

## OBJECT-ORIENTED PROGRAMMING

### LAB 5: REVIEW

#### I. Objective

After completing this tutorial, we want you:

- Review about Array in Java,
- Review about String in Java,
- Review about OOP, Class, Encapsulation in Java.

#### II. Array

**1. Array are used to store multiple values in a single variable, instead of declaring separate variables for each value:**

```
String [] strings = {"IT", "TDTU", "HCM"};  
int[] nums = {10, 20, 30, 40};
```

**2. You access an array element by referring to the index number:**

```
int[] nums = {10, 20, 30, 40};  
System.out.println(nums[1]); // 20
```

**3. To change the value of a specific element, refer to the index number:**

```
int[] nums = {10, 20, 30, 40};  
nums[1] = 15;  
System.out.println(nums[1]); // 15
```

**4. To find out how many elements an array has, use the **length** property:**

```
int[] nums = {10, 20, 30, 40};  
System.out.println(nums.length); // 4
```

**5. You can loop through the array elements with the **for** loop, and use the **length** property to specify how many times the loop should run.**

```
int[] nums = {10, 20, 30, 40};  
for (int i = 0; i < nums.length; i++) {  
    System.out.println(nums[i]);  
}
```

6. There is also a "for-each" loop, which is used exclusively to loop through elements in array:

```
int[] nums = {10, 20, 30, 40};  
for (int num : nums) {  
    System.out.println(num);  
}
```

7. A multidimensional array is an array containing one or more arrays. To create a two-dimensional array, add each array within its own set of curly braces:

```
int[][] array2D = new int[2][3];  
int[][] matrix = {{1, 2, 3}, {4, 5, 6}};
```

### III. String

1. Strings are used for storing text. A **String** variable contains a collection of characters surrounded by double quotes:

```
String str = "Ton Duc Thang";
```

2. The length of a string can be found with the **length()** method:

```
String str = "Ton Duc Thang";  
System.out.println(str.length()); //13
```

3. You can reference the individual characters in a string by using the method **charAt()** with the same index that you would use for an array:

```
String str = "Ton Duc Thang";  
System.out.println(str.charAt(0)); //T
```

4. You must compare strings by using the **equals()** method:

```
"Star".equals("star"); // returns false  
"abc".equals("abc"); // returns true
```

5. You can use the **concat()** method to concatenate two strings. You can also concatenate two strings to form another string by using the **+** operator:

```
String str1 = "Hello";  
str1.concat(" HCM"); // Hello HCM  
  
String str2 = "Hello";  
str2 = str2 + " TDTU"; // Hello TDTU
```

**6. You can use `substring()` to access part of a string:**

```
String str = "Hello TDTU";  
System.out.println(str.substring(0, 5)); // Hello
```

**7. You can split a string into an array of substrings:**

```
String str = "Hello TDTU";  
String[] arr = str.split(" "); // [Hello, TDTU]
```

#### **IV. OOP, Class, Encapsulation**

1. OOP stands for Object-Oriented Programming.
2. Classes and objects are the two main aspects of object-oriented programming. A class is a template for objects, and an object is an instance of a class. The filename must have the same name as the public class name in that file.
3. A class can contain the following types of variables: Local variables, instance variables, class variables.
4. A class can also have methods. Method declarations have some components, in order: Modifiers, the return type, the parameter list in parenthesis, the method body (the method body must be enclosed in curly brackets).
5. Every class has a constructor. A constructor must have the same name as the class. A class can have more than one constructor, but in most cases, you need to define at least three types of the constructor: Default constructor, with no parameter; Parameterized constructor; Copy constructor.
6. Java provides several access modifiers to set access levels for classes, variables, methods, and constructors. The four access levels: private, protected, default, public.
7. To achieve encapsulation in Java:
  - Declare the variables of a class as private/protected.
  - Provide public getter and setter methods to modify and view the variable's values.

```
public class Student
{
    private String name;
    private String gender;
    private int age;

    public Student()
    {
        this.name = "";
        this.gender = "male";
        this.age = 0;
    }

    public Student(String name, String gender, int age)
    {
        this.name = name;
        this.gender = gender;
        this.age = age;
    }

    public Student(Student st)
    {
        this.name = st.name;
        this.gender = st.gender;
        this.age = st.age;
    }

    void studying()
    {
        System.out.println("studying...");
    }

    void reading()
    {
        System.out.println("reading...");
    }

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

    public String getGender()
    {
        return this.gender;
    }
}
```

```
public int getAge()
{
    return this.age;
}

public void setName(String name)
{
    this.name = name;
}

public void setGender(String gender)
{
    this.gender = gender;
}

public void setAge(int age)
{
    this.age = age;
}
}
```

## V. Exercises

### Array

1) Write a Java program:

- Write function `public static int maxEven(int[] a)` to find the greatest even number in an array.
- Write function `public static int minOdd(int[] a)` to find the smallest odd number in an array.
- Write function `public static int sumMEMO(int[] a)` to calculate the sum of the greatest even number and the smallest odd number in an array.
- Write function `public static int sumEven(int[] a)` to calculate the sum of even numbers in an array.
- Write function `public static int prodOdd(int[] a)` to calculate the product of odd numbers in an array.
- Write function `public static int idxFirstEven(int[] a)` return the position of the first even number in the array.
- Write function `public static int idxLastOdd(int[] a)` return the position of the last odd number in the array.

- h) Write function `public static int[] input(int n)` return an array with **n** elements which input from keyboard.
- i) Write a main function `public static void main(String []args)`:
- Input **n** and an array with **n** elements from keyboard.
  - Call above functions and test them with input data.

## String

- 1) Write a Java program:
- Write a function `public static String shortName(String str)` to first and last name.  
Ex: “Nguyen Le Trong Tin” => “Tin Nguyen”.
  - Write a function `public static String hashtagName(String str)` to create names with hashtag.  
Ex: “Nguyen Le Trong Tin” => “#TinNguyen”.
  - Write a function `public static String upperCaseAllVowel(String str)` to uppercase all vowel letters in a string.  
Ex: “Nguyen Le Trong Tin” => “NgUyEn LE TrOng TIn”.
  - Write a function `public static String upperCaseAllN(String str)` to uppercase all n letters in a string.  
Ex: “Nguyen Le Trong Tin” => “NguyeN Le TroNg Tin”.
  - Write a main function `public static void main(String []args)` to test above functions.
- 2) For the following paragraph: “*The Edge Surf is of course also a whole lot better, which will hopefully win Microsoft some converts. It offers time trial, support for other input methods like touch and gamepads, accessibility improvements, high scores, and remastered visuals.*”
- Write function `public static int countWord(String paragraph)` to count the number of words in the paragraph.
  - Write function `public static int countSentences(String paragraph)` to count the number of sentences in the paragraph.
  - Write function `public static int countAppear(String paragraph, String word)` to count the number of occurrences of the **word** in the paragraph.

- Write a main function `public static void main(String []args)` to test above functions.

## OOP, Class, Encapsulation

1) Implement the **Club** class is defined as the description below:

### Attributes:

- **name:** String.
- **wins:** int (number of wins).
- **draws:** int (number of draws).
- **losses:** int (number of losses).

### Constructors:

- Constructor with no parameter `public Club()` (name = "", wins = 0, draws = 0, losses = 0).
- Constructor with parameters `public Club(String name, int wins, int draws, int losses)`.
- Copy constructor `public Club(Club club)`.

### Methods:

- `public String getName():` return the name of the club.
- `public int getWins():` return number of wins.
- `public int getDraws():` return number of draws.
- `public int getLosses():` return number of losses.
- `public void setName(String name):` set the name of the club.
- `public void setWins(int wins):` set the number of wins.
- `public void setDraws(int draws):` set the number of draws.
- `public void setLosses(int losses):` set the number of losses.
- `public int numMatchesPlayed():` return the number of matches that club played  
$$\text{numMatches} = \text{win} + \text{draw} + \text{lose}.$$
- `public int isFinish():` Check if the club has finished the league yet. It is known that the league has 10 matches.

- **public int getPoints():** Return the number of points the club has received

$$\text{points} = \text{win} * 3 + \text{draw} * 1 + \text{lose} * 0.$$

- **public String toString()** with format: Club **name**: **wins/draws/losses**

Write a test program (called TestClub) to test all the methods defined.

2) Implement the RegularPolygon class is defined as the description below:

**Attributes:**

- **name:** String.
- **egdeAmount:** int (amount of edges).
- **egdeLength:** double (length of edge).

**Constructors:**

- Constructor with no parameter **public RegularPolygon()** (name = "", edgeAmount= 3, egdeLength = 1).
- Constructor with parameters **public RegularPolygon(String name, int edgeAmount, double edgeLength)**.
- Constructor with parameters **public RegularPolygon(String name, int edgeAmount)** (egdeLength = 1).
- Copy constructor **public RegularPolygon(RegularPolygon polygon)**.

**Methods:**

- **public String getName():** return the name of the polygon.
- **public int getEdgeAmount():** return amount of edges.
- **public int getEdgeLength():** return length of edge.
- **public void setName(String name):** set the name of the polygon.
- **public void setEdgeAmount(int num):** set amount of edges.
- **public void setEdgeLength (double length):** set length of edge.
- **public String getPolygon():**
  - If the amount of edges equals 3 then return "Triangle",
  - If the amount of edges equals 4 then return "Quadrangle",



- If the amount of edges equals 5, then return "Pentagon",
  - If the amount of edges equals 6, then return "Hexagon",
  - If the amount of sides equals greater than 6, return on "Polygon has the number of edges greater than 6".
- **public double getPerimeter():** return the perimeter of the polygon  
$$\text{perimeter} = \text{egdeLength} * \text{egdeAmount}.$$
  - **public double getArea():** return the area of the polygon

$$\text{area} = (\text{egdeLength})^2 * a$$

egdeAmount	a
3	0.433
4	1
5	1.72
6	2.595

If a polygon has the number of edges greater than 6 return area = -1.

- **public String toString()** with format: **name - PolygonType - Area**

Example: RegularPolygon rp = new RegularPolygon("q1", 4) will be printed like the following string: q1 - Quadrangle - 1.

Write a test program (called TestRegularPolygon) to test all the methods defined.