# Experiment 1

**1. Create a Java program that demonstrates the use of various data types and their limitations.**

**Tasks:**

**Declare and initialize variables of different data types (int, double, char, boolean). Perform arithmetic operations (addition, subtraction, multiplication, division) on integer and double variables. Demonstrate type conversion (casting) between data types. Display the values of variables along with their data types.**

## **Program:**

public class DataTypesDemo {

    public static void main(String args[]){

        int a=10,b=8;

        double c=5.5,d=6.7;

        char charValue='A';

        boolean booleanValue = true;

        // Display values along with their data types

        System.out.println("Integer Value:"+a+" (Type:"+Integer.TYPE+")");

        System.out.println("Integer Value:"+c+" (Type:"+Double.TYPE+")");

        System.out.println("Integer Value:"+charValue+" (Type:"+Character.TYPE+")");

        System.out.println("Integer Value:"+booleanValue+" (Type:"+Character.TYPE+")");

        //Arithmatic operations

        System.out.println("Addition: "+a+"+"+b+"="+(a+b));

        System.out.println("Subtraction: "+a+"-"+b+"="+(a-b));

        System.out.println("Multiplication: "+a+"\*"+b+"="+(a\*b));

        System.out.println("Division: "+a+"/"+b+"="+(a/b));

        System.out.println("Addition: "+c+"+"+d+"="+(c+d));

        System.out.println("Subtraction: "+c+"-"+d+"="+(c-d));

        System.out.println("Multiplication: "+c+"\*"+d+"="+(c\*d));

        System.out.println("Division: "+c+"/"+d+"="+(c/d));

        //Demonstrate type conversion (casting) between data types.

        int dobule\_to\_int\_typecast= (int) c; // c is double type and it will be converted to integer  c=5.5 will become c-=5

        double int\_to\_double\_typecast=a;// a=10 will become 10.0

    }

}

## **Output:**

Integer Value:10 (Type:int)

Integer Value:5.5 (Type:double)

Integer Value:A (Type:char)

Integer Value:true (Type:char)

Addition: 10+8=18

Subtraction: 10-8=2

Multiplication: 10\*8=80

Division: 10/8=1

Addition: 5.5+6.7=12.2

Subtraction: 5.5-6.7=-1.2000000000000002

Multiplication: 5.5\*6.7=36.85

Division: 5.5/6.7=0.8208955223880596

**2. Problem Statement:**

**Develop a Java application for a real-time inventory management system for a grocery store. The system should handle various data types to accurately represent the inventory items and their attributes.**

**Requirements:**

**Define appropriate data types for different attributes of inventory items such as name, quantity, price, expiration date, and category.**

**Implement data validation mechanisms to ensure that the entered data types adhere to specified constraints (e.g., non-negative quantities, valid price format).**

## **Program:**

import java.util.Scanner;

class InventoryItem {

    private String name;

    private int quantity;

    private double price;

    private String expirationDate;

    private String category;

    // Constructor

    public InventoryItem(String name, int quantity, double price, String expirationDate, String category) {

        this.name = name;

        this.quantity = quantity;

        this.price = price;

        this.expirationDate = expirationDate;

        this.category = category;

    }

    public String getName() {

        return name;

    }

    public int getQuantity() {

        return quantity;

    }

    public double getPrice() {

        return price;

    }

    public String getExpirationDate() {

        return expirationDate;

    }

    public String getCategory() {

        return category;

    }

    public void setQuantity(int quantity) {

        if (quantity >= 0) {

            this.quantity = quantity;

        } else {

            System.out.println("Error: Quantity cannot be negative.");

        }

    }

    public void setPrice(double price) {

        if (price >= 0) {

            this.price = price;

        } else {

            System.out.println("Error: Price cannot be negative.");

        }

    }

    public void setExpirationDate(String expirationDate) {

        this.expirationDate = expirationDate;

    }

    public void displayItemDetails() {

        System.out.println("Name: " + name);

        System.out.println("Quantity: " + quantity);

        System.out.println("Price: $" + price);

        System.out.println("Expiration Date: " + expirationDate);

        System.out.println("Category: " + category);

    }

}

public class InventoryManagementSystem {

    public static void main(String[] args) {

        // Example usage

        Scanner scanner = new Scanner(System.in);

        System.out.print("Enter item name: ");

