Programming Fundamentals II

Lab 4: Mathematical Functions, Characters, and Strings

Learning Objectives:

- Solve mathematical problems using the methods in the Math class.
- Character and String Manipulation.
- String Operations and Methods.
- Format output with “System.out.printf”.

Requisite knowledge:

- Chapter 4 Elementary Programming from “Introduction to Java Programming Brief Version” Reference (See lms.uofk.edu).
- Lecture 4 (See lms.uofk.edu).

Lab 4 Assignment: No Assignment for this lab!

```
//          Trigonometric Methods


            Math.sin(0) returns 0.0
            Math.sin(Math.PI / 6)// returns 0.5
            Math.sin(Math.PI / 2)// returns 1.0
            Math.cos(0)// returns 1.0
            Math.cos(Math.PI / 6) // returns 0.866
            Math.cos(Math.PI / 2) // returns 0

             System.out.print(Math.tan(Math.PI / 6));
```

```
//    Exponent Methods


            Math.exp(1)  // returns 2.71
            Math.log(2.71) // returns 1.0
            Math.pow(2, 3) // returns 8.0
            Math.pow(3, 2) // returns 9.0
            Math.pow(3.5, 2.5) // returns 22.91765
            Math.sqrt(4) // returns 2.0
            Math.sqrt(10.5)

      System.out.print(Math.exp(1));
```

```
//          Rounding Methods

            Math.ceil(2.1) returns 3.0
            Math.ceil(2.0) returns 2.0
            Math.ceil(-2.0) returns -2.0
            Math.ceil(-2.1) returns -2.0
            Math.floor(2.1) returns 2.0
            Math.floor(2.0) returns 2.0
            Math.floor(-2.0) returns -2.0
            Math.floor(-2.1) returns -3.0
            Math.rint(2.1) returns 2.0
            Math.rint(2.0) returns 2.0
            Math.rint(-2.6) returns -3.0
            Math.rint(-2.1) returns -2.0
            Math.rint(2.5) returns 2.0
            Math.rint(2.501) returns 3.0
            Math.rint(-2.5) returns -2.0
            Math.round(2.5) returns 3
            Math.round(2.501) returns 3
            Math.round(2.0) returns 2
```

```
            Math.round(-2.4) returns -2
            Math.round(-2.6) returns -3

            System.out.print(Math.round(2.1));
```

```
//    min, max, and abs , Random

             Math.max(2, 3) ;
             Math.max(2.5, 3) ;
             Math.min(2.5, 3.6) ;
             Math.abs(-2) ;
             Math.abs(-2.1) ;
          int` x = (int)(Math.random() * 100); //0->0.99

          System.out.print(x);
```

