# Department of Computer Science
# Faculty of Physical Sciences
# Ahmadu Bello University, Zaria

## COSC 211 : Object Oriented Programming I - LAB02

### Objectives:

To gain experience with:

- Creating objects from classes
- Fundermental Data Types
- The String class

### 1. Creating Objects from classes

Java is an **object-oriented** programming language, meaning problems are solved by interaction among objects.

An **Object** is a software-entity that models some real-world entity – e.g. A particular rectangle, a particular student, etc.

Each object has a state (represented by its **fields**) and behaviors (represented by its **methods**).

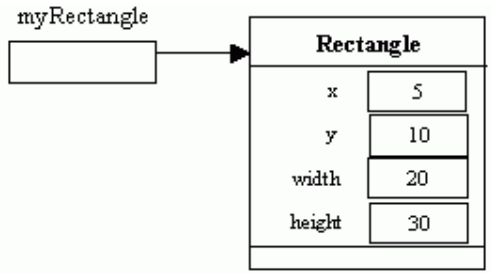
Objects are created from **classes**, thus to create an object, we need first to design a class. We can also use classes from the Java library. The Java library consists of hundreds of classes organized into related groups called **packages**.

A **class** is a general blueprint or specification for a set of objects in which fields and methods are defined.

To create an object from a class, we use the ***new*** operator as follows:

```
Rectangle myRectangle = new Rectangle(5,10, 20, 30);
```

In the above, **Rectangle** is a class provided in the Java library under **java.awt** package. When creating a rectangle object, we need to provide values for the top-left corner (x,y), with and height of the rectangle object. The new operator creates the rectangle object and returns the address of the object in memory which is then assigned to the **reference** variable ***myRectangle.***




Once an object is created, we can call its methods using the **dot** operator. For example, to call the **translate** method, we write:

```
myRectangle.translate(10, 15).
```

The following is a complete program showing the above points. Notice that if we use a Java library class that is not in the java.lang package, we must import the class using the ***import*** statement.

**Example1:**

```
import java.awt.Rectangle;


/*  Creates a rectangle object, calls its translate method and then print it. */

public class MoveRectangle {

        public static void main(String[] args) {

                Rectangle myRectangle=new Rectangle(5, 5, 10, 10);

                System.out.println("Before Translation: "+myRectangle);

                myRectangle.translate(15,25);
```

```
                System.out.println("After Translation: "+myRectangle);

        }

}
```

## 2. The String Class.

A string is a sequence of characters enclosed in double quotes.

String processing is one of the common applications of computers. Java recognizes this fact and therefore provides special support for string processing through a class called **String** in the java.lang package, which has many useful methods.

To create a string object from the string class we can use the new operator as follows:

```
String s = new String("the content of the string in quates");
```

However, because of its common use, Java allows strings objects to be created without using the new operator as in:

```
String greeting = "Hello, World!";
```

In a string object, the characters are indexed starting from 0 as shown below:

***greeting***

| address of object |
|---|

| H | e | l | l | o | , |  | W | o | r | l | d | ! |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

The table below shows some of the most frequently used methods of the String class:

| method | description | String myString = "examples" |
|---|---|---|
| `int length()` | returns the number of characters in this String. | `int i = myString.length();`<br>`// i = 8` |
| `String toUpperCase()` | returns a new String, representing the Upper-case equivalent of this String. | `String upper=myString.toUpperCase();`<br>`// upper == "EXAMPLES"` |
| `String toLowerCase()` | returns a new String, representing the lower-case equivalent of this String. | `String lower=myString.toLowerCase();`<br>`// lower == "examples"` |
| `boolean equals(String s)`<br>`Boolean equalsIgnoreCase (String s)` | returns true if the argument has the same length, and same characters as this String.<br>the second version ignores the case. | `if (myString.equals("EXAMPLES") )`<br>`// false` |
| `int compareTo(String s)`<br>`int compareToIngoreCase (String s)` | returns positive number, 0, or negative number if this String is greater than, equal to or less than the argument respectively. | `if (myString.compareTo("Yes")>0 )`<br>`// true` |
| `char charAt(int index)` | returns the char in this String, at the index position passed to the method. Note: Index positions always start at 0 | `char c = myString.charAt(6);`<br>`// c = 'e'` |
| `int indexOf(int ch)`<br>`int lastIndexOf(int ch)`<br>`//also overloaded to accept String parameter` | finds the first / last occurrence of a character or substring within this string, and returns the index. If the substring or char is not found -1 is returned. | `int i = myString.indexOf("amp");`<br>`// i == 2`<br>`if (myString.indexOf("Y") > 0)`<br>`// returns -1 and is false` |
| `String substring (int from)`<br>`String substring (int from, int to)` | returns a part of the original String starting from the fromIndex to the end of the string or up to but not including toIndex if one is given. | `String s=myString.substring(5)`<br>`// returns "ample" and "les"`<br>`String s=myString.substring(2, 7);`<br>`// returns "les"` |
| `String trim()` | returns a String, produced by removing any whitespace characters from the beginning and | `String s = "  125  ";`<br>`s = s.trim();` |