        String name = scanner.nextLine();

        System.out.print("Enter quantity: ");

        int quantity = scanner.nextInt();

        System.out.print("Enter price: ");

        double price = scanner.nextDouble();

        scanner.nextLine(); // Consume the newline character

        System.out.print("Enter expiration date: ");

        String expirationDate = scanner.nextLine();

        System.out.print("Enter category: ");

        String category = scanner.nextLine();

        // Create an inventory item

        InventoryItem item = new InventoryItem(name, quantity, price, expirationDate, category);

        item.displayItemDetails();

        System.out.print("Enter new quantity: ");

        int newQuantity = scanner.nextInt();

        item.setQuantity(newQuantity);

        item.displayItemDetails();

        scanner.close();

    }

}

## **Output:**

Enter item name: sugar

Enter quantity: 1

Enter price: 40

Enter expiration date: 12/4/2024

Enter category: A

Name: sugar

Quantity: 1

Price: $40.0

Expiration Date: 12/4/2024

Category: A

Enter new quantity: 4

Name: Rice

Quantity: 4

Price: $40.0

Expiration Date: 12/4/2024

Category: A

**3. Problem Statement: Java Operators**

**Create a Java program that demonstrates the use of various operators in Java. Your program should include the following:**

**Arithmetic Operators: Addition, Subtraction, Multiplication, Division, Modulus.**

**Assignment Operators: Simple Assignment, Compound Assignment.**

**Comparison Operators: Equal to, Not equal to, Greater than, Less than, Greater than or equal to, Less than or equal to.**

**Logical Operators: AND, OR, NOT.**

**Increment and Decrement Operators: Prefix and**

**Postfix forms of both increment and decrement. Bitwise Operators: AND, OR, XOR, Shift Left, Shift Right.**

## **Program:**

public class OperatorDemo {

    public static void main(String[] args) {

        // Arithmetic Operators

        int a = 10, b = 5;

        System.out.println("Arithmetic Operators:");

        System.out.println("Addition: " + (a + b));

        System.out.println("Subtraction: " + (a - b));

        System.out.println("Multiplication: " + (a \* b));

        System.out.println("Division: " + (a / b));

        System.out.println("Modulus: " + (a % b));

        // Assignment Operators

        int c = 15;

        System.out.println("\nAssignment Operators:");

        System.out.println("Simple Assignment: " + c);

        c += 5;

        System.out.println("Compound Assignment (c += 5): " + c);

        // Comparison Operators

        int x = 10, y = 20;

        System.out.println("\nComparison Operators:");

        System.out.println("Equal to: " + (x == y));

        System.out.println("Not equal to: " + (x != y));

        System.out.println("Greater than: " + (x > y));

        System.out.println("Less than: " + (x < y));

        System.out.println("Greater than or equal to: " + (x >= y));

        System.out.println("Less than or equal to: " + (x <= y));

        // Logical Operators

        boolean p = true, q = false;

        System.out.println("\nLogical Operators:");

        System.out.println("AND: " + (p && q));

        System.out.println("OR: " + (p || q));

        System.out.println("NOT: " + !p);

        // Increment and Decrement Operators

        int num = 5;

        System.out.println("\nIncrement and Decrement Operators:");

        System.out.println("Original Value: " + num);

        System.out.println("Postfix Increment: " + (num++));

        System.out.println("Prefix Increment: " + (++num));

        System.out.println("Postfix Decrement: " + (num--));

        System.out.println("Prefix Decrement: " + (--num));

        // Bitwise Operators

        int m = 5, n = 3;

        System.out.println("\nBitwise Operators:");

        System.out.println("AND: " + (m & n));

        System.out.println("OR: " + (m | n));

        System.out.println("XOR: " + (m ^ n));

        System.out.println("Shift Left: " + (m << 1));

        System.out.println("Shift Right: " + (m >> 1));

    }

}

## **Output:**

Arithmetic Operators:

Addition: 15

Subtraction: 5

Multiplication: 50

Division: 2

Modulus: 0

Assignment Operators:

Simple Assignment: 15

Compound Assignment (c += 5): 20

Comparison Operators:

Equal to: false

Not equal to: true

Greater than: false

Less than: true

Greater than or equal to: false

Less than or equal to: true

Logical Operators:

AND: false

OR: true

NOT: false

Increment and Decrement Operators:

Original Value: 5

Postfix Increment: 5

Prefix Increment: 7

Postfix Decrement: 7

Prefix Decrement: 5

Bitwise Operators:

AND: 1

OR: 7

XOR: 6

Shift Left: 10

Shift Right: 2

**4. Create a Java program that prompts the user to enter two numbers and then perform arithmetic operations on them using arithmetic operators. The program should allow the user to choose which operation to perform (addition, subtraction, multiplication, division) and display the result.**

**Requirements:**

**Prompt the user to enter two numbers.**

**Provide a menu for the user to choose the arithmetic operation.**

**Perform the selected operation using arithmetic operators.**

**Display the result to the user.**

**Write a Java program that takes a number as input and prints its multiplication table up to 10**

## **Program:**

import java.util.Scanner;

public class ArithmeticCalculator {

    public static void main(String[] args) {

        Scanner scanner = new Scanner(System.in);

        // Prompt the user to enter two numbers

        System.out.print("Enter the first number: ");

        double num1 = scanner.nextDouble();

        System.out.print("Enter the second number: ");

        double num2 = scanner.nextDouble();

        // Display the menu for arithmetic operations

        System.out.println("\nChoose an arithmetic operation:");

        System.out.println("1. Addition");

        System.out.println("2. Subtraction");

        System.out.println("3. Multiplication");

        System.out.println("4. Division");

        // Get user's choice

        System.out.print("Enter your choice (1-4): ");

        int choice = scanner.nextInt();

        // Perform the selected arithmetic operation and display the result

        double result = 0.0;

        switch (choice) {

            case 1:

                result = num1 + num2;

                System.out.println("Result: " + result);

                break;

            case 2:

                result = num1 - num2;

                System.out.println("Result: " + result);

                break;

            case 3:

                result = num1 \* num2;

                System.out.println("Result: " + result);

                break;

            case 4:

                if (num2 != 0) {

                    result = num1 / num2;

                    System.out.println("Result: " + result);

                } else {

                    System.out.println("Error: Cannot divide by zero.");

                }

                break;

            default:

                System.out.println("Invalid choice. Please choose a number between 1 and 4.");

        }

        // Close the scanner

        scanner.close();

    }

}

## **Output:**

Enter the first number: 34

Enter the second number: 4

Choose an arithmetic operation:

1. Addition

2. Subtraction

3. Multiplication

4. Division

Enter your choice (1-4): 1

Result: 38.0

1. **Write a Java program that takes a number as input and prints its multiplication table up to 10**

## **Program:**

import java.util.Scanner;

public class multiplication\_table {

    public static void main(String args[]){

        Scanner sc = new Scanner(System.in);

        System.out.print("Enter an integer: ");

        int a = sc.nextInt();

                for(int i=1; i<=10; i++){

        System.out.println(+a+"\*"+i+"="+a\*i);

        }

    }

}

## **Output:**

Enter an integer: 10

10\*1=10

10\*2=20

10\*3=30

10\*4=40

10\*5=50

10\*6=60

10\*7=70

10\*8=80

10\*9=90

10\*10=100

1. **Write a Java program to print the sum (addition), multiply, subtract, divide and remainder of two numbers.**

## **Program:**

import java.util.Scanner;

public class calculate {

    public static void main(String args[]){

        Scanner sc = new Scanner(System.in);

        System.out.print("Enter first number:");

        int a = sc.nextInt();

        System.out.print("Enter second number:");

        int b = sc.nextInt();

        System.out.println("Addition: "+a+"+"+b+"="+(a+b));

        System.out.println("Subtraction: "+a+"-"+b+"="+(a-b));

        System.out.println("Multiplication: "+a+"\*"+b+"="+(a\*b));

        System.out.println("Division: "+a+"/"+b+"="+(a/b));

        System.out.println("Remainder: "+a+"%"+b+"="+(a%b));

    }

}

## **Output:**

Enter first number:125

Enter second number:24

Addition: 125+24=149

Subtraction: 125-24=101

Multiplication: 125\*24=3000

Division: 125/24=5

Remainder: 125%24=5

1. **Write a Java program to count the letters, spaces, numbers and other characters of an input string.***Expected Output*

