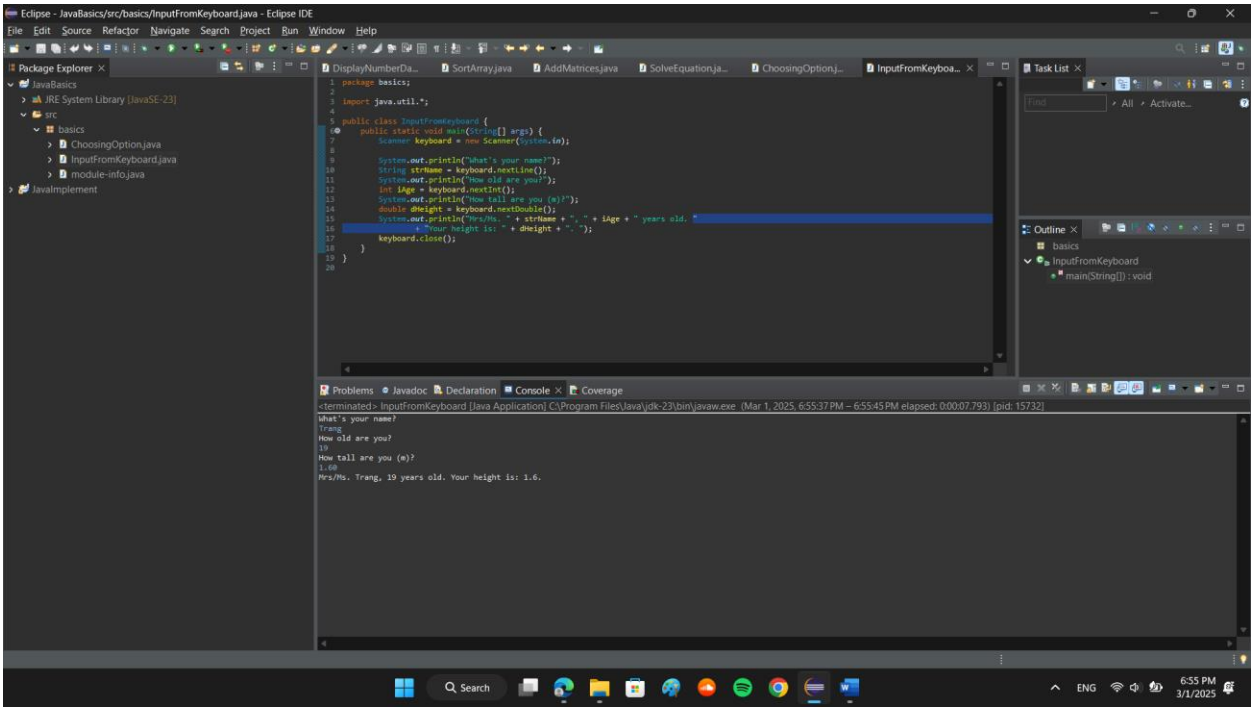


Assignment 6.2: **Write a program for input/output from keyboard**

Source code:

```
package basics;
import java.util.*;
public class InputFromKeyboard {
	public static void main(String[] args) {
		Scanner keyboard = new Scanner(System.in);

		System.out.println("What's your name?");
		String strName = keyboard.nextLine();
		System.out.println("How old are you?");
		int iAge = keyboard.nextInt();
		System.out.println("How tall are you (m)?");
		double dHeight = keyboard.nextDouble();
		System.out.println("Mrs/Ms. " + strName + ", " + iAge + " years old. "
				+ "Your height is: " + dHeight + ". ");
		keyboard.close();
	}
}
```

Result:


Eclipse - JavaBasics/src/basics/InputFromKeyboard.java - Eclipse IDE
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ChoosingOption.java
InputFromKeyboard.java
module-info.java
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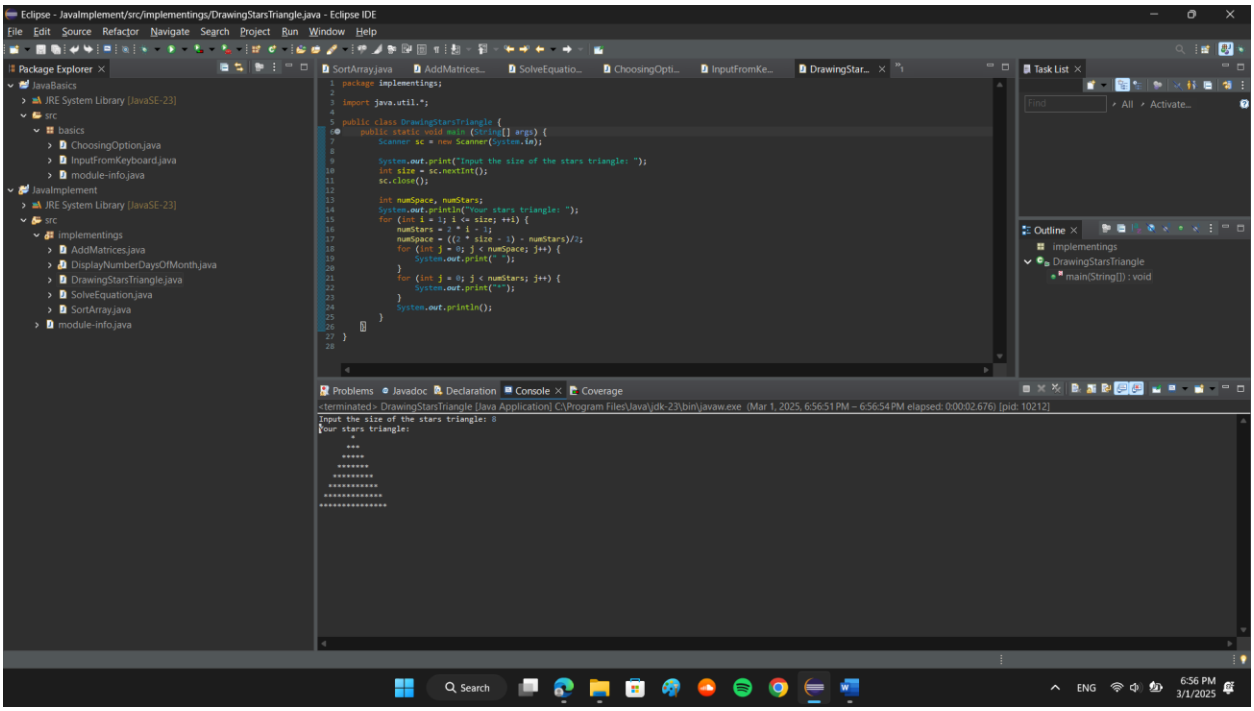
DisplayNumberDa...
SortArray.java
AddMatrices.java
SolveEquation.ja...
ChoosingOption.j...
InputFromKeyboa...
package basics;
import java.util.*;
public class InputFromKeyboard {
public static void main(String[] args) {
Scanner keyboard = new Scanner(System.in);
System.out.println("What's your name?");
String strName = keyboard.nextLine();
System.out.println("How old are you?");
int iAge = keyboard.nextInt();
System.out.println("How tall are you (m)?");
double dHeight = keyboard.nextDouble();
System.out.println("Mrs/Ms. " + strName + ", " + iAge + " years old. "
+ "Your height is: " + dHeight + ". ");
keyboard.close();
}
}
Task List
Outline
basics
InputFromKeyboard
main(String[]) : void
Problems Javadoc Declaration Console Coverage
<terminated> InputFromKeyboard [Java Application] C:\Program Files\Java\jdk-23\bin\javaw.exe (Mar 1, 2025, 6:55:37 PM – 6:55:45 PM elapsed: 0:00:07.793) [pid: 15732]
What's your name?
Trang
How old are you?
19
How tall are you (m)?
1.60
Mrs/Ms. Trang, 19 years old. Your height is: 1.6.
Search
ENG
6:55 PM
3/1/2025