| | | |
|---|---|---|
| | end of this string. | `//returns "125"` |
| `static String valueOf (any primitive type)` | is a static method, that is overloaded for all the primitive data types, and returns a String representation of the argument. | `String s = String.valueOf(3.14F); // numbers to Strings "3.14"` |
| `String concat(String s) //equivalent to + symbol` | append the argument string at the end of this string. | `String s = myString.concat(" below") // returns "examples below"` |

**Example 2:**

The following example generates a password for a student using his initials and age. (note: do not use this for your actual passwords).

```
/* generates a password for a student using his initials and age */


public class MakePassword {

      public static void main(String[] args) {

            String firstName = "Amr";

            String middleName = "Samir";

            String lastName = "Al-Ibrahim";

            int age = 20;


            //extract initials

            String initials =

                 firstName.substring(0,1)+

                 middleName.substring(0,1)+

                lastName.substring(3,4);



            //append age

            String password = initials.toLowerCase()+age;


            System.out.printf("Your Password =%-20s",password);

      }

}
```

## 3. Assignments

1. Write a program that will do the following.:

(a) Declare a double variable named miles with initial value of 10.5, increase its value by 1 using the increament operator. Show the result in the form:

```
"The current value of miles is now: ... "
```

(b) Declare *X*, *Y*, *Z* as doubles, a as an integer equal to 1, and d as a double equal to 1.0. Compute the values of the following expressions.

```
X = d + 43 % 5 * (23 * 3 % 2),
Y = 1.5 * 3 + (++a), and
Z = 3 + d * d + 4.
```

(c) Declare *R* and *p* to be doubles with *p* storing the value 3.758. Compute and display the value of *R*, where *R= log p*.

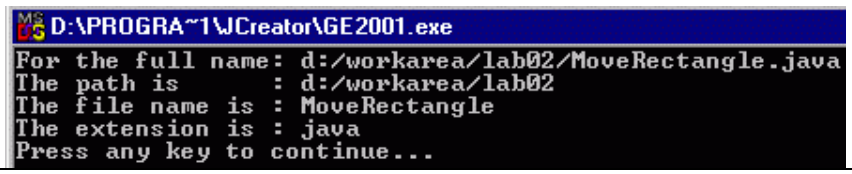
2. Use either Math.PI or declare PI as constant and use it below:
   Write a program that will display the following;

"The value of Cos 30° is ...",
"The value of exp(15) is ..."
"The value of Sin 30° is: ..."
"The absolute value of k is …"
"The value of tan 30° is ..."

where k = 2 / 4 * 4 % 3, Note also that 30° = (PI * 30)/180 radian

3. Write a program that breaks a given email address into username and domain name


4. Write a program that breaks a given full file name into path, filename and extension..




## 4. Home Work

1. The class Random of the java.util package can be used to create an object which can then be used to generate a random integer number from 0 to a given maximum.
   **Example:**

```
Random rand = new Random();
int randomInt = rand.nextInt(1000);
```

   Improve the password example by generating a random number, multiply the random number with the age before appending it to the initials.

2. Write a program to evaluate and print the value of the following mathematical function :

$$f(x,y) = 2x^2 - y + 3$$

   Vary the values of x and y according to the following table and prints the values of f(x,y) as shown in the table.

| x | y | f(x,y) |
|---|---|---|
| 3.0 | 3.0 | |
| 2.0 | 3.0 | |
| -4.0 | 2.0 | |

Very important guidelines:

1. You should submit both printed copy and soft copy in a flash drive bofore the next lab.
2. All your programs files should be saved in a folder HW1 on your flash drive.
3. Code your programs according to the Java naming conventions -- check this out on my home page.
4. Indent your work so that content of a class and methods are pushed inside by a tab or at least three spaces.
5. Use comments at the beginning of each program to explain its purpose. Also include your name and ID number as part of the comment.
6. Use comments to explain each variable whose purpose cannot be determined from its name.