The string is : Aa kiu, I swd skieo 236587. GH kiu: sieo?? 25.33

letter: 23

space: 9

number: 10

other: 6

## **Program:**

import java.util.Scanner;

public class Char\_Counter {

    public static void main(String[] args) {

        Scanner sc = new Scanner(System.in);

        System.out.print("Enter a string: ");

        String inputString = sc.nextLine();

        int letterCount = 0;

        int spaceCount = 0;

        int numberCount = 0;

        int otherCount = 0;

        for (char c : inputString.toCharArray()) {

            if (Character.isLetter(c)) {

                letterCount++;

            } else if (Character.isSpaceChar(c)) {

                spaceCount++;

            } else if (Character.isDigit(c)) {

                numberCount++;

            } else {

                otherCount++;

            }

        }

        System.out.println("The string is: " + inputString);

        System.out.println("letter: " + letterCount);

        System.out.println("space: " + spaceCount);

        System.out.println("number: " + numberCount);

        System.out.println("other: " + otherCount);

    }

}

## **Output:**

Enter a string: Aa kiu, I sed skieo 236587. GH kiu: sieo?? 25.33

The string is: Aa kiu, I sed skieo 236587. GH kiu: sieo?? 25.33

letter: 23

space: 9

number: 10

other: 6

1. **Write a Java program that accepts three integers from the user and return true if the second number is greater than first number and third number is greater than second number. If "abc" is true second number does not need to be greater than first number.**

## **Program:**

import java.util.Scanner;

public class comapre\_integer {

    public static void main(String args[]){

        Scanner sc = new Scanner (System.in);

        System.out.println("Enter first number");

        int a =sc.nextInt();

        System.out.println("Enter Second number");

        int b =sc.nextInt();

        System.out.println("Enter third number");

        int c =sc.nextInt();

        if(a<b){

            if(b<c){

                System.out.println("True");

            }

        }else{

            System.out.println("False");

        }

    }

}

## **Output:**

Enter first number

10

Enter Second number

16

Enter third number

27

True

1. **Write a program called SumAverageRunningInt to produce the sum of 1, 2, 3, ..., to 100. Store 1 and 100 in variables lowerbound and upperbound, so that we can change their values easily. Also compute and display the average. The output shall look like:**

**The sum of 1 to 100 is 5050**

**The average is 50.5**

## **Program:**

public class Average{

    public static void main(String args[]){

        int lowerbound=1;

        int upperbound=100;

        int sum=0;

        for(int i=lowerbound; i<=upperbound; i++){

            sum += i;

        }

        double average = (double) sum / (upperbound - lowerbound + 1);

    System.out.println("The sum of "+lowerbound+" to "+upperbound+" is "+ sum);

        System.out.println("The average is "+ average);

    }

}

## **Output:**

The sum of 1 to100 is 5050

The average is 50.5

1. **Modify the program to produce two sums: sum of odd numbers and sum of even numbers from 1 to 100. Also, computer their absolute difference.**

## **Program:**

public class Average {

    public static void main(String args[]) {

        int lowerbound = 1;

        int upperbound = 100;

        int sum = 0;

        int sum\_of\_even = 0;

        int sum\_of\_odd = 0;

        for (int i = lowerbound; i <= upperbound; i++) {

            sum += i;

        }

        double average = (double) sum / (upperbound - lowerbound + 1);

        System.out.println("The sum of " + lowerbound + " to " + upperbound + " is " + sum);

        System.out.println("The average is " + average);

        for (int i = lowerbound; i <= upperbound; i++) {

            if (i % 2 == 0) {

                sum\_of\_even += i;

            } else {

                sum\_of\_odd += i;

            }

        }

        System.out.println("The sum of even numbers is " + sum\_of\_even);

        System.out.println("The sum of odd numbers is " + sum\_of\_odd);

        int absolute\_difference = sum\_of\_even - sum\_of\_odd;

        System.out.println("The absolute difference between the sum of even and odd numbers is " + absolute\_difference);

    }

}

## **Output:**

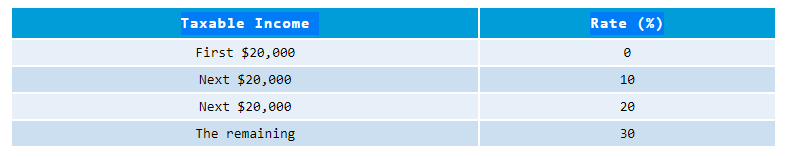
The sum of 1 to 100 is 5050

The average is 50.5

The sum of even numbers is 2550

The sum of odd numbers is 2500

The absolute difference between the sum of even and odd numbers is 50

1. **IncomeTaxCalculator**

## **Program:**

import java.util.Scanner;

public class IncomeTaxCalculator {

    public static void main(String[] args) {

        Scanner sc = new Scanner(System.in);