Assignment 6.3: **Write a program to display a triangle with a height of n stars (*), n is entered by users.**

Source code:

```
package implementings;
import java.util.*;
public class DrawingStarsTriangle {
	public static void main (String[] args) {
		Scanner sc = new Scanner(System.in);
		System.out.print("Input the size of the stars triangle: ");
		int size = sc.nextInt();
		sc.close();
		int numSpace, numStars;
		System.out.println("Your stars triangle: ");
		for (int i = 1; i <= size; ++i) {
			numStars = 2 * i - 1;
			numSpace = ((2 * size - 1) - numStars)/2;
			for (int j = 0; j < numSpace; j++) {
				System.out.print(" ");
			}
			for (int j = 0; j < numStars; j++) {
				System.out.print("*");
			}
			System.out.println();
		}
	}
}
```

Result:



Assignment 6.4: **Write a program to display the number of days of a month, which is entered by users (both month and year). If it is an invalid month/year, ask the user to enter again.**

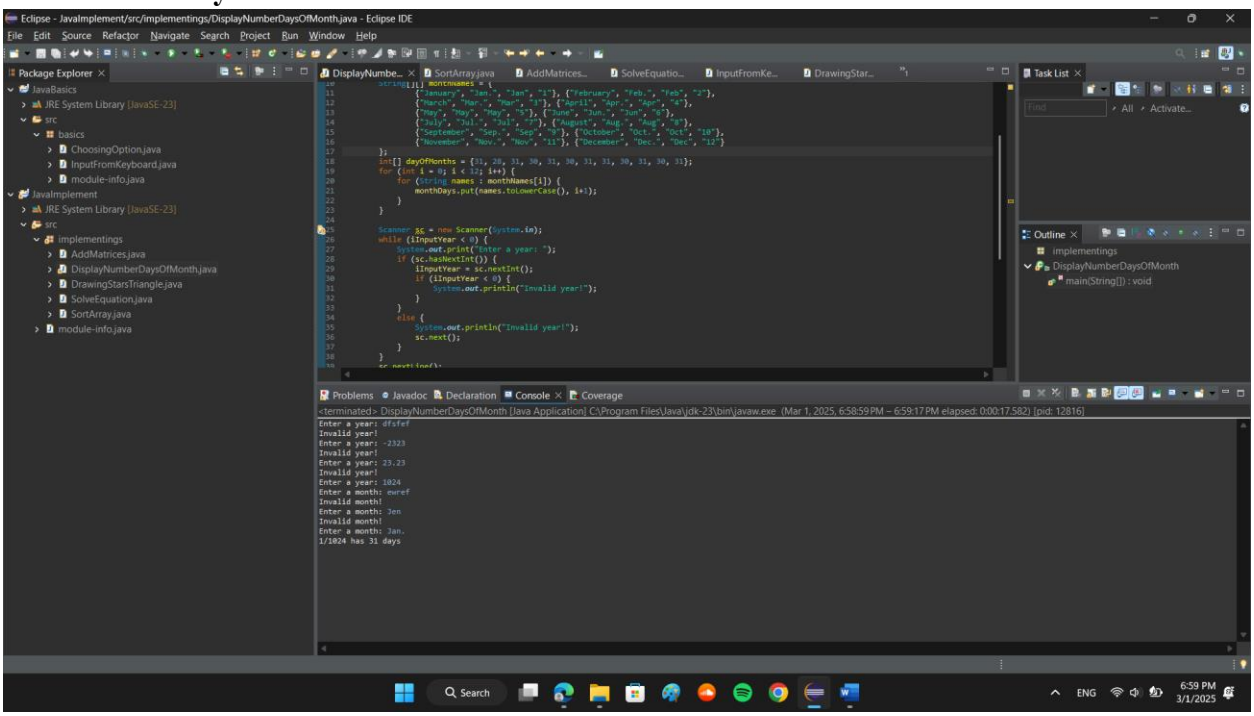
Source code:

```
package implementings;

import java.util.*;

public class DisplayNumberDaysOfMonth {
	public static void main(String[] args) {
		HashMap<String, Integer> monthDays = new HashMap<String, Integer>();
		int iInputYear = -1, iInputMonth = -1;
		String buffer;
		String[][] monthNames = {
			{"January", "Jan.", "Jan", "1"}, {"February", "Feb.", "Feb", "2"},
			{"March", "Mar.", "Mar", "3"}, {"April", "Apr.", "Apr", "4"},
			{"May", "May", "May", "5"}, {"June", "Jun.", "Jun", "6"},
			{"July", "Jul.", "Jul", "7"}, {"August", "Aug.", "Aug", "8"},
			{"September", "Sep.", "Sep", "9"}, {"October", "Oct.", "Oct", "10"},
			{"November", "Nov.", "Nov", "11"}, {"December", "Dec.", "Dec", "12"}
		};
		int[] dayOfMonths = {31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31};
		for (int i = 0; i < 12; i++) {
			for (String names : monthNames[i]) {
				monthDays.put(names.toLowerCase(), i+1);
```

