



# Java Programming in VS Code

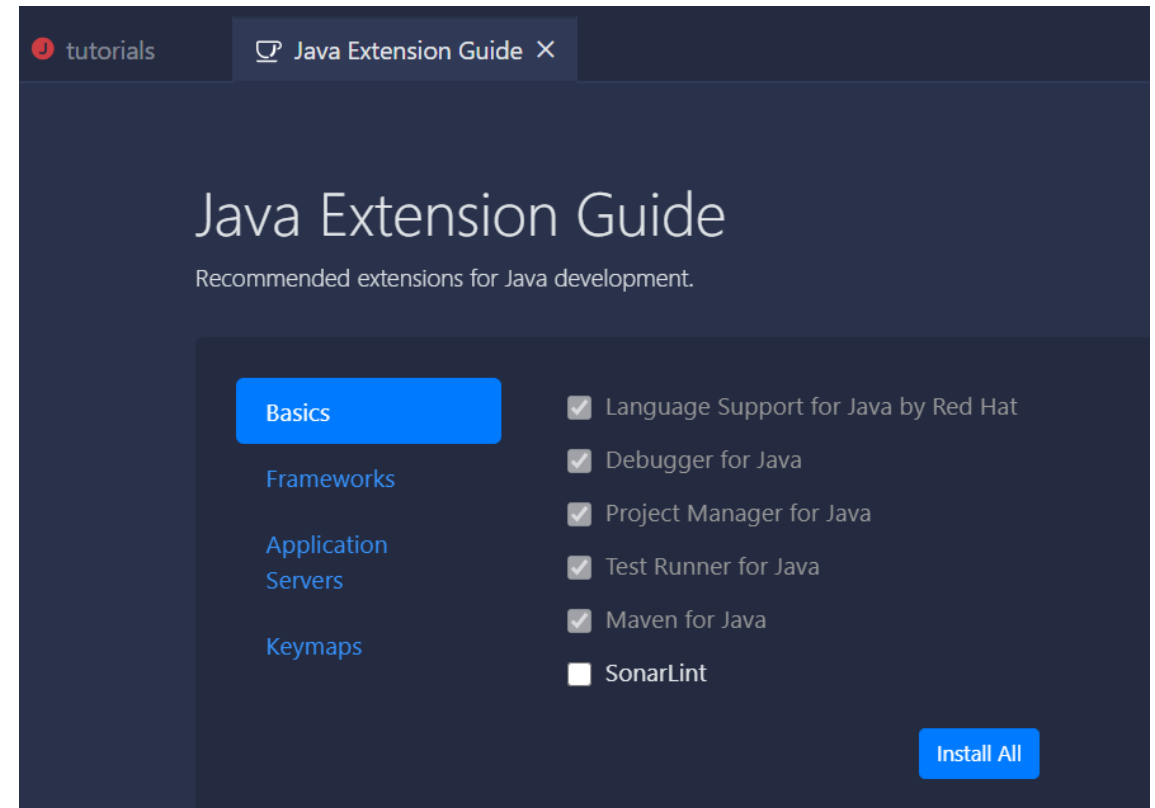
Neba Nfonsang, 2021  
University of Denver

# Setting up VS Code for Java development

- You can either install Coding Pack for Java which includes:
  - VS Code
  - Java Development Kit (JDK)
  - Essential Java extensions
- Windows: <https://aka.ms/vscode-java-installer-win>
- MacOS: <https://aka.ms/vscode-java-installer-mac>
- If you already have VS code, you can install the **Java Extension Pack** instead, which includes:
  - [Language Support for Java\(TM\) by Red Hat](#)
  - [Debugger for Java](#)
  - [Java Test Runner](#)
  - [Maven for Java](#)
  - [Project Manager for Java](#)

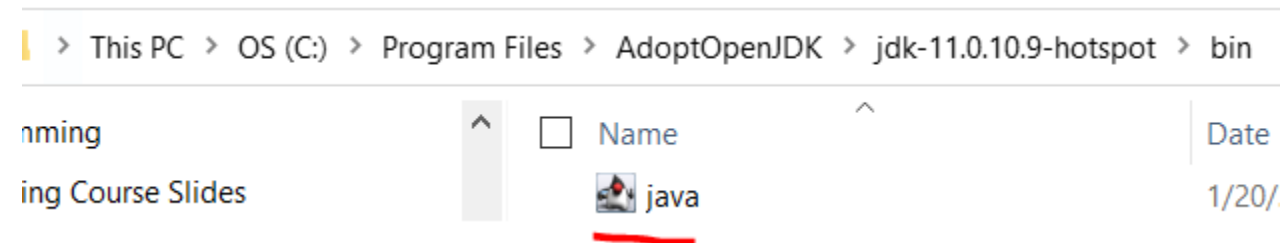
# Java Extension Pack

- Go to the command Palette using CTRL + SHIFT + P
- Then search **Java Extension Guide**.
- You would see all the extensions installed that come with the Java Extension Pack.
- To run VS Code for Java, Java SE 11 or above version is required;