        System.out.print("Enter your taxable income: $");

        double taxableIncome = sc.nextDouble();

        double tax = calculateIncomeTax(taxableIncome);

        System.out.println("Your income tax is: $" + tax);

    }

    public static double calculateIncomeTax(double income) {

        double tax = 0;

        if (income <= 20000) {

            tax = 0.1 \* income;

        } else if (income <= 40000) {

            tax = 0.1 \* 20000 + 0.2 \* (income - 20000);

        } else if (income <= 60000) {

            tax = 0.1 \* 20000 + 0.2 \* 20000 + 0.3 \* (income - 40000);

        } else {

            // Assuming a 30% tax rate for income beyond $60,000

            tax = 0.1 \* 20000 + 0.2 \* 20000 + 0.3 \* 20000 + 0.3 \* (income - 60000);

        }

        return tax;

    }

}

## **Output:**

Enter your taxable income: $20000

Your income tax is: $2000.0

1. **PensionContributionCalculator (Decision)**
2. **Both the employer and the employee are mandated to contribute a certain percentage of the employee's salary towards the employee's pension fund. The rate is tabulated as follows:**

|  |  |  |
| --- | --- | --- |
| **Employee's Age** | **Employee Rate (%)** | **Employer Rate (%)** |
| 55 and below | 20 | 17 |
| above 55 to 60 | 13 | 13 |
| above 60 to 65 | 7.5 | 9 |
| above 65 | 5 | 7.5 |

However, the contribution is subjected to a salary ceiling of $6,000. In other words, if an employee earns $6，800, only $6，000 attracts employee's and employer's contributions, the remaining $800 does not.

Write a program called **PensionContributionCalculator** that reads the monthly salary and age (in int) of an employee. Your program shall calculate the employee's, employer's and total contributions (in double); and print the results rounded to 2 decimal places. For examples,

Enter the monthly salary: $**3000**

Enter the age: **30**

The employee's contribution is: $600.00

The employer's contribution is: $510.00

The total contribution is: $1110.00

## **Program:**

import java.util.Scanner;

public class PensionContributionCalculator {

    public static void main(String[] args) {

        Scanner sc = new Scanner(System.in);

        System.out.print("Enter the monthly salary: $");

        double monthlySalary = sc.nextDouble();

        System.out.print("Enter the age: ");

        int age = sc.nextInt();

        // Apply salary ceiling

        double eligibleSalary = (monthlySalary > 6000) ? 6000 : monthlySalary;

        // Calculate employee's contribution

        double employeeRate = getEmployeeRate(age);

        double employeeContribution = eligibleSalary \* (employeeRate / 100);

        // Calculate employer's contribution

        double employerRate = getEmployerRate(age);

        double employerContribution = eligibleSalary \* (employerRate / 100);

        // Calculate total contribution

        double totalContribution = employeeContribution + employerContribution;

        // Print the results rounded to 2 decimal places

        System.out.printf("The employee's contribution is: $%.2f\n", employeeContribution);

        System.out.printf("The employer's contribution is: $%.2f\n", employerContribution);

        System.out.printf("The total contribution is: $%.2f\n", totalContribution);

        sc.close();

    }

    // Helper method to get the employee rate based on age

    private static double getEmployeeRate(int age) {

        if (age <= 55) {

            return 20;

        } else if (age <= 60) {

            return 13;

        } else if (age <= 65) {

            return 7.5;

        } else {

            return 5;

        }

    }

    // Helper method to get the employer rate based on age

    private static double getEmployerRate(int age) {

        if (age <= 55) {

            return 17;

        } else if (age <= 60) {

            return 13;

        } else if (age <= 65) {

            return 9;

        } else {

            return 7.5;

        }

    }

}

## **Output:**

Enter the monthly salary: $30000

Enter the age: 20

The employee's contribution is: $1200.00

The employer's contribution is: $1020.00

The total contribution is: $2220.00