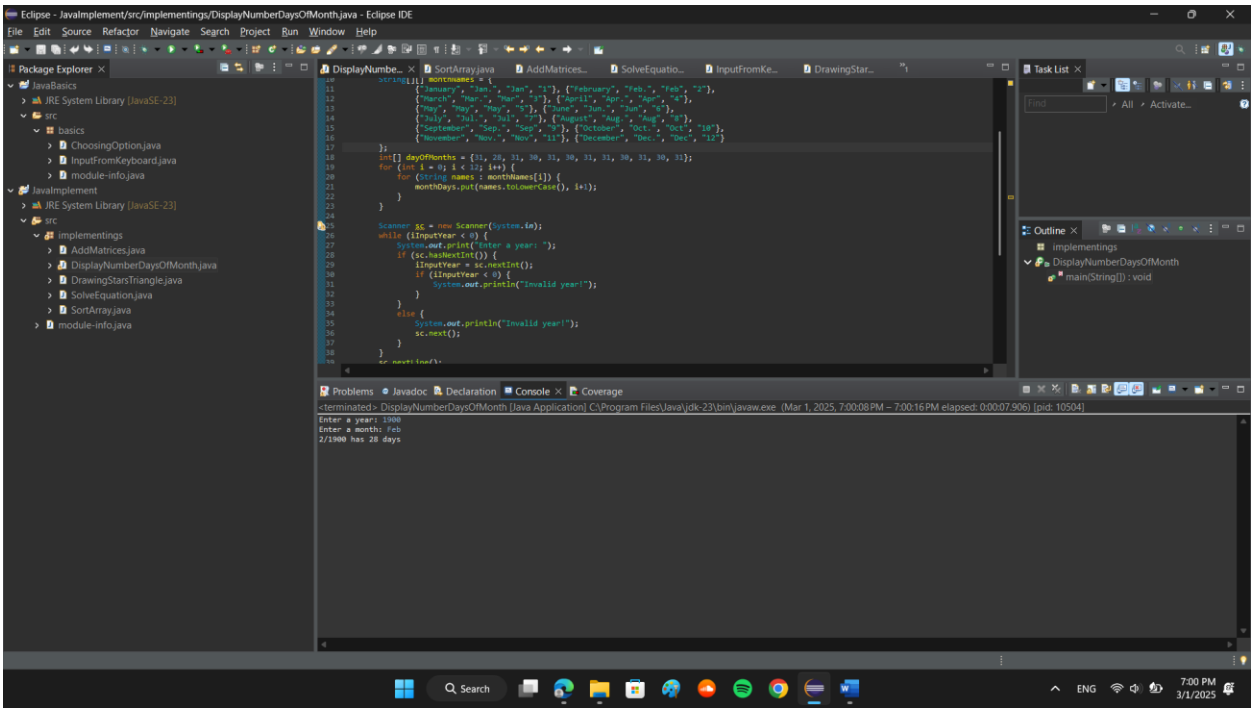
```
                }
            }

            Scanner sc = new Scanner(System.in);
            while (iInputYear < 0) {
                System.out.print("Enter a year: ");
                if (sc.hasNextInt()) {
                    iInputYear = sc.nextInt();
                    if (iInputYear < 0) {
                        System.out.println("Invalid year!");
                    }
                }
                else {
                    System.out.println("Invalid year!");
                    sc.next();
                }
            }
            sc.nextLine();

            while(iInputMonth < 0) {
                System.out.print("Enter a month: ");
                buffer = sc.next().toLowerCase();
                if (monthDays.containsKey(buffer)) {
                    iInputMonth = monthDays.get(buffer);
                }
                else {
                    System.out.println("Invalid month!");
                }
            }
            int res = dayOfMonths[iInputMonth-1];
            if (iInputMonth == 2) {
                if ((iInputYear % 4 == 0 && iInputYear % 100 != 0) || (iInputYear % 400
== 0)) {
                    res = 29;
                }
            }
            System.out.println(iInputMonth + "/" + iInputYear + " has " + res + " days");
            return;
        }
}
```