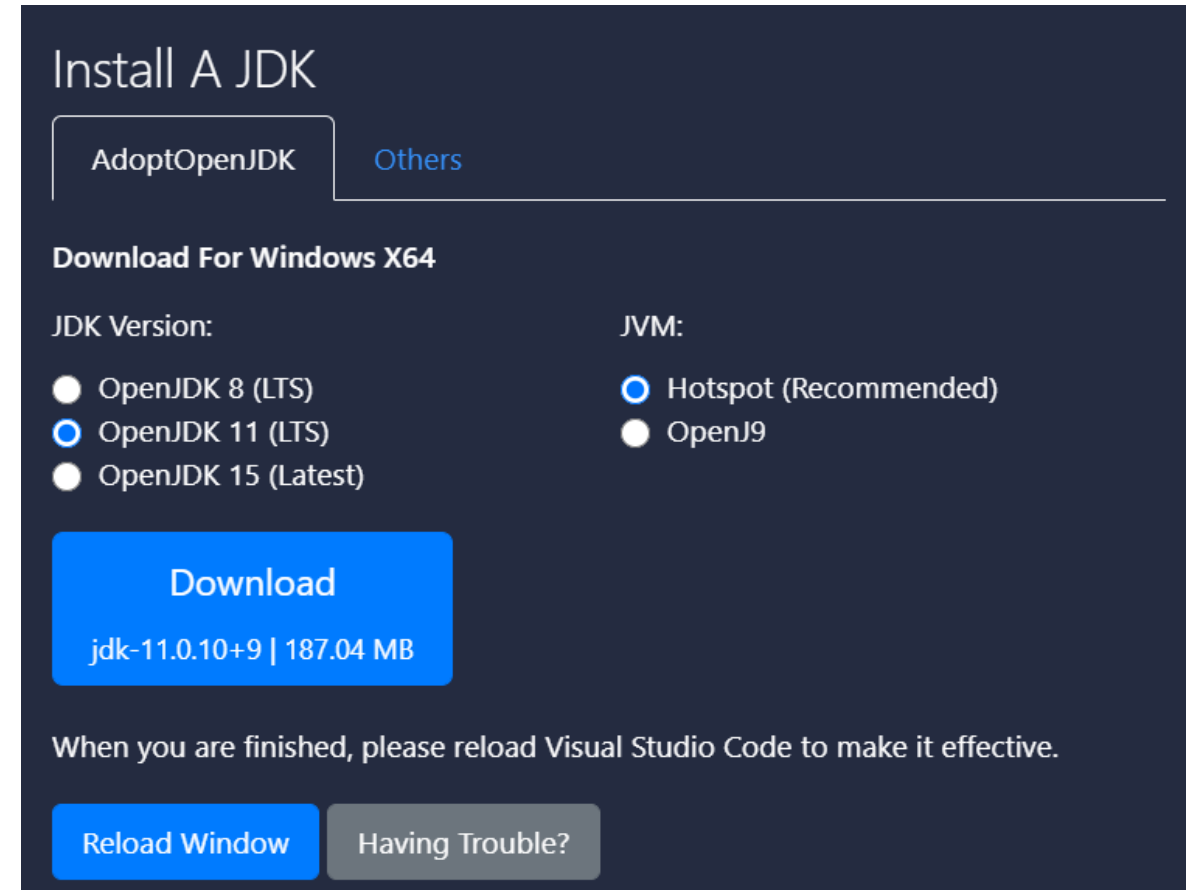
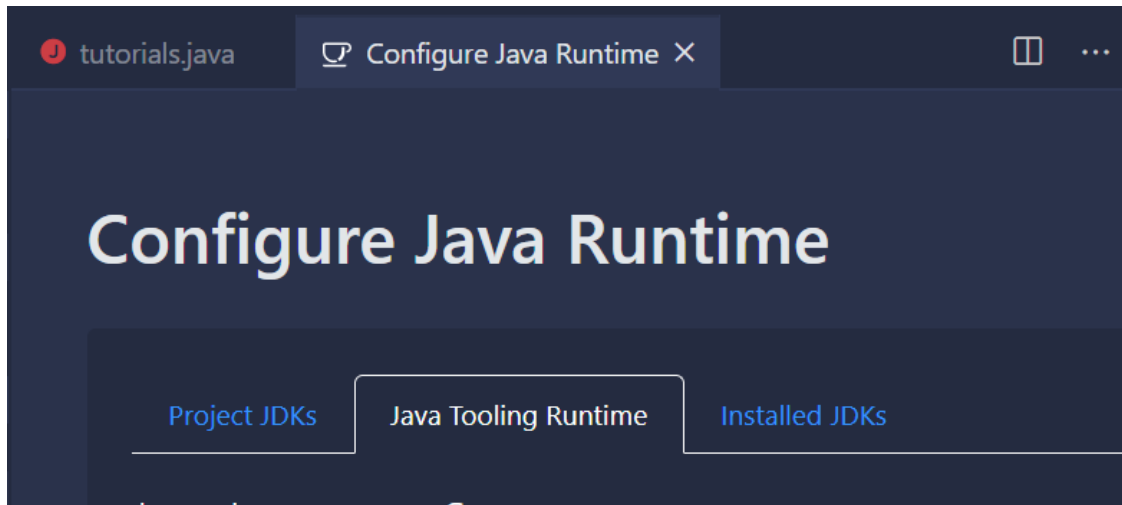
# JRE and JDK

- Java run environment (JRE) is used to run java applications
- Java development kit (JDK) is used to build and develop java programs.
- You can go to the command palette and find **Java Run Time** and scroll down to download an open JDK which has the java.exe



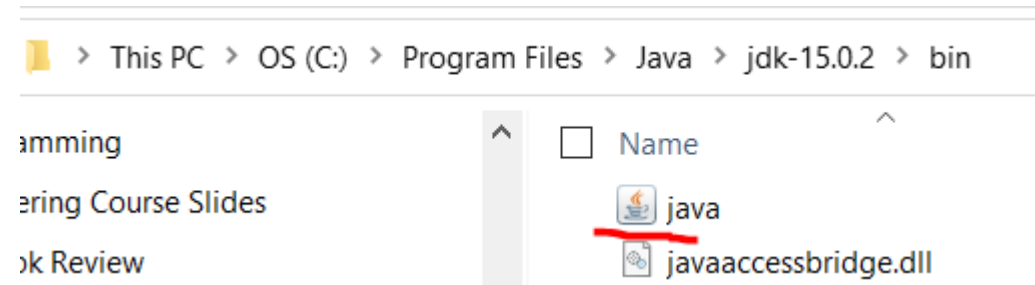
# Download and Install JDK from VS Code

- Use the command palette, find the **Configure Java Runtime** and scroll down and download JDK and install it on your computer



# Download and Install Java SE

- JDK, JRE and other tools for creating Java programs.
- Java SE contains JDK + JRE
- Alternative to the open JDK download and install the latest version of the Java SE to have access to the interpreter, java.exe  
<https://www.oracle.com/java/technologies/javase-jdk15-downloads.html>

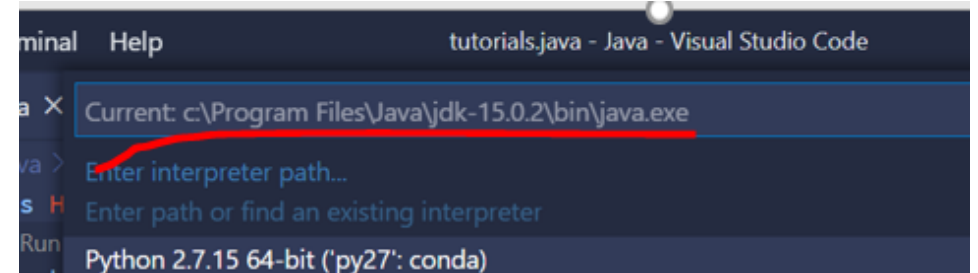


Before running a java file, make sure that the path to java interpreter is selected (you can use the status bar)



# Create Java File

- Create a Java file that ends with a file extension, .java
- Make sure to select the java interpreter that you downloaded with the Java SE.




```
App.java ×
src > App.java > ...
1 public class App {
    Run | Debug
2     public static void main(String[] args) {
3         System.out.println("Hello World");
4     }
5 }
6
```

Hello World

# Java Syntax

- In Java, every line of code to be run must be written inside a class
- The class name (App in this case) must match the file name.
- The main() method, `public static void main(String[] args)`, is required, it is used to execute any code written inside that method.
- That is, the main() method executes your Java program.

