



# JAVA

## JAVA INTRODUCTION:

What is JAVA?

JAVA is a popular programming language, created in 1995.

It is used for:

- Mobile applications (specially Android apps)
- Desktop applications.
- Web applications
- Web servers and application servers
- Games
- Database connection
- And much, much more!

## Why Use JAVA ?

- JAVA works on different platforms (Windows, Mac, Linux, Raspberry pi, etc.)
- It is one of the most popular programming languages in the World.
- It has a large demand in the current Job Market.
- It is easy to learn and simple to use.
- It is open-source and free.
- It is secure, fast and powerful.
- JAVA is an Object Oriented language which gives a clear structure to programs and allows code to be reused, lowering development costs.
- As JAVA is close C++ and C#, it makes it easy for programmers to switch to JAVA or vice versa.

## JAVA Syntax :

In previous chapter, we created a JAVA file called **Main.java**, and we used the following code to print "Hello World" to the screen:



Main.java

```
public class Main {  
    public static void main (String [] args) {  
        System.out.println ("Hello World");  
    }  
}
```

## JAVA Comments :

Comments can be used to explain JAVA code, and to make it more readable. It can also be used to prevent execution when testing alternative code.

### Single-line Comments

(Single-line comments start with two forward slashes ( // ).

Any text between // and the end of the line is ignored by Java (will not be executed)

### Example ↴

```
// This is a comment  
System.out.println ("Hello World");
```



## JAVA Variables :

Variables are containers for storing data values.

In JAVA, there are different types of variable for example:

String - Stores text, such as "Hello". String values are surrounded by double quotes.

Int - Stores integers (whole numbers). Without decimals, such as 123 or 123

Float - Stores Floating point numbers. With decimals, such as 19.99 or -19.99

char - Stores single characters, such as 'a' or 'B'. char values are surrounded by single quotes

boolean - Stores value with two states:  
True or False.

## Declaring Variables

Syntax:

type variablename = value;



## Example ↴

Create a variable called name of type String and assign it the value " John":

```
String name = " John";  
System.out.println(name);
```

## JAVA Print Variables:

The println() method is often used to display variables.

To