

OBJECT-ORIENTED PROGRAMMING

LAB 5: REVIEW

I. Objective

After completing this tutorial, we want you:

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

II. Array

1. Array is 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 the 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, and 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, and 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: are *private*, *protected*, *default*, and *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:
 - a) Write function `public static int maxEven(int[] a)` to find the greatest even number in an array.
 - b) Write function `public static int minOdd(int[] a)` to find the smallest odd number in an array.
 - c) 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.
 - d) Write function `public static int sumEven(int[] a)` to calculate the sum of even numbers in an array.
 - e) Write function `public static int prodOdd(int[] a)` to calculate the product of odd numbers in an array.
 - f) Write function `public static int idxFirstEven(int[] a)` return the position of the first even number in the array.
 - g) 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 the keyboard.
- Call the 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 the 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 the 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 the 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 the club played
$$\text{numMatches} = \text{win} + \text{draw} + \text{lose}.$$
- **public boolean 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 the 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.
- **edgeAmount:** int (amount of edges).
- **edgeLength:** double (length of edge).

Constructors:

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

Methods:

- **public String getName():** return the name of the polygon.
- **public int getEdgeAmount():** return the number of edges.
- **public int getEdgeLength():** return the length of an 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 the 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 edges is greater than 6, return on "Polygon has the number of edges greater than 6".
- **public double getPerimeter():** return the perimeter of the polygon
perimeter = edgeLength * edgeAmount.

- **public double getArea():** return the area of the polygon

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

edgeAmountl	a
3	0.433
4	1
5	1.72
6	2.595

If a polygon has several edges greater than 6 return area = -1.

- **public String toString()** with the 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.

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