A screenshot of a Java IDE window titled 'App.java'. The code is as follows:

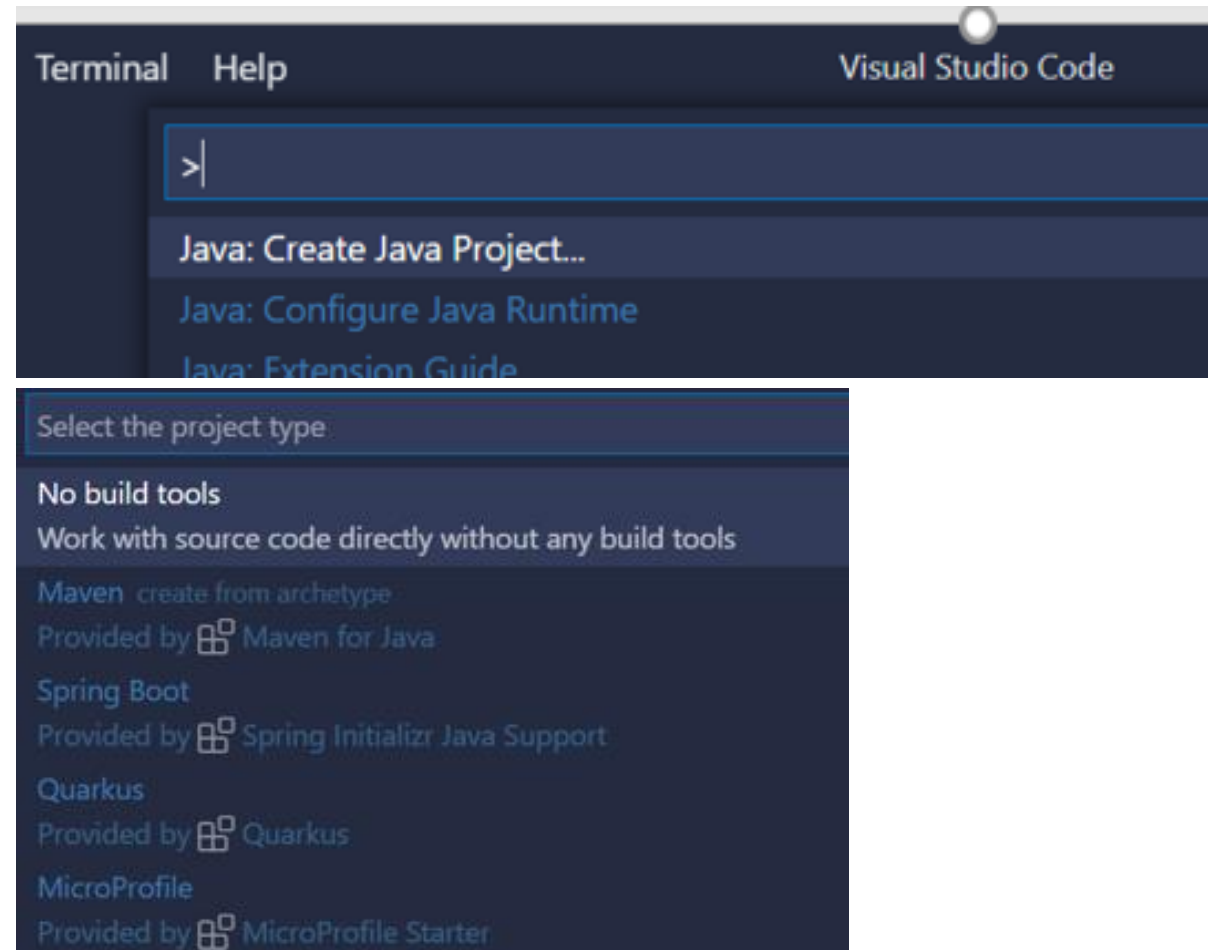
```
src > App.java > ...
1  public class App {
    Run | Debug
2      public static void main(String[] args) {
3          System.out.println("Hello World");
4      }
5  }
6
```

Java's print method `.println()` is used to print a value.  
{ } indicates the beginning and end of a code block

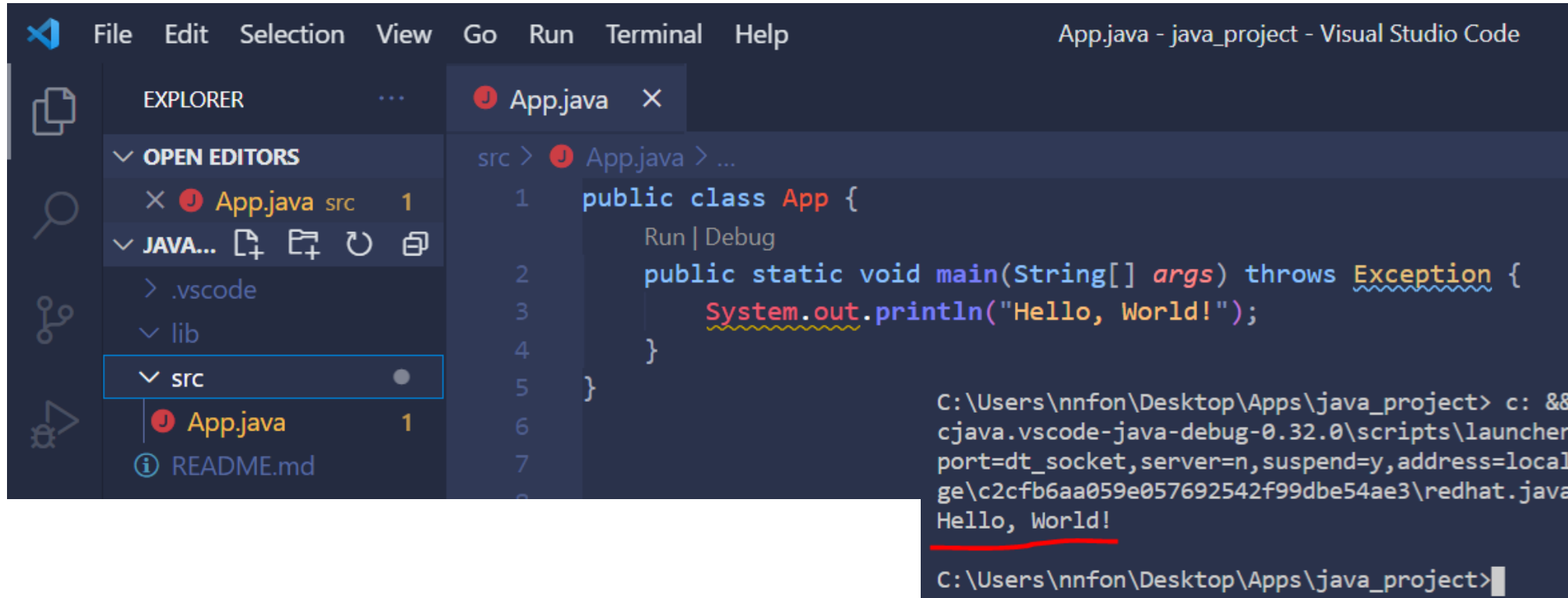


# Create a Java Project

- To create a java project, use the command palette and select Create Java Project.
- Then select the build tools to use with the project.
- For now, we will select the **No build tools** option.
- You will be prompted to select project location and to provide the name of the project.



# Java Project



```
File Edit Selection View Go Run Terminal Help
App.java - java_project - Visual Studio Code

EXPLORER
OPEN EDITORS
App.java src 1
JAVA...
.vscode
lib
src
App.java 1
README.md

src > App.java > ...
1 public class App {
2     Run | Debug
3     public static void main(String[] args) throws Exception {
4         System.out.println("Hello, World!");
5     }
6 }
7

C:\Users\nnfon\Desktop\Apps\java_project> c: &
cjava.vscode-java-debug-0.32.0\scripts\launcher
port=dt_socket,server=n,suspend=y,address=local
ge\c2cfb6aa059e057692542f99dbe54ae3\redhat.java
Hello, World!
C:\Users\nnfon\Desktop\Apps\java_project>
```

The java project is created with some initial folders and files including the source code folder and App file

# Data Types in Java

Data Type	Size	Description
byte	1 byte	Stores whole numbers from -128 to 127
short	2 bytes	Stores whole numbers from -32,768 to 32,767
int	4 bytes	Stores whole numbers from -2,147,483,648 to 2,147,483,647
long	8 bytes	Stores whole numbers from -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807
float	4 bytes	Stores fractional numbers. Sufficient for storing 6 to 7 decimal digits
double	8 bytes	Stores fractional numbers. Sufficient for storing 15 decimal digits
boolean	1 bit	Stores true or false values
char	2 bytes	Stores a single character/letter or ASCII values

[https://www.w3schools.com/java/java\\_data\\_types.asp](https://www.w3schools.com/java/java_data_types.asp)

# Data Types

- The main method is required in Java as this is the entry point into the program.
- We need to start writing the program after this entry point.
- Note that a comment is added in Java using two forward slashes //



The screenshot shows a code editor window titled 'App.java'. The code defines a public class 'App' with a static 'main' method. Inside the 'main' method, several variables are declared and initialized, demonstrating different Java data types: byte, short, int, long, float, double, char, String, and boolean. The 'int' variable 'num1' is printed to the console using 'System.out.println(num1);'. The code is as follows:

```
src > App.java > App > main(String[])
1  public class App {
    Run | Debug
2      public static void main(String[] args) {
3          byte b1 = 123;
4          short sh1 = 7654;
5          int num1 = 456789;
6          long l1 = 3456789;
7          float f1 = 12.5678f;
8          double d1 = 234.456789;
9          char ch1 = 'A';
10         String str1 = "qwerty12345";
11         boolean b2 = true;
12         System.out.println(num1);
13     }
14 }
```

# Type casting

- Type casting is the conversion of one primitive type to another. This happens when we assign the value of one primitive type to another.
- **Widening Casting** (automatically) - converting a smaller type to a larger type size  
byte -> short -> char -> int -> long -> float -> double

```
App.java
src > App.java > ...
1 public class App {
    Run | Debug
2     public static void main(String[] args) {
3         int length = 25;
4         float height = length; // automatically cast int to float
5         System.out.println(length); //outputs 25
6         System.out.println(height); //outputs 25.0
7     }
8 }
```

# Type Casting

- **Narrowing Casting** (manually) - converting a larger type to a smaller size type
  - double** -> **float** -> **long** -
  - > **int** -> **char** -> **short** -
  - > **byte**

```
App.java
src > App.java > ...
1 public class App {
    Run | Debug
2     public static void main(String[] args) {
3         float length = 25f;
4         int height = (int) length; // manually cast int to float
5         System.out.println(length); //outputs 25
6         System.out.println(height); //outputs 25.0
7     }
8 }
```

# Java Operators

Operator	Name	Example
+	Addition	$x + y$
-	Subtraction	$x - y$
*	Multiplication	$x * y$
/	Division	$x / y$
%	Modulus	$x \% y$
++	Increment	$++x$
--	Decrement	$--x$

Arithmetic operators

Assignment operators

Operator	Example	Same As
=	$x = 5$	$x = 5$
+=	$x += 3$	$x = x + 3$
-=	$x -= 3$	$x = x - 3$
*=	$x *= 3$	$x = x * 3$
/=	$x /= 3$	$x = x / 3$
%=	$x \% = 3$	$x = x \% 3$
&=	$x \& = 3$	$x = x \& 3$
=	$x  = 3$	$x = x   3$
^=	$x \wedge = 3$	$x = x \wedge 3$
>>=	$x >> = 3$	$x = x >> 3$
<<=	$x << = 3$	$x = x << 3$

# Java Operators

Operator	Name	Example
<code>==</code>	Equal to	<code>x == y</code>
<code>!=</code>	Not equal	<code>x != y</code>
<code>&gt;</code>	Greater than	<code>x &gt; y</code>
<code>&lt;</code>	Less than	<code>x &lt; y</code>
<code>&gt;=</code>	Greater than or equal to	<code>x &gt;= y</code>
<code>&lt;=</code>	Less than or equal to	<code>x &lt;= y</code>

Comparison operators

Operator	Name	Example
<code>&amp;&amp;</code>	Logical and	<code>x &lt; 5 &amp;&amp; x &lt; 10</code>
<code>  </code>	Logical or	<code>x &lt; 5    x &lt; 4</code>
<code>!</code>	Logical not	<code>!(x &lt; 5 &amp;&amp; x &lt; 10)</code>

Logical operators



# Examples of Operators

```
App.java ×
src > App.java > ...
1 public class App {
    Run | Debug
2     public static void main(String[] args) {
3         float length = 25f;
4         ++ length; // increase value by 1
5         System.out.println(length); //outputs 26
6     }
7 }
8 }
```

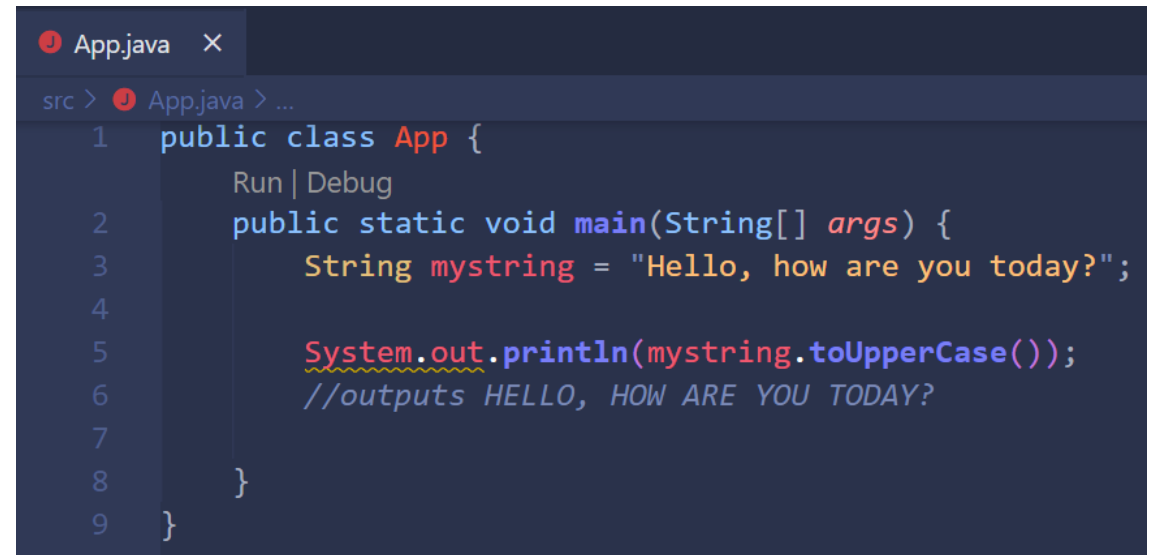
```
App.java ●
src > App.java > ...
1 public class App {
    Run | Debug
2     public static void main(String[] args) {
3         float length = 25f;
4         length += 10; // increase value by 10
5         System.out.println(length); //outputs 35
6     }
7 }
8 }
```

```
App.java ×
src > App.java > ...
1 public class App {
    Run | Debug
2     public static void main(String[] args) {
3         float length = 25f;
4         float width = 10;
5         float area = length*width;
6         System.out.println(area); //outputs 250
7     }
8 }
9 }
```

```
App.java ●
src > App.java > ...
1 public class App {
    Run | Debug
2     public static void main(String[] args) {
3         float length = 25f;
4         float width = 10;
5         System.out.println(length > width); //outputs true
6     }
7 }
8 }
```

# String Methods

- `.toUpperCase()` //converts to upper case
- `.toLowerCase()` // converts to lowercase
- `.length()` //prints the length of the sting
- `.indexOf()` // prints the position of the first occurrence



The screenshot shows a Java IDE with a file named 'App.java'. The code defines a public class 'App' with a main method. Inside the main method, a String variable 'mystring' is initialized with the value 'Hello, how are you today?'. The code then uses 'System.out.println(mystring.toUpperCase());' to print the string in uppercase. A comment below the print statement indicates the expected output: '//outputs HELLO, HOW ARE YOU TODAY?'. The IDE interface includes a tab for 'App.java', a toolbar with 'Run' and 'Debug' buttons, and a line number margin on the left.

```
App.java x
src > App.java > ...
1 public class App {
    Run | Debug
2     public static void main(String[] args) {
3         String mystring = "Hello, how are you today?";
4
5         System.out.println(mystring.toUpperCase());
6         //outputs HELLO, HOW ARE YOU TODAY?
7     }
8 }
9 }
```

# String Concatenation

- “john” + “is a good boy”
- String name = “john”
- String text = “is a good boy”
- String sentence = name + text

Or

- name.concat(text)

```
App.java ×
src > App.java > ...
1  public class App {
    Run | Debug
2  public static void main(String[] args) {
3      String mystring = "Hello, how are you today?";
4      String answer = " I am doing good!";
5
6      System.out.println(mystring + answer);
7      //outputs HELLO, HOW ARE YOU TODAY?
8
9  }
10 }
```

# Escape Character

```
App.java ×
src > App.java > ...
1 public class App {
  Run | Debug
2   public static void main(String[] args) {
3       String text1 = "It\'s ok";
4       String text2 = "It is called, \"encapsulation\"";
5
6       System.out.println(text1);
7       System.out.println(text2);
8   }
9 }
```

```
It's ok
It is called, "encapsulation"
```

Escape character	Result	Description
\'	'	Single quote
\"	"	Double quote
\\	\	Backslash

## Other escape characters

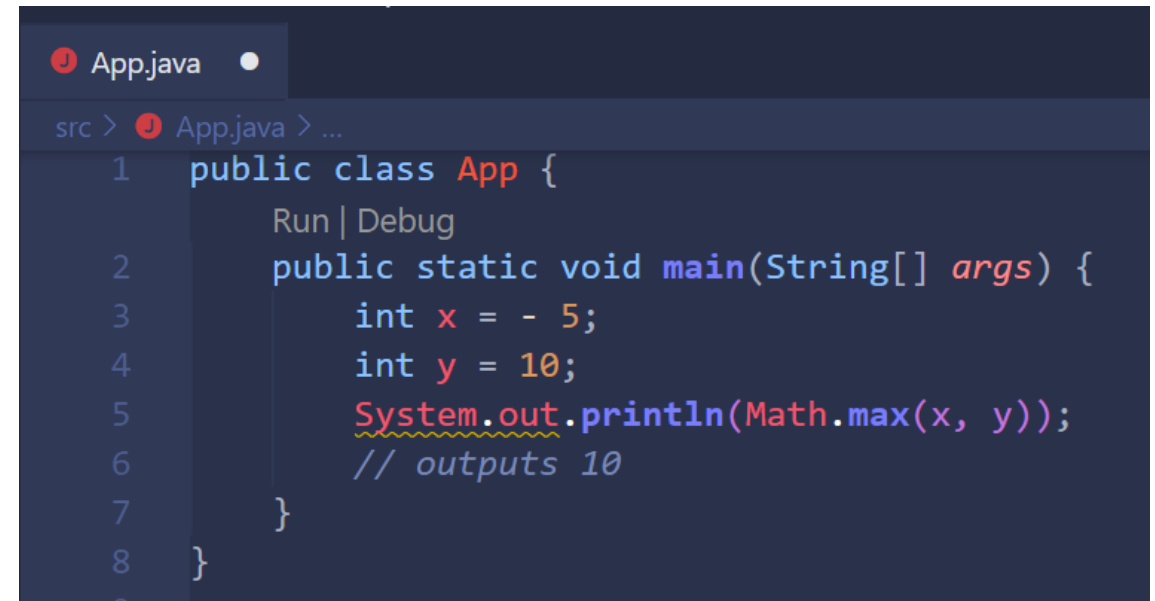
\n → new line

\t → tab

\b → backspace

# Math Methods

- `int x = -5;`
- `int y = 10;`
- `Math.max(x, y);`
- `Math.min(x, y);`
- `Math.abs(x);`
- `Math.sqrt(x);`
- `Math.random()` // generate a random number between 0 and 1



The screenshot shows a Java IDE window titled 'App.java'. The code is as follows:

```
src > App.java > ...  
1 public class App {  
    Run | Debug  
2     public static void main(String[] args) {  
3         int x = - 5;  
4         int y = 10;  
5         System.out.println(Math.max(x, y));  
6         // outputs 10  
7     }  
8 }
```



# Conditions: if statements

- `if (condition) { // block of code to be executed if the condition is true }`

# Condition: if/else statement

```
if (condition) { //  
    block of code to be  
    executed if the  
    condition is true  
} else { //  
    block of code  
    to be executed if the  
    condition is false  
}
```

# Condition: if/else if/else statement

```
if (condition) { //  
    block of code to be  
    executed when the if  
    condition is true  
} else if { //  
    block of code  
    to be executed when the if  
    condition is false  
} else { //  
    block of code  
    to be executed when the else if  
    condition is false  
}
```



# Switch statement

- Switch statement is used to switch between case

```
int num = 1;
switch (num) {
    case 1:
        System.out.println("Male");
        break;
    case 2:
        System.out.println("Female");
        break;
}
```

# Switch Statement Example

```
App.java
src > App.java > ...
1 public class App {
    Run | Debug
2     public static void main(String[] args) {
3         int num = 1;
4         switch (num) {
5             case 1:
6                 System.out.println("Male");
7                 break;
8             case 2:
9                 System.out.println("Female");
10                break;
11        }
12    }
13
14 }
15
16 // outputs Male
```

```
App.java
src > App.java > ...
1 public class App {
    Run | Debug
2     public static void main(String[] args) {
3         int num = 5;
4         switch (num) {
5             case 1:
6                 System.out.println("Toyota");
7                 break;
8             case 2:
9                 System.out.println("Honda");
10                break;
11            default:
12                System.out.println("Other");
13                break;
14        }
15    }
16 }
17
18 // outputs Other
```

We can also include a default statement



# While statement

```
while (condition) {  
    // code block to be  
    executed  
}
```

# For Loop

```
for (statement 1; statement 2; statement 3) { //  
    code block to be executed }
```

- **Statement 1** is executed (one time) before the execution of the code block.
- **Statement 2** defines the condition for executing the code block.
- **Statement 3** is executed (every time) after the code block has been executed.

```
for (int i = 0; i < 10; i++) {  
    System.out.println(i);  
}
```

# For-Each Loop

- If we have elements inside an array, we can use “for-each loop” to loop through each element and execute some code block.

// general syntax for looping through an array

```
for (type variable : arrayname) { ... }
```

// looping through an array

```
String[] names= {"Jane", "James", "Jack", "Jill"};
```

```
for (String name : names) {      System.out.println(name);  
}
```

# Break Statement

```
for (int i = 0; i < 10; i++) {  
    if (i == 6) {  
        break;  
    }  
    System.out.println(i);  
}
```

Break out of the loop or stop  
executing the loop when i is 6

# Break Statement Example

```
App.java
src > App.java > ...
1  public class App {
    Run | Debug
2      public static void main(String[] args) {
3          for (int i = 0; i < 10; i++) {
4              if (i == 6) {
5                  break;
6              }
7              System.out.println(i);
8          }
9      }
10
11 }
12 // outputs 1 2 3 4 5
```

# Continue Statement

```
for (int i = 0; i < 10; i++) {  
    if (i == 6) {  
        continue;  
    }  
    System.out.println(i);  
}
```

When i is 6, don't execute the code block below, instead run the for loop header line again and continue executing code body until condition is met.



# Continue Statement Example

```
App.java
src > App.java > ...
1  public class App {
    Run | Debug
2  public static void main(String[] args) {
3      for (int i = 0; i < 10; i++) {
4          if (i == 6) {
5              continue;
6          }
7          System.out.println(i);
8      }
9  }
10
11 }
12 // outputs 1 2 3 4 5 7 8 9 10
13
```

# Java Arrays

```
String[] names = {"Jane", "James", "Jack", "Jill"};
```

```
int[] nums = {100, 200, 300, 400, 500}
```

```
names[0] = "Jacky" //change the name in the first position
```

```
System.out.println(names.length) //print the length of the array
```

# Looping through Arrays

```
// looping through an array
String[] names= {"Jane", "James", "Jack", "Jill"};
for (String name : names) {
    System.out.println(name);
}
```

```
// another example of how to loop through an array
String[] names= {"Jane", "James", "Jack", "Jill"};
for (int i = 0; i < names.length; i++) {
    System.out.println(names[i]);
}
```

# Multidimensional Array

```
int[] nums = {{100, 200}, {300, 400}, {500, 600}};  
int[] ind10 = nums[1][0]  
System.out.println(ind10); // outputs 300
```

Note that Java starts counting from zero, so indexinf starts from zero

# Nested for loop

```
int[][] myNumbers = { {1, 2, 3, 4}, {5, 6, 7} };  
for (int i = 0; i < myNumbers.length; ++i) {  
    for(int j = 0; j < myNumbers[i].length; ++j) {  
        System.out.println(myNumbers[i][j]);  
    }  
}
```

# Java Methods

- Methods are functions inside a class that take input arguments and perform a task or process some data.
- Java has builtin methods such as `Math.min()`
- You can create your own methods
- The name of the method here is `myMethod`

- A method is a block of code that starts and ends with curly brackets
- The methods are executed when called inside the main method.

```
public class App{  
    static void myMethod() {  
        // code to be executed  
    }  
}
```

# Java Methods

- **Static** means the method can be access at the class level [App.myMethod()] or belongs to the class.
- That means we do not need to create an instance before we access the method.
- Void means the method does not have to return a value.

```
public class App{  
    static void myMethod() {  
        // code to be executed  
    }  
}
```

Note: An object could be created a follows and the method access but we don't need to do this when **static** is used.

```
App myObject = new App();  
myObject.myMethod();
```



# Java Methods

```
public class App{  
    static void myMethod() {  
        // code to be executed  
    }  
    public static void main(String[] args) {  
        myMethod();  
    }  
}
```

To execute a Java method, the method needs to be called inside the main method.



# Java Method Example

```
App.java
src > App.java > ...
1  public class App {
2      static void sayHello(){
3          System.out.println("Hello");
4      }
   Run | Debug
5  public static void main(String[] args) {
6      sayHello();
7  }
8  }
9  // Outputs "Hello"
10
```

The method here is called **sayHello()** and it outputs "Hello" when run

# A Java Method with Parameters

```
App.java
src > App.java > ...
1  public class App {
2      static void sayHello(String name){
3          System.out.println("Hello " + name);
4      }
   Run | Debug
5  public static void main(String[] args) {
6      sayHello("John");
7      sayHello("Peter");
8  }
9  }
10 // Outputs "Hello John" "Hello Peter"
```

Parameter are variables that are assign values or arguments when the method is run.

So the parameter type has to declared when creating the method.

# A Method with Multiple Parameters

```
App.java ×
src > App.java > ...
1  public class App {
2      static void sayHello(String name, int age){
3          System.out.println("Hello " + "my name is " +
4              name + ", I am " + age);
5      }
6      Run | Debug
7      public static void main(String[] args) {
8          sayHello("John", 30);
9          sayHello("Peter", 32);
10     }
11     // Outputs    Hello my name is John, I am 30
12                 Hello my name is Peter, I am 32
```

# A Methods with a Return Statement

- A method with a return statement does not have the void.
- The type of value to be returned needs to be declared before the method name.

```
App.java ×
src > App.java > ...
1  public class App {
2      static int add(int num1, int num2){
3          int total = num1 + num2;
4          return total;
5      }
6      Run | Debug
7      public static void main(String[] args) {
8          System.out.println(add(20, 30));
9          System.out.println(add(100, 100));
10     }
11 }
12 // Outputs
50
200
```

# A Method with Conditions

```
App.java
src > App.java > ...
1 public class App {
2     static void checkNumber(int num){
3         if (num==0){
4             System.out.println("This number is zero");
5         } else if (num>0){
6             System.out.println("This number is positive");
7         } else {
8             System.out.println("This number is negative");
9         }
10    }
11    Run | Debug
12    public static void main(String[] args) {
13        checkNumber(0);
14        checkNumber(-5);
15        checkNumber(2);
16    }
17 }
18 // Outputs
    This number is zero
    This number is negative
    This number is positive
```

# Method Overloading

- If a method does the same thing but takes different types as input arguments, we can overload the method by creating it with same name several times to return different types.

```
App.java x
src > App.java > ...
1 public class App {
2     static int add(int num1, int num2){
3         return num1 + num2;
4     }
5     static float add(float num1, float num2){
6         return num1 + num2;
7     }
8
9     Run | Debug
10    public static void main(String[] args) {
11        System.out.println(add(5, 5));
12        System.out.println(add(5.1f, 5.2f));
13    }
14    // Outputs      10
15                   10.299999
```

# Variable Scope

- Variables are only accessible within the scope or region where they declared.
- A value of a variable cannot be used before it is declared.
- The variable can be used block after it is declared not before declaration or outside the block.

```
App.java
src > App.java > ...
17
18 public class Main {
    Run | Debug
19     public static void main(String[] args) {
20         // Code here CANNOT use x
21         { // This is a block
22             // Code here CANNOT use x
23             int x = 20;
24             // Code here CAN use x
25             System.out.println(x);
26         } // The block ends here
27         // Code here CANNOT use x
28     }
29 }
```



# Java Object Oriented Programming





# OOP in Java

- Java is an object-oriented programming (OOP) language.
- OOP promotes code reuse.
- OOP involves the use of classes to create objects.
- You could have a class of fruits and the specific objects of could be fruits like a mangoes, orange, apple etc.
- A class is a template, blueprint for constructing an object.
- The keyword class is used to create a class.
- A classes and objects have associated attributes and methods.
- Class names should always start with upper case and file names should always match class name.

# Create a Class

```
Employee.java
src > Employee.java > ...
1  public class Employee {
2      String city = "Denver";
   Run | Debug
3      public static void main(String[] args){
4
5          Employee emp1 = new Employee(); // create an object, emp1
6          Employee emp2 = new Employee(); // create an object, emp1
7          System.out.println(emp1.city);
8          System.out.println(emp2.city);
9      }
10 }
11 // outputs Denver
    Denver
```

**city** is a class attribute, all employees will have that same attribute

# Modified Attribute

```
Employee.java X
src > Employee.java > ...
1  public class Employee {
2      String city = "Denver";
   Run | Debug
3      public static void main(String[] args){
4
5          Employee emp1 = new Employee(); // create an object, emp1
6          emp1.city = "Aurora";
7          Employee emp2 = new Employee(); // create an object, emp1
8          emp2.city = "Lakewood";
9          System.out.println(emp1.city);
10         System.out.println(emp2.city);
11     }
12 }
13 // outputs  Aurora
               Lakewood
```

We can override the class attribute and assign different values to specific objects after creating the object

# To Avoid Overriding Class Attribute

```
Employee.java
src > Employee.java > ...
1  public class Employee {
2      final String city = "Denver";
   Run | Debug
3      public static void main(String[] args){
4
5          Employee emp1 = new Employee(); // create an object, emp1
6          emp1.city = "Aurora";
7          Employee emp2 = new Employee(); // create an object, emp1
8          emp2.city = "Lakewood";
9          System.out.println(emp1.city);
10         System.out.println(emp2.city);
11     }
12 }
13 // outputs
```

```
The final field Employee.city cannot be assigned
The final field Employee.city cannot be assigned
```

Include the keyword **final** when creating the class attribute to avoid overriding it

# Multiple Attributes

```
Employee.java •
src > Employee.java > ...
1  public class Employee {
2      String city;
3      String fname;
4      String lname;
   Run | Debug
5      public static void main(String[] args){
6
7          Employee emp1 = new Employee(); // create an object, emp1
8          emp1.city = "Aurora";
9          emp1.fname = "James";
10         emp1.lname = "Smith";
11         System.out.println(emp1.city);
12         System.out.println(emp1.fname);
13         System.out.println(emp1.lname);
14     }
15 }
16 // outputs    Aurora
                  James
                  Smith
```

# Class Method (Static Method)

```
Employee.java
src > Employee.java > ...
1  public class Employee {
2
3      // static method
4      static void getName(String fname, String lname){
5          System.out.println(fname + " " + lname);
6      }
7      Run | Debug
8      public static void main(String[] args){
9          getName("John", "Smith");
10     }
11 }
12 // outputs John Smith
```

Static methods are methods that don't need an instantiated object to run. They do not belong to the object but to the class.

# Public Method

```
Employee.java X
src > Employee.java > ...
1  public class Employee {
2
3      // public method
4      public void companyName(){
5          System.out.println("University of Denver");
6      }
7      Run | Debug
8      public static void main(String[] args){
9          Employee emp1 = new Employee();
10         emp1.companyName();
11     }
12 }
13 // outputs University of Denver
```

Public methods can be accessed only through an object. These methods belong to the object not to the class.

# The Constructor Method

The constructor method is used to initialize an object.

With the constructor method, it is easier to create an object with several attributes.

```
Employee.java
src > Employee.java > ...
1  public class Employee {
2      // attributes
3      String fname;
4      String lname;
5
6      // create a constructor method
7      public Employee(String firstName, String lastName){
8          fname = firstName;
9          lname = lastName;
10     }
11
12     // method
13     public String getName(){
14         return fname + " " + lname;
15     }
16
17     Run | Debug
18     public static void main(String[] args){
19         Employee emp1 = new Employee("James", "Smith");
20         System.out.println(emp1.getName());
21     }
22     // outputs James Smith
```



# Encapsulation

- This is when we hide sensitive data from uses by making variables and attributes inside the class private.
- With encapsulation, we instead provide uses with:
  - **Set** methods to set or update attribute values
  - **Get** method to retrieve attribute values

**this** keyword is used to refer to the current object in a method or constructor. It is commonly used to distinguish between the class attribute and the parameter of the method especially when they have the same name

```
Employee.java X
src > Employee.java > ...
1  public class Employee {
2      // attribute
3      String name;
4
5      // create a getter method
6      public String getName(){
7          return name;
8      }
9
10     // create a setter method
11     public void setName(String newName){
12         this.name = newName;
13     }
14
15     Run | Debug
16     public static void main(String[] args){
17         Employee emp1 = new Employee();
18         emp1.setName("James Smith");
19         System.out.println(emp1.getName());
20     }
21     // outputs
```

# Access Modifiers

- When a class is public, it can be accessed by other classes.
- When attributes/methods are public, they code can be accessed from other classes.
- When attributes/methods are made private, they can be accessed only within the class where they are declared.

```
Employee.java X
src > Employee.java > ...
1  public class Employee {
2      // attribute
3      private String name;
4
5      // create a getter method
6      public String getName(){
7          return name;
8      }
9
10     // create a setter method
11     public void setName(String newName){
12         this.name = newName;
13     }
14     Run | Debug
15     public static void main(String[] args){
16         Employee emp1 = new Employee();
17         emp1.setName("James Smith");
18         System.out.println(emp1.getName());
19     }
20 }
21
22 // outputs
```

# Public Attributes and Methods

```
Employee.java Main.java
src > Employee.java > ...
1 public class Employee {
2     // attribute
3     public String name;
4
5     // create a getter method
6     public String getName(){
7         return name;
8     }
9
10    // create a setter method
11    public void setName(String newName){
12        this.name = newName;
13    }
14    Run | Debug
15    public static void main(String[] args){
16        Employee emp1 = new Employee();
17        emp1.setName("James Smith");
18        System.out.println(emp1.getName());
19    }
20 }
```

```
Employee.java Main.java X
src > Main.java > ...
1 public class Main {
2
3     Run | Debug
4     public static void main(String[] args){
5         Employee emp1 = new Employee();
6         emp1.name = "Jack";
7         // emp1.setName("James Smith");
8         System.out.println(emp1.getName());
9     }
}
PROBLEMS 2 DEBUG CONSOLE OUTPUT TERMINAL
Jack
C:\Users\nnfon\Desktop\Apps\java_project>
```

The **public** attribute in the employee class can be accessed directly in the Main class.

# Public Attributes and Methods

```
Employee.java Main.java
src > Employee.java > ...
1 public class Employee {
2     // attribute
3     public String name;
4
5     // create a getter method
6     public String getName(){
7         return name;
8     }
9
10    // create a setter method
11    public void setName(String newName){
12        this.name = newName;
13    }
14    Run | Debug
15    public static void main(String[] args){
16        Employee emp1 = new Employee();
17        emp1.setName("James Smith");
18        System.out.println(emp1.getName());
19    }
20 }
```

```
Employee.java Main.java X
src > Main.java > ...
1 public class Main {
2
3     Run | Debug
4     public static void main(String[] args){
5         Employee emp1 = new Employee();
6         //emp1.name = "Jack";
7         emp1.setName("James Smith");
8         System.out.println(emp1.getName());
9     }
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```

# Private Attributes and Methods

```
Employee.java • Main.java
src > Employee.java > ...
1 public class Employee {
2     // attribute
3     private String name;
4
5     // create a getter method
6     public String getName(){
7         return name;
8     }
9
10    // create a setter method
11    public void setName(String newName){
12        this.name = newName;
13    }
14    Run | Debug
15    public static void main(String[] args){
16        Employee emp1 = new Employee();
17        emp1.setName("James Smith");
18        System.out.println(emp1.getName());
19    }
20 }
```

```
Employee.java X Main.java •
src > Main.java > ...
1 public class Main {
2
3     Run | Debug
4     public static void main(String[] args){
5         Employee emp1 = new Employee();
6         emp1.name = "Jack";
7         //emp1.setName("James Smith");
8         System.out.println(emp1.getName());
9     }
10 }
```

PROBLEMS 2 DEBUG CONSOLE OUTPUT TERMINAL

The field Employee.name is not visible  
at Main.main(Main.java:5)

C:\Users\nnfon\Desktop\Apps\java\_project>

The **private** attribute in the employee class cannot be accessed in the Main class.

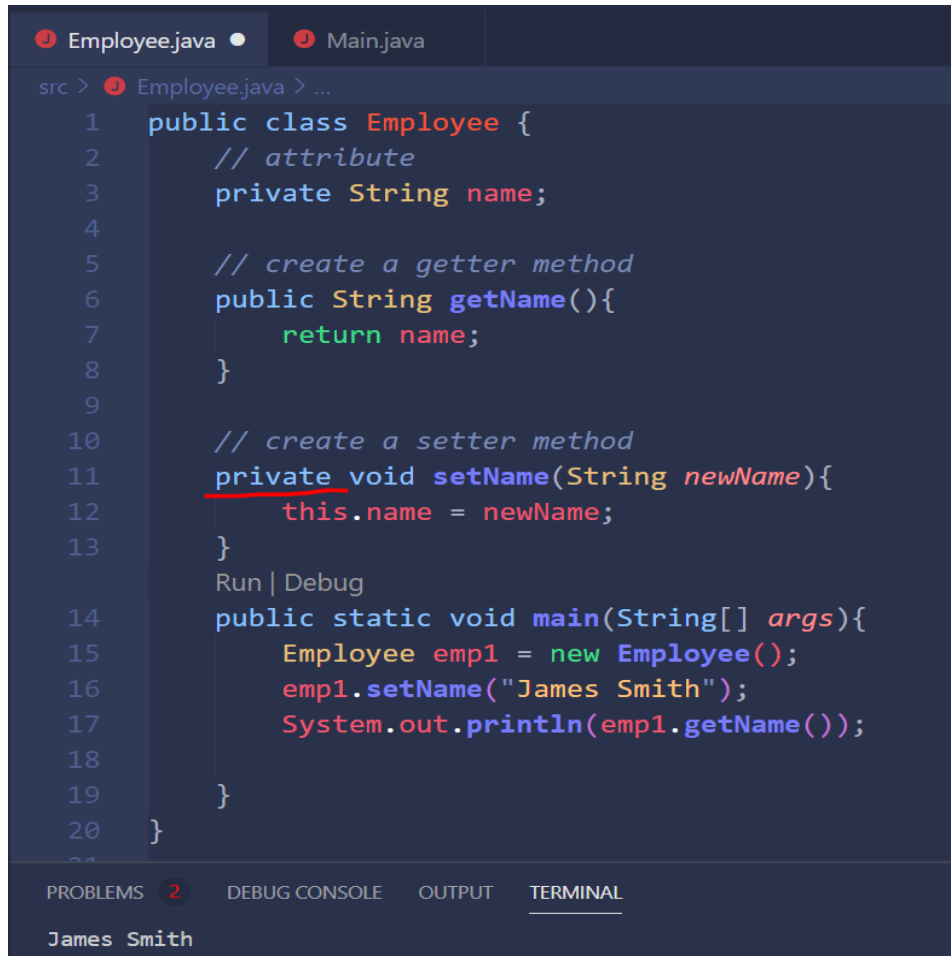
# Private Attributes and Methods

```
Employee.java • Main.java
src > Employee.java > ...
1 public class Employee {
2     // attribute
3     private String name;
4
5     // create a getter method
6     public String getName(){
7         return name;
8     }
9
10    // create a setter method
11    public void setName(String newName){
12        this.name = newName;
13    }
14    Run | Debug
15    public static void main(String[] args){
16        Employee emp1 = new Employee();
17        emp1.setName("James Smith");
18        System.out.println(emp1.getName());
19    }
20 }
```

```
Employee.java Main.java X
src > Main.java > ...
1 public class Main {
2
3     Run | Debug
4     public static void main(String[] args){
5         Employee emp1 = new Employee();
6         //emp1.name = "Jack";
7         emp1.setName("James Smith");
8         System.out.println(emp1.getName());
9     }
}
PROBLEMS 1 DEBUG CONSOLE OUTPUT TERMINAL
James Smith
```

As already seen, the private attribute could not be access directly through .name attribute but can be access through the setter and getter method.

# Private Attributes and Methods



```
src > Employee.java > ...
1 public class Employee {
2     // attribute
3     private String name;
4
5     // create a getter method
6     public String getName(){
7         return name;
8     }
9
10    // create a setter method
11    private void setName(String newName){
12        this.name = newName;
13    }
14    Run | Debug
15    public static void main(String[] args){
16        Employee emp1 = new Employee();
17        emp1.setName("James Smith");
18        System.out.println(emp1.getName());
19    }
20 }
```

James Smith

Private methods can be access only within the class where they were declared



```
src > Main.java > Main > main(String[])
1 public class Main {
2
3     Run | Debug
4     public static void main(String[] args){
5         Employee emp1 = new Employee();
6         //emp1.name = "Jack";
7         emp1.setName("James Smith");
8         System.out.println(emp1.getName());
9     }
}
```

PROBLEMS 2 DEBUG CONSOLE OUTPUT TERMINAL

The method setName(String) from the type Employee is not visible  
at Main.main(Main.java:6)

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Private class and methods cannot be access outside the class where they were declared