Case Study: Computing Angles of a Triangle

```
Scanner input = new Scanner(System.in);

              // Prompt the user to enter three points
              System.out.print("Enter three points: ");
               double x1 = input.nextDouble();
               double y1 = input.nextDouble();
               double x2 = input.nextDouble();
               double y2 = input.nextDouble();
               double x3 = input.nextDouble();
               double y3 = input.nextDouble();

              // Compute three sides
              double a = Math.sqrt((x2 - x3) * (x2 - x3) + (y2 - y3) * (y2 - y3));
              System.out.println("a = " + a);
              double b = Math.sqrt((x1 - x3) * (x1 - x3) + (y1 - y3) * (y1 - y3));
              System.out.println("b = " + b);
            double c = Math.sqrt((x1 - x2) * (x1 - x2) + (y1 - y2) * (y1 - y2));
            System.out.println("c = " + c);

             // Compute three angles
              double A = Math.toDegrees(Math.acos((a * a - b * b - c * c) / (-12 * b
* c)));
              double B = Math.toDegrees(Math.acos((b * b - a * a - c * c) / (-2 * a
* c)));
              double C = Math.toDegrees(Math.acos((c * c - b * b - a * a) / (-2 * a
```

```
* b)));

            // Display results
               System.out.println("The three angles are " +
               Math.`(A * 100) / 100.0 + " " +
               Math.round(B * 100) / 100.0 + " " +
               Math.round(C * 100) / 100.0);
```

```java
package lab4_1;
import java.util.Scanner;
public class Lab4_1 {

    public static void main(String[] args) {
        //Character Data Type and Operations
        //Unicode and ASCII code
        //'' ---> char
        //"" ---> String

//        char c = 'A';
//        System.out.println(c);
//









//        char c1 = 65; // 65 -90 ----> A - Z
//        System.out.println(c1);
//
//        char c2 = 98; // 97 - 122 ----> a - z
//        System.out.println(c2);
//
//        char c3 = 40; // 48 - 57 ----> 0 - 9
//        System.out.println(c3);


//          char c = '\u0041';
//          System.out.println(c);
//

//                Common escape sequences
```

```
//        System.out.println("Newline:\nSecond Line");
//        System.out.println("Carriage Return:\rOverwrite Start");
//        System.out.println("Tab:\tIndented Text");
//        System.out.println("Single Quote: \'Single\'");
//        System.out.println("Double Quote: \"Double\"");
//        System.out.println("Backslash: \\Backslash\\");
//        System.out.println("Backspace: Text\bBackspaced");
//        System.out.println("Form Feed: First Page\fSecond Page");
//









//        System.out.println("Hello,\nWorld!");       // Newline
//        System.out.println("Hesfdsfsfsfsllo,\rWorld!");       // Carriage return
//        System.out.println("Hello,\tWorld!");       // Tab
//        System.out.println("Hello, \'World!\'");    // Single quote
//        System.out.println("Hello, \"World!\"");    // Double quote
//        System.out.println("Hello, \\World!\\");    // Backslash
//        System.out.println("Hello,\bWorld!");       // Backspace
//        System.out.println("Hello,\fWorld!");       // Form feed (may not have a
visible effect in some environments)
//
//









        //Casting between char and Numeric Types

//        float i = 'b'; // Same as int i = (int)'a';
//        System.out.println(i);
//        char c = (char) 97.98988; // Same as char c = (char)97;
//        System.out.println(c);



        //++char    // char++

//        char c = 97;
```

```
//        System.out.println(++c);
//        System.out.println(++c);









//
//        Scanner input = new Scanner(System.in);
//        //char ch = input.next();
//        char ch = '1';  // 97
//        if (ch >= 'A' && ch <= 'Z') //false
//            System.out.println(ch + " is an uppercase letter");
//        else if (ch >= 'a' && ch <= 'z') // true
//            System.out.println(ch + " is a lowercase letter");
//        else if (ch >= '0' && ch <= '9')
//            System.out.println(ch + " is a numeric character");









// method               Description
//isDigit(ch)           Returns true if the specified character is a digit.
//isLetter(ch)          Returns true if the specified character is a letter.
//isLetterOrDigit(ch)   Returns true if the specified character is a letter or
digit.
//isLowerCase(ch)       Returns true if the specified character is a lowercase
letter.
//isUpperCase(ch)       Returns true if the specified character is an uppercase
letter.
//toLowerCase(ch)       Returns the lowercase of the specified character.
//toUpperCase(ch)       Returns the uppercase of the specified character.

//For example,

System.out.println("isDigit('a') is " + Character.isLetterOrDigit('a'));
System.out.println("isLetter('a') is " + Character.isLetter(')'));
System.out.println("isLowerCase('a') is " + Character.isLowerCase('a'));
System.out.println("isUpperCase('a') is " + Character.isUpperCase('A'));
System.out.println("toLowerCase('T') is " + Character.toLowerCase('T'));
System.out.println("toUpperCase('q') is " + Character.toUpperCase('Q'));
```

```
    }

}
```

```
package lab4_2;
import java.util.Scanner;
public class Lab4_2 {

    public static void main(String[] args) {

//        String message = "Welcome to Java";  //reference variable
//        String s = "java";

//     Method            Description
//length()              Returns the number of characters in this string.
```

```
//charAt(index)         Returns the character at the specified index from this
string.
//concat(s1)            Returns a new string that concatenates this string with
string s1.
//toUpperCase()         Returns a new string with all letters in uppercase.
//toLowerCase()         Returns a new string with all letters in lowercase.
//trim()                Returns a new string with whitespace characters trimmed on
both sides.

//        System.out.println(s.length());
//        System.out.println(s.charAt(0));
//        System.out.println(s.concat("text2"));
//        System.out.println("        a ABC            ".trim());
//
//
//









        //////////  next()  vs   nextLine()

//        Scanner input = new Scanner(System.in);
//        System.out.print("Enter three words separated by spaces: ");
//        String s1 = input.next();
//
//        System.out.println(as1);




//Reading a Character from the Console


        Scanner input = new Scanner(System.in);
        System.out.print("Enter a character: ");
        String s = input.nextLine();
        char ch = s.charAt(0);
        System.out.println("The character entered is " + ch);
    }

}
```

```java
package lab4_3;
import java.util.Scanner;
public class Lab4_3 {

    public static void main(String[] args) {

//Two Types of String Objects

        String strObject = new String("Java"); //heap
        String strLiteral = "Java"; //pool




/**The == operator checks only whether two string
variables refer to the same object; it does not
tell you whether they have the same contents.*/


//        String strLiteral2 = new String("Java") ;
//        System.out.println(strLiteral == strLiteral2);









//  Comparing Strings  // عايز اقارن قيمةالنص


1//- equals(s1)


//        if ("a ".equals("a"))
//        System.out.println("string1 and string2 have the same contents");
//        else
//        System.out.println("string1 and string2 are not equal");



//        String s1 = "Welcome to Java";
//        String s2 = "Welcome to Java";
```

```
//        String s3 = "Welcome to C++";
//        System.out.println(s1.equals(s2)); // true
//        System.out.println(s1.equals(s3)); // false




//2- equalsIgnoreCase(s1)


//        String s1 = "Hello";
//        String s2 = "hello";
//
//        System.out.println(s1.equalsIgnoreCase(s2)); // true









//3- compareTo(s1)

//
//        String s1 = "Apple";
//        String s2 = "Banana";
//        String s3 = "Apple";
//
//        System.out.println(s1.compareTo(s2)); // negative value
//        System.out.println(s1.compareTo(s3)); // 0
//        System.out.println(s2.compareTo(s1)); // positive value
//

// c vs g مثال الكشر
//        System.out.println("abc".compareTo("abg"));




// OrderTwoCities.java

//
```

```
//Scanner input = new Scanner(System.in);
//
// // Prompt the user to enter two cities
//System.out.print("Enter the first city: ");
//String city1 = input.nextLine();
//System.out.print("Enter the second city: ");
//String city2 = input.nextLine();
//
//if (city1.compareTo(city2) < 0)
//System.out.println("The cities in alphabetical order are " + city1 + " " + city2);
//else
//System.out.println("The cities in alphabetical order are " + city2 + " " + city1);









//4- compareToIgnoreCase(s1)

//        String s1 = "apple";
//        String s2 = "Banana";
//        String s3 = "APPLE";
//
//        System.out.println(s1.compareToIgnoreCase(s2)); // negative value
//        System.out.println(s1.compareToIgnoreCase(s3)); // 0
//        System.out.println(s2.compareToIgnoreCase(s1)); // positive value









//5- startsWith(prefix)

//        String s1 = "Hello, World!";
//
```

```
////        System.out.println(s1.startsWith("Hello")); // true
////        System.out.println(s1.startsWith("H")); // false
//
//
////6- endsWith(suffix)
//
//        System.out.println(s1.endsWith("World!")); // true
//        System.out.println(s1.endsWith("!"));  // false









//Obtaining Substrings
//substring(beginIndex)

////substring(beginIndex,endIndex)
//
//        String message = "Welcome to Java";
//
//        System.out.println( message.substring(1));
//        System.out.println( message.substring(0,11));
```

```
//Finding a Character or a Substring in a String
// All methods ----> Returns -1 if not matched.

//                      1111111111
///            01234567890123456789
// String str = "Hello, World! Hello!";
//
//        // indexOf(ch)
//        int indexOfChar = str.indexOf('o');
//        System.out.println("indexOf('o'): " + indexOfChar); // 4
//
//        // indexOf(ch, fromIndex)
//        int indexOfCharFromIndex = str.indexOf('o', 5);
//        System.out.println("indexOf('o', 5): " + indexOfCharFromIndex); // 8
//
//        // indexOf(s)
//        int indexOfSubstring = str.indexOf("Hello");
//        System.out.println("indexOf(\"Hello\"): " + indexOfSubstring); // 0
//
//        // indexOf(s, fromIndex)
//        int indexOfSubstringFromIndex = str.indexOf("Hello", 8);
//        System.out.println("indexOf(\"Hello\", 8): " + indexOfSubstringFromIndex);
// 13

////                     1111111111
/////           01234567890123456789
//String str = "Hello, World! Hello!";
//
//        // lastIndexOf(ch)
//        int lastIndexOfChar = str.lastIndexOf('o');
//        System.out.println("lastIndexOf('o'): " + lastIndexOfChar); //
//
//        // lastIndexOf(ch, fromIndex)
//        int lastIndexOfCharFromIndex = str.lastIndexOf('o', 14);
//        System.out.println("lastIndexOf('o', 14): " + lastIndexOfCharFromIndex);
//
//
//        // lastIndexOf(s)
//        int lastIndexOfSubstring = str.lastIndexOf("Hello");
//        System.out.println("lastIndexOf(\"Hello\"): " + lastIndexOfSubstring); //
14
//
//        // lastIndexOf(s, fromIndex)
//        int lastIndexOfSubstringFromIndex = str.lastIndexOf("Hello", 3);
//        System.out.println("lastIndexOf(\"Hello\", 13): " +
lastIndexOfSubstringFromIndex); // 0
```

```java
// مثال الكشر

        String s ="Kim Jones";  //fullName
        int k = s.indexOf(' '); // 3
        String firstName = s.substring(0, k);
        String lastName = s.substring(k + 1);









//Conversion between Strings and Numbers

//Integer.parseInt(String)
//Double.parseDouble(String)


        String s1 = "123.7";

        double x = Double.parseDouble(s1);

        System.out.println(x+1);

        String s2 = x + "";
                System.out.println(s2);


    }

}
```

```java
package lab4_4;


public class Lab4_4 {


    public static void main(String[] args) {

       // System.out.printf("print");



        int count = 5;  //------------------- %d
        double amount = 45.56;  //-------------------- %f
        float f = 7.411f;  //-------------------- %e



       System.out.printf("count is %d and amount is %f", count, amount);


        boolean b = true; //--------------------- %b
        char c = 'c';//-------------------- %c
        String s = "string";//-------------------- %s

        String s1 = " \n boolean %b , char %s\n";
        System.out.printf(s1, b,c);


    }

}
```