Result:

Handle invalid year/month + Jan./1024



Feb/1900:



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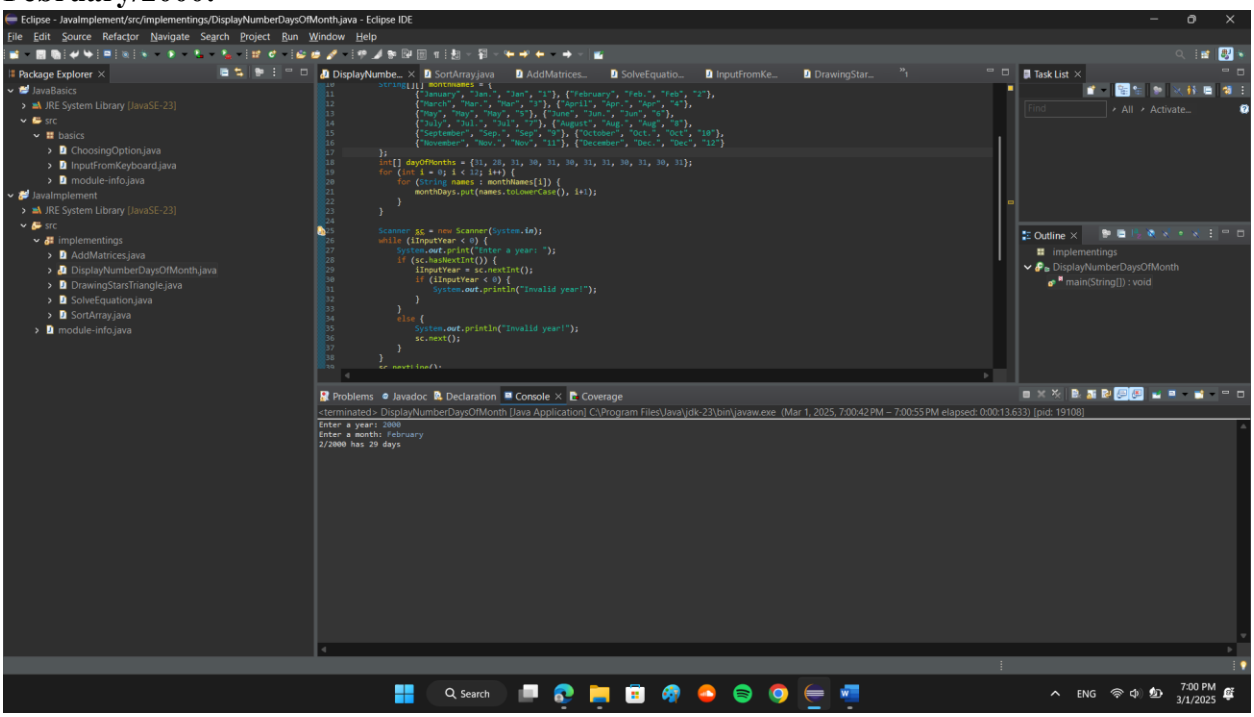
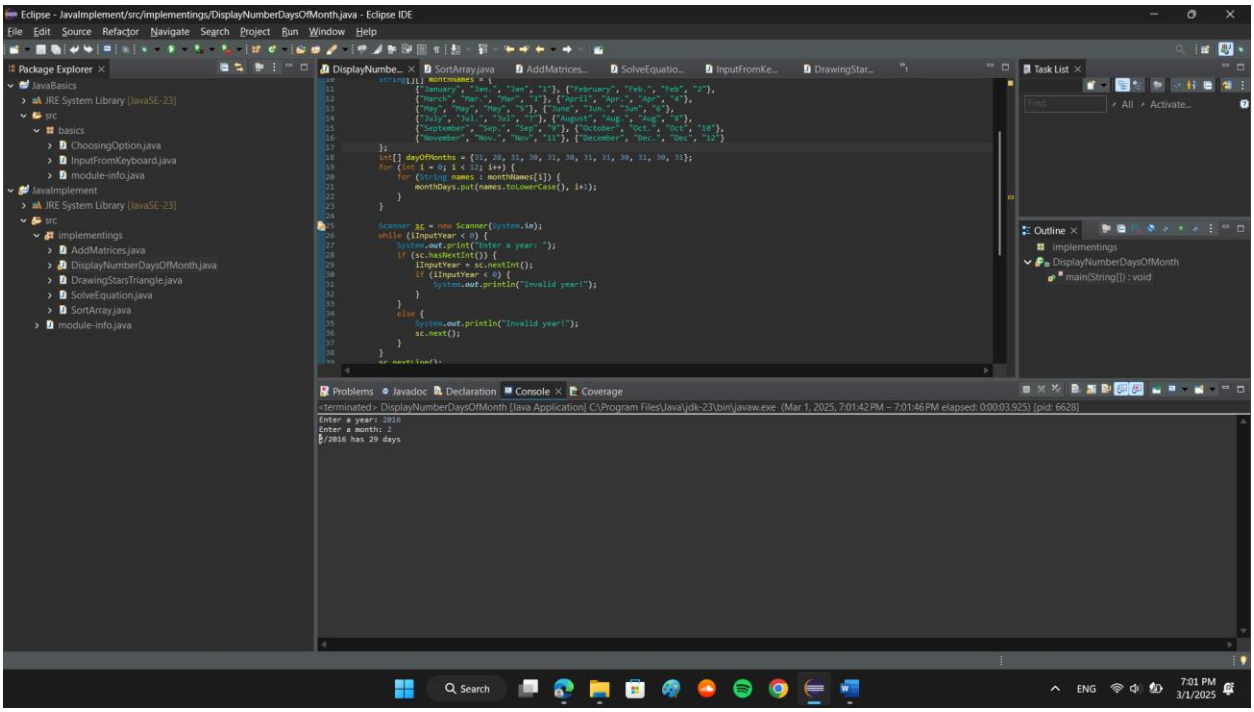


2/2016:



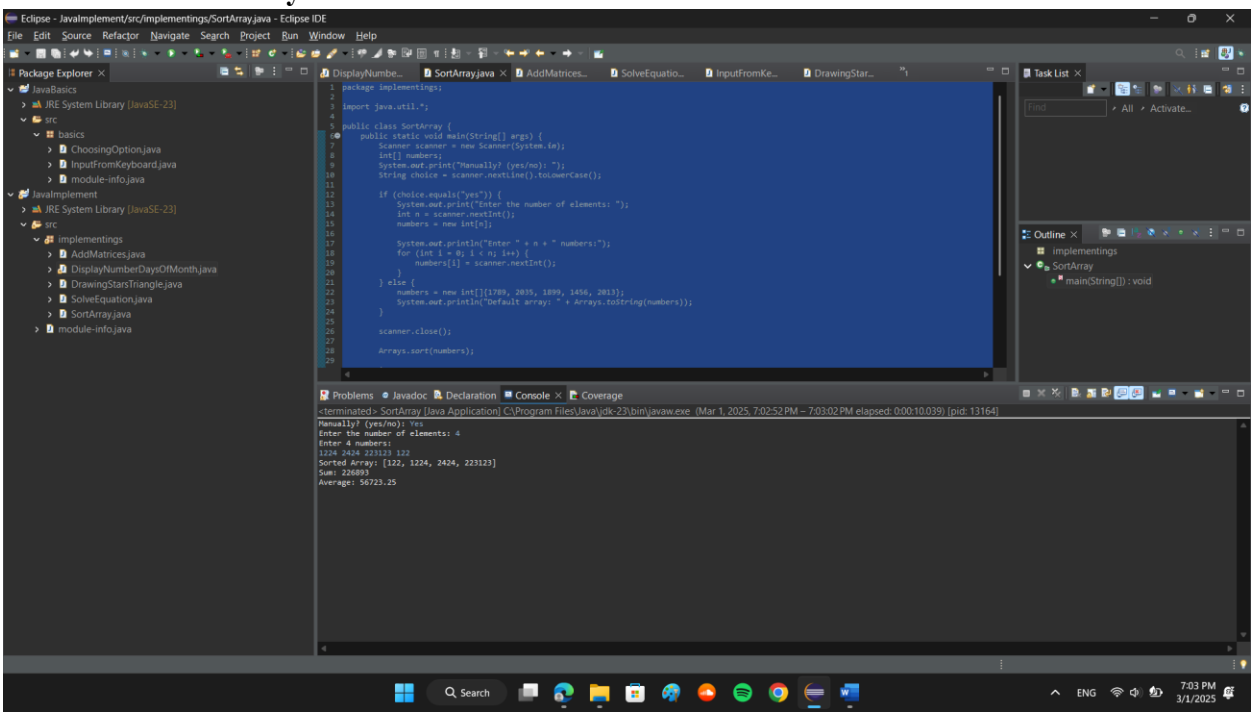
Assignment 6.5: **Write a Java program to sort a numeric array, and calculate the sum and average value of array elements.**

Soucre code:

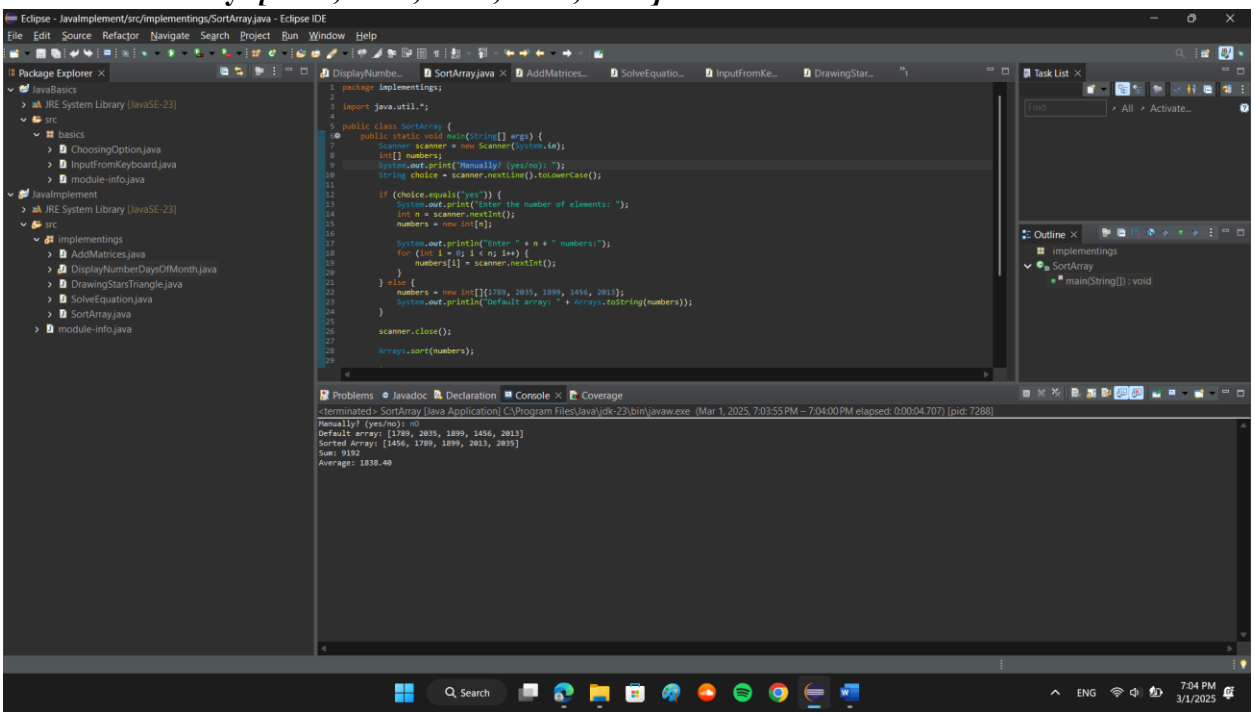
```
package implementings;

import java.util.*;

public class SortArray {
	public static void main(String[] args) {
		Scanner scanner = new Scanner(System.in);
	int[] numbers;
	System.out.print("Manually? (yes/no): ");
	String choice = scanner.nextLine().toLowerCase();

	if (choice.equals("yes")) {
	   System.out.print("Enter the number of elements: ");
	   int n = scanner.nextInt();
	   numbers = new int[n];

	   System.out.println("Enter " + n + " numbers:");
	   for (int i = 0; i < n; i++) {
	      numbers[i] = scanner.nextInt();
	   }
	} else {
	   numbers = new int[]{1789, 2035, 1899, 1456, 2013};
	   System.out.println("Default array: " + Arrays.toString(numbers));
	}

	scanner.close();

	Arrays.sort(numbers);

	int sum = 0;
	for (int num : numbers) {
	   sum += num;
	}
	double average = (double) sum / numbers.length;

	System.out.println("Sorted Array: " + Arrays.toString(numbers));
	System.out.println("Sum: " + sum);
	System.out.printf("Average: %.2f\n", average);
	   }
}
```

Result:

User enter their array:



Use default array: *[1789, 2035, 1899, 1456, 2013]*



Assignment 6.6: **Write a Java program to add two matrices of the same size.**

Source code:

```
package implementings;

import java.util.*;

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

      System.out.print("Enter number of rows: ");
      int rows = scanner.nextInt();
      System.out.print("Enter number of columns: ");
      int cols = scanner.nextInt();

      int[][] matrix1 = new int[rows][cols];
      int[][] matrix2 = new int[rows][cols];
      int[][] sumMatrix = new int[rows][cols];

      System.out.println("Enter elements of first matrix:");
      for (int i = 0; i < rows; i++) {
         for (int j = 0; j < cols; j++) {
            matrix1[i][j] = scanner.nextInt();
         }
      }

      System.out.println("Enter elements of second matrix:");
      for (int i = 0; i < rows; i++) {
         for (int j = 0; j < cols; j++) {
            matrix2[i][j] = scanner.nextInt();
         }
      }

      for (int i = 0; i < rows; i++) {
         for (int j = 0; j < cols; j++) {
            sumMatrix[i][j] = matrix1[i][j] + matrix2[i][j];
         }
      }

      System.out.println("Sum of matrices:");
      for (int i = 0; i < rows; i++) {
         for (int j = 0; j < cols; j++) {
            System.out.print(sumMatrix[i][j] + " ");
```

```
            }
            System.out.println();
        }

        scanner.close();
    }
}
```

Result: