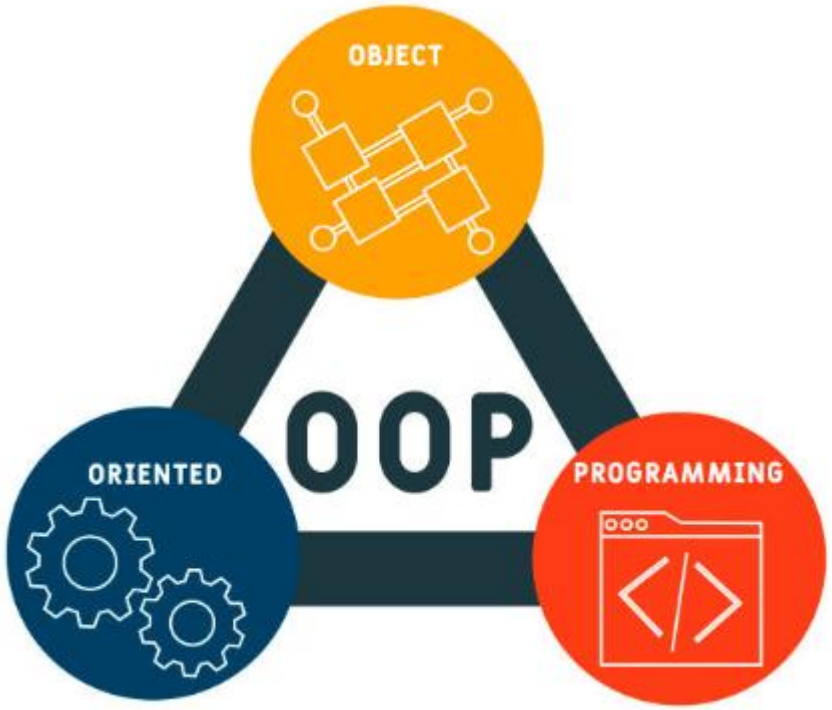


OOP Concepts and Implementation

Nimesha Hewawasam

Lecturer
nimesha.h@nsbm.ac.lk

Content

- Object Oriented Programming
- OOP Hierarchy
- Files, Folders and Packages
- Classes
- Class Scope
- Variables
- Objects
- Constructors
- Object Generation
- Methods

Introduction to OOP in Java

- Java is an **Object-Oriented Programming Language**.
- OOP organizes code into **classes** and **objects**.
- Use **Multi Threading**
- Benefits:
  - Code reusability
  - Modular design
  - Easier maintenance

OOP Hierarchy

- Classes
- Objects
- Methods
- Variable
- Those are only things we need to do program.

Files, Folders and Packages

- **Class**:
  - source – *classname*.java
  - compiled – *classname*.class
- **Package**:
  - collection of classes, like a library
  - package name – all lower case
  - source package – in project folder, in subfolder src*packagename*
  - compiled – in project folder, in subfolder build\classes*packagename*

First application with Netbeans

Hello_World_App (Project Root): This is your **main project folder**. It contains everything related to your Java application.

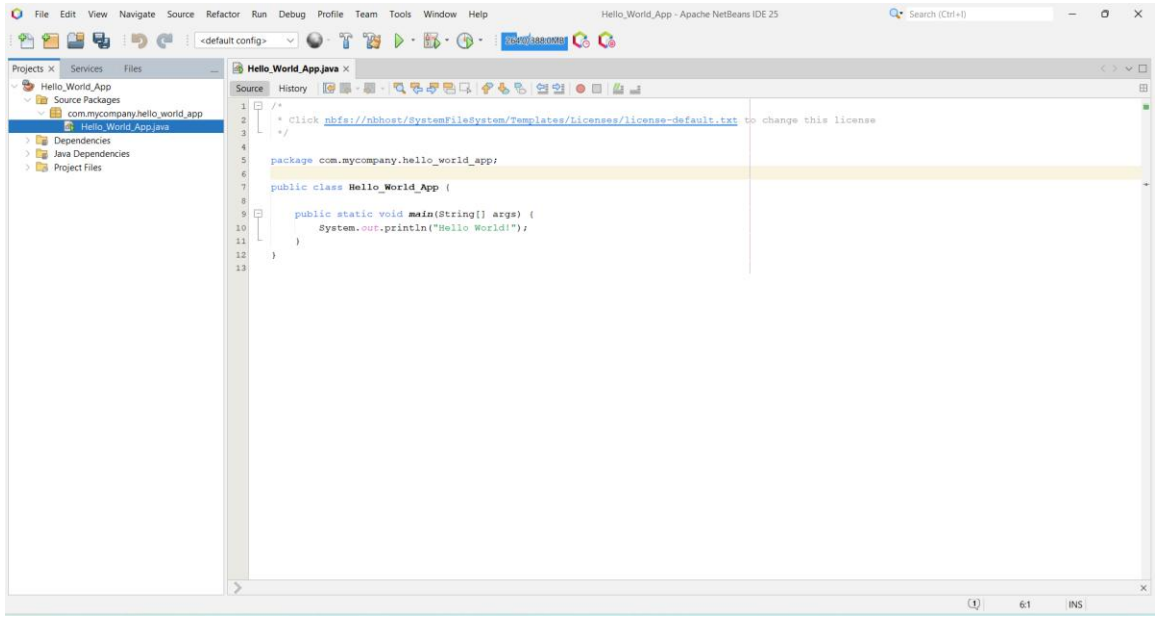
Source Packages:This folder holds your **Java source code** files, structured by **packages**.

com.mycompany.hello_world_app: is the package name

Hello_World_App.java: is your **Java class file** that contains the main() method

Dependencies / Java Dependencies :These folders show any external **libraries** or **Java platform dependencies** your project relies on. For a simple "Hello World", this remains default (i.e., standard Java libraries).

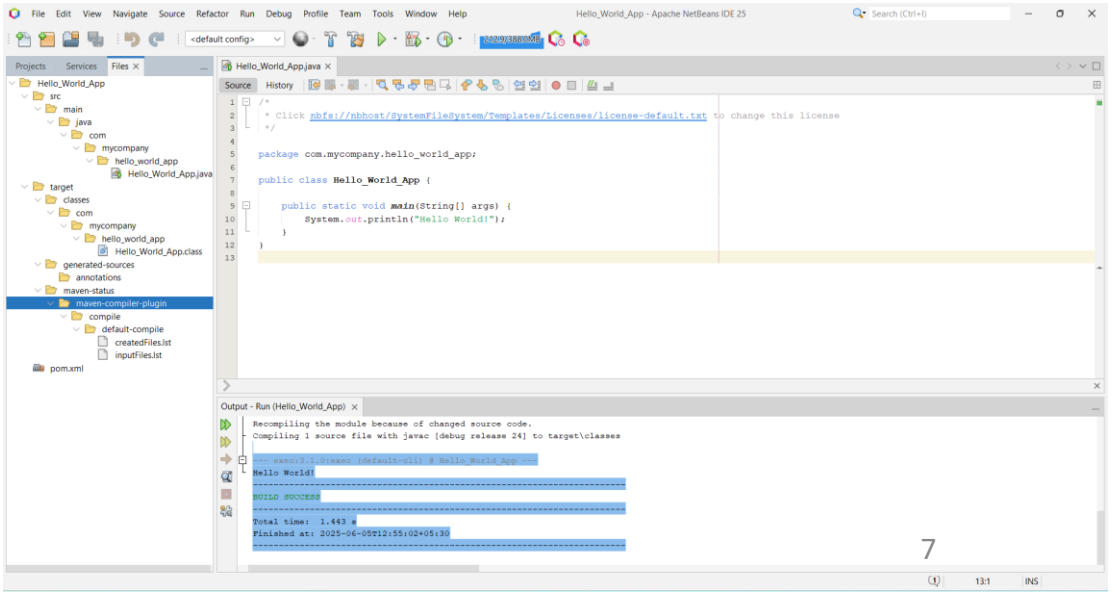
Project Files: This contains **metadata files** used by NetBeans to manage your project (like build configs, project settings, etc.). You usually don't need to edit these manually.



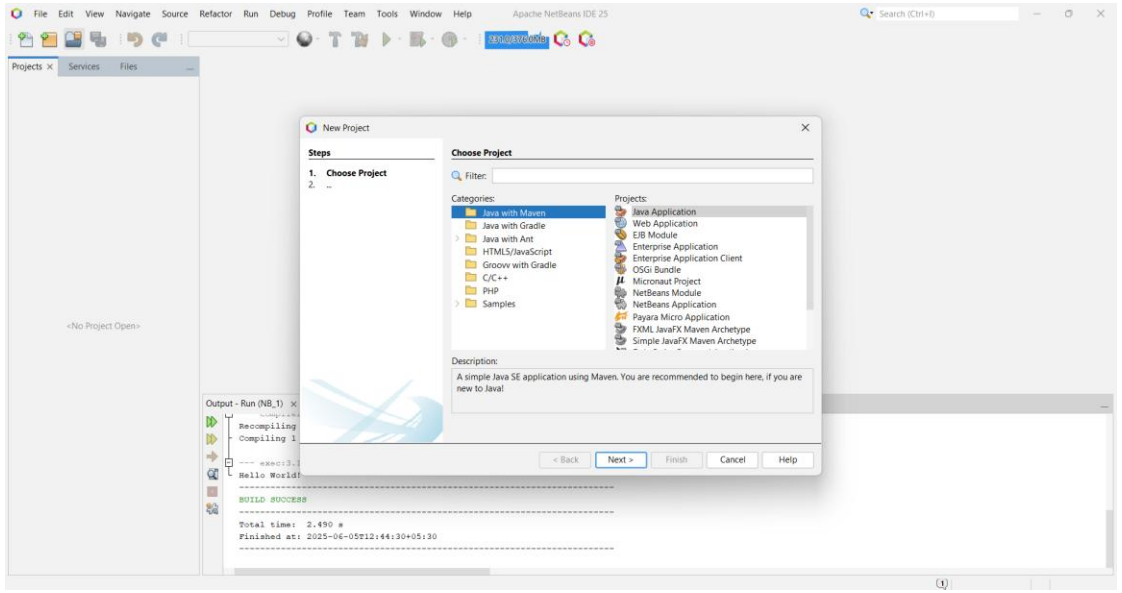
First application with Netbeans

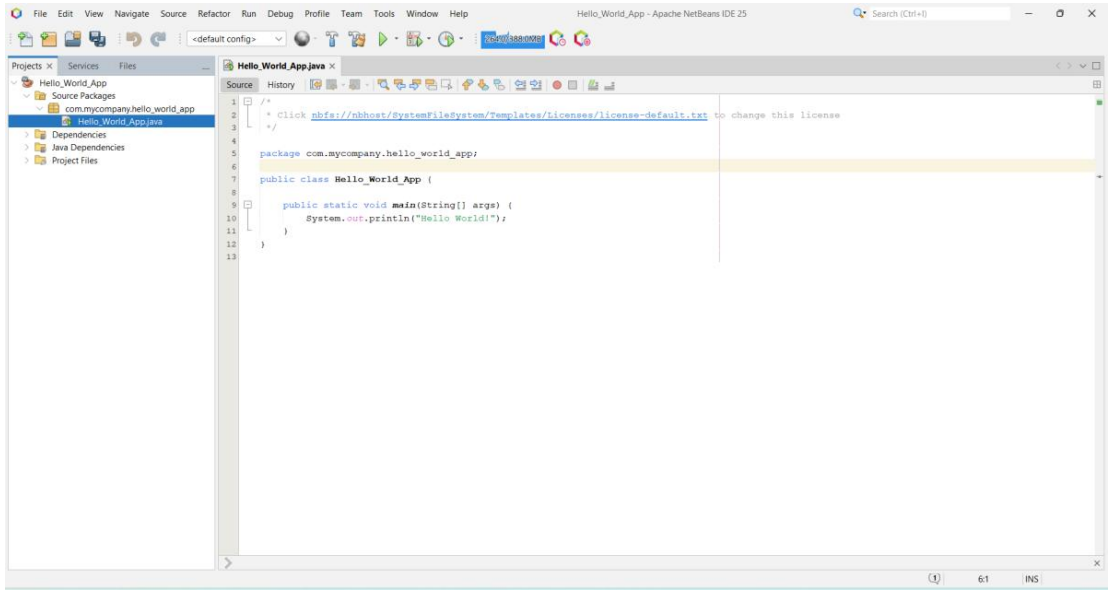
Hello_World_App (Project Root) :This is your entire Maven project folder.
src/main/java :Standard Maven project structure for source code.
com/mycompany/hello_world_app/Hello_World_App.java : Your source code file. This is the Hello World class you wrote.
Target:This is the output directory Maven uses to store compiled files and other generated content.
Inside target: classes/com/mycompany/hello_world_app/Hello_World_App.class. The compiled .class file for your Java source (.java) file.
generated-sources/annotations/ : Reserved for annotation processors (e.g., if you're using frameworks like Lombok or JPA in advanced cases).
maven-status & maven-compiler-plugin/compile/ :Internal Maven build system files for tracking compile actions and input/output.
pom.xml : This is your Maven configuration file.
It declares project metadata and dependencies.
For now, it's very simple — but later, you'll use this to:

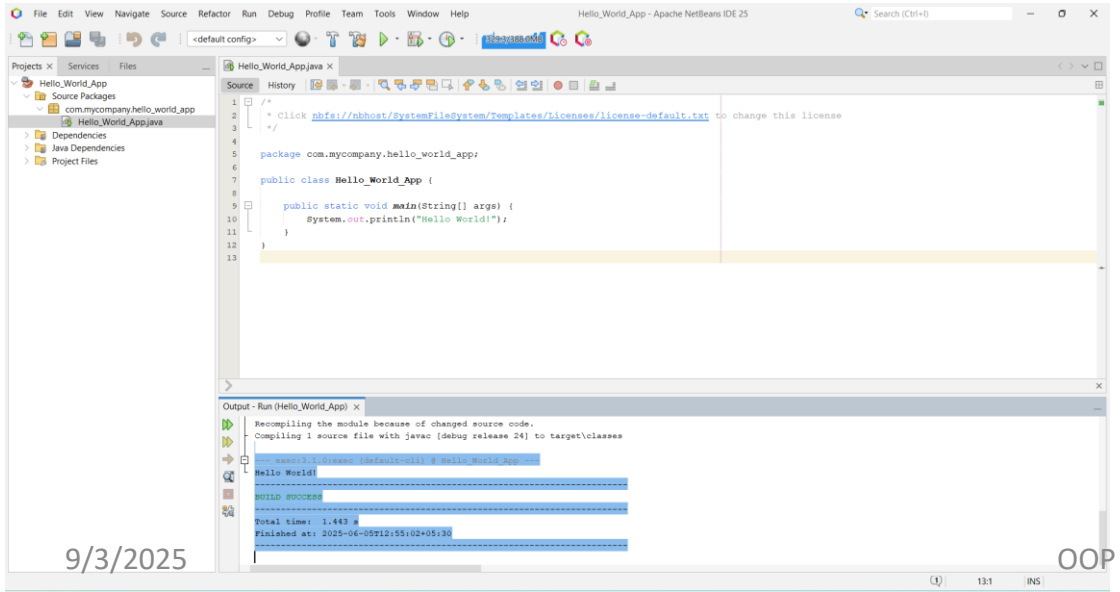
- Add libraries (e.g., JUnit, Spring Boot)
- Define Java version
- Configure plugins



First application with Netbeans







What is a Class?

- Class is a template to create objects having similar properties and behavior.
- Or we can say that a class is a blueprint for objects.
- Structural template that we use to keep our objects, methods, variables in an order.
- Also we can say it is a representation of the object.

```
access_modifier class<class_name> {
    data member;
    method;
    constructor;
    nested class;
    interface
    ;
}
```

Class Scope

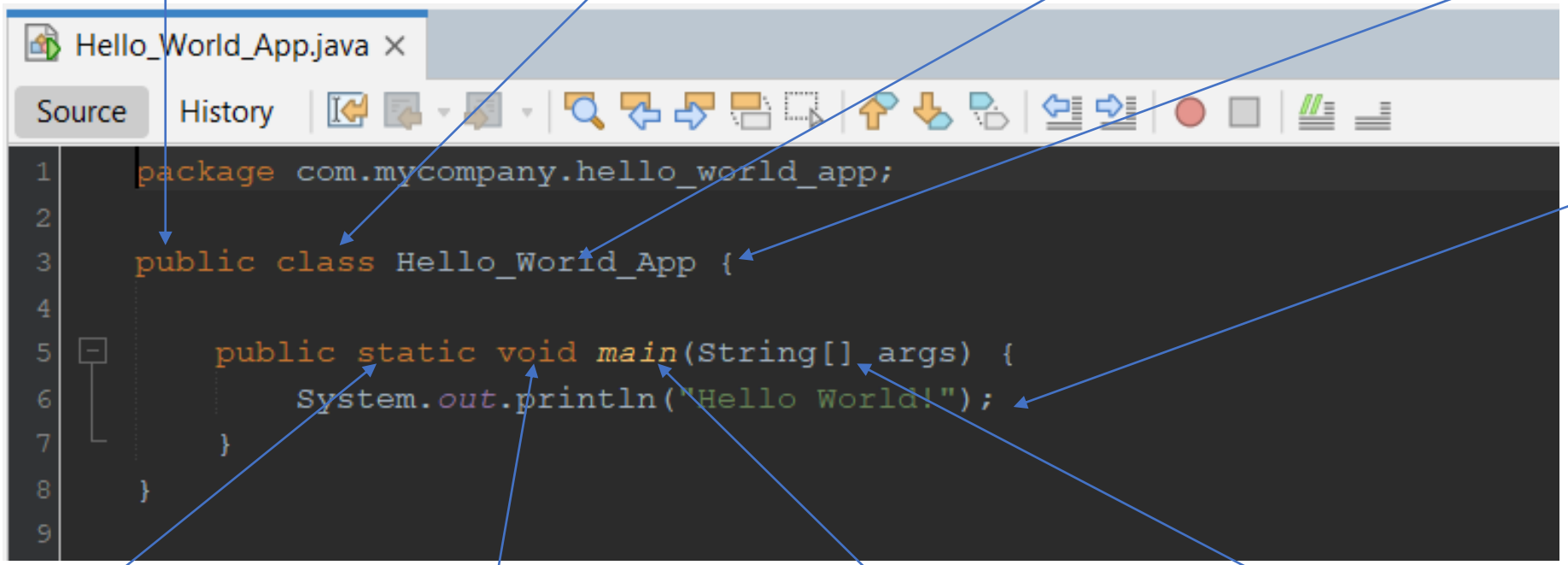
```java
class Students {

    // Class-level variable (has class scope)
    String name;

    // Constructor
    public Students(String studentName) {
        name = studentName;
    }

    // Method 1
    public void displayName() {
        System.out.println("Student Name: " + name);
    }

    // Method 2
    public void greet() {
        System.out.println("Hello, " + name + "!");
    }

    // Main method
    public static void main(String[] args) {
        Students s1 = new Students("Nimesha");
        s1.displayName();  // Accessing class scope variable
        s1.greet();        // Accessing class scope variable
    }
}
```

Access modifier — means the class or method is **visible to all** (any class can access it)

Keyword used to **declare a class** (a blueprint for objects)

Name of the class. By convention, should start with a **Capital Letter**

Braces - enclose the **body of the class or method**



Print statement: Print text to the console (no newline)

Means this method belongs to the **class itself**, not an object

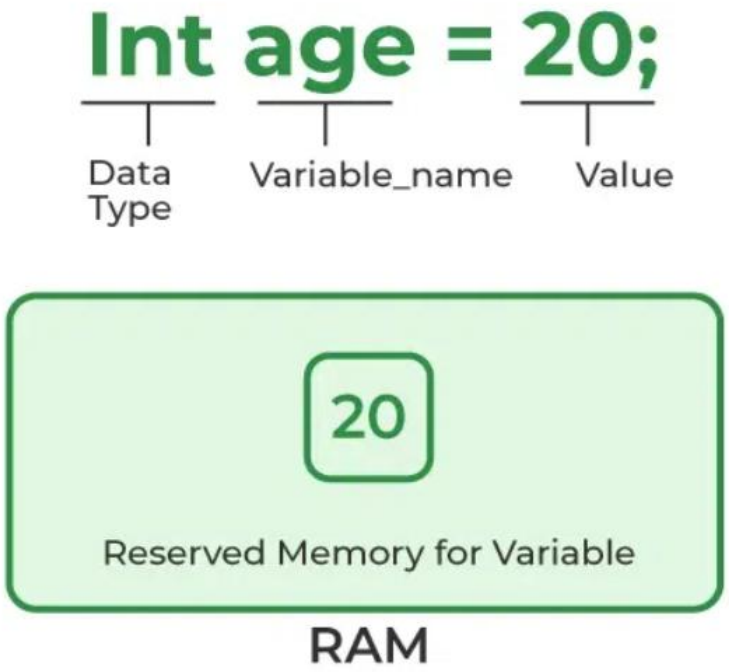
Return type — means this method **does not return any value**

The **entry point** of any Java application (method that runs first)

(String [] arg) : Accept **command-line arguments** (an array of Strings named arg)

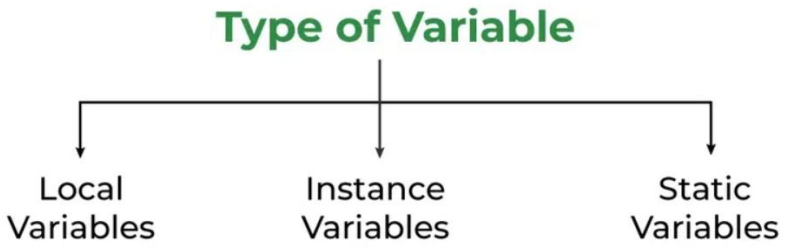
Variables

- **Definition**: A container that holds a value which can change during program execution.
- **Components**:
  - Data type - Defines the kind of data stored (e.g., int, String, float).
  - Variable name - A unique identifier following Java naming rules (camelCase).
  - Value - The actual data assigned to the variable.



Variables

```java
class VariableExample {

    // Instance variable
    int instanceVar = 10;

    // Static variable
    static int staticVar = 20;

    public void showVariables() {
        // Local variable
        int localVar = 5;

        System.out.println("Local Variable: " + localVar);          // 5
        System.out.println("Instance Variable: " + instanceVar);    // 10
        System.out.println("Static Variable: " + staticVar);        // 20
    }

    public static void main(String[] args) {
        VariableExample obj = new VariableExample();
        obj.showVariables();
    }

}
```



Instance vs Static Variables

Feature	Instance Variable	Static Variable
Copies per object	Each object has its own copy	Only one copy per class (shared by all objects)
Effect of modification	Changes affect only the object	Changes affect all objects
Access method	Accessed using object reference	Accessed using class name
Lifetime	Created when object is created, destroyed with object	Created when program starts, destroyed when program ends
Syntax example	int a;	static int a;

What is an Object?

- **Basic unit** of Object-Oriented Programming and **represents real-life entities.**
- An **object** is an instance of a class that are **created to use** the **attributes and methods** of a class.
- An object consists of:
  - State : represented by **attributes.** Reflect the **properties** of an object (***what you have***)
  - Behavior : **methods** of an object. (***what can you do***)
  - Identity : unique name (***who you are***).

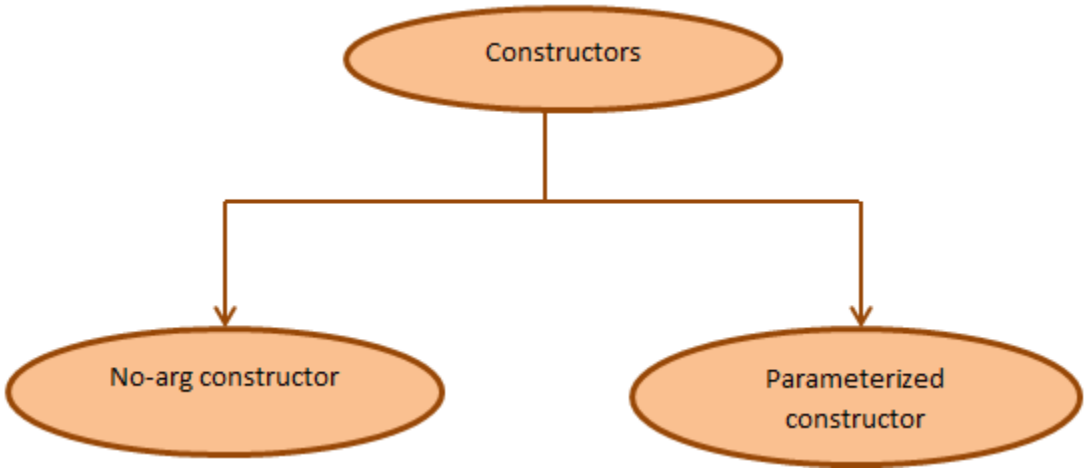
Constructor

- Special block of code that is called when an object is created
- **Key points of Constructors:**
  - Same Name as the Class
  - No need a return type : **purpose is initialize the object, not to return a value**
  - Automatically called on object creation

```java
class Bick {

    //create the constructor
    Bick(){
        System.out.println("I am the one who work first");
    }

    //Main method
    public static void main(String[] args) {

        //Create the Object
        Bick obj_bick = new Bick();
    }
}
```

Constructor

- **Types of Constructors in Java**
  - Default Constructor
  - Parameterized Constructor




```
// Java Program to demonstrate
// Default Constructor
// Driver class
class Car{

    // Default Constructor
    Car() {
        System.out.println("Default constructor");

    }

    // Driver function
    public static void main(String[] args)
    {
        Car hello = new Car();
    }
}
```

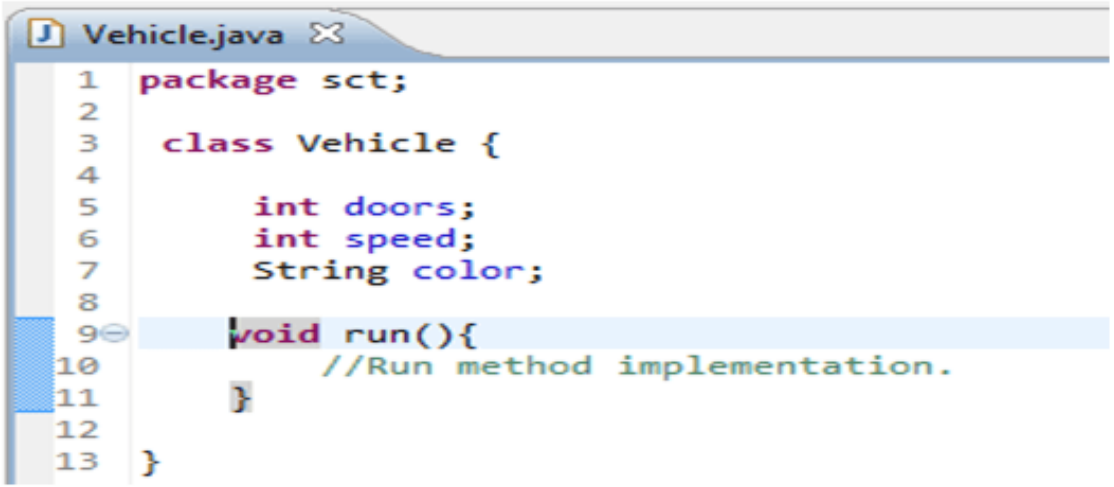
```
class Student {

    // data members of the class
    String name;
    int id;

    Student(String name, int id) {
        this.name = name;
        this.id = id;
    }
}

class GFG
{
    public static void main(String[] args)
    {
        // This would invoke the parameterized constructor
        Student student1 = new Student("Anura", 68);
        System.out.println("Student Name: " + student1.name
                           + " and Student Id: " + student1.id);
    }
}
```

Object Generation

```java
class Animal {
    // Instance variable
    String type = "Dog";

    // Method
    void makeSound() {
        System.out.println("The " + type + " says: Woof!");
    }

    public static void main(String[] args) {
        // Object creation
        Animal myAnimal = new Animal();

        // Calling method using the object
        myAnimal.makeSound();
    }
}
```

Methods

- Blocks of code that perform a specific task
- It shows **behaviors** that **change** from each others
- Allows us to reuse code, improving both efficiency and organization
- All **methods in Java** must belong to a **class**



Methods

- Pre Define Methods:
  - Already defined in the Java class libraries

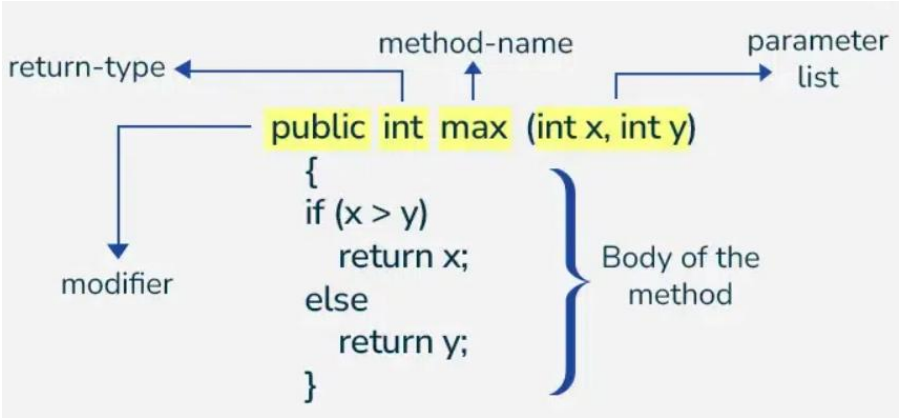
```
Math.random()    // returns random value
Math.PI()     // return pi value
```

- User Define Methods:
  - Written by the user or programmer

```
public void printMessage() {
    System.out.println("Hello, Java!");
}
```

Methods

- There are points that we need to consider to create a method
  - Modifier : **access level** [based on the requirement]
  - Return type : type of value **returned**, or ***void*** if **no value is returned**
  - Method name : **must**
  - Parameters : list of **input parameters** inside parentheses ()
  - Method body : **scope {}**



All Together

```java
// A simple class to introduce Class, Constructor, Methods, Variables, and Objects
public class Student {
    // Attributes (variables)
    String name;
    int age;
    // Constructor (to initialize variables)
    public Student(String n, int a) {
        name = n;
        age = a;
    }
    // Method 1
    public void displayInfo() {
        System.out.println("Name: " + name + ", Age: " + age);
    }
    // Method 2
    public void study() {
        System.out.println(name + " is studying.");
    }
    // Main method
    public static void main(String[] args) {
        // Create an object of Student
        Student s1 = new Student("Anura", 22);

        // Call methods using the object
        s1.displayInfo();   // shows student details
        s1.study();         // shows action
    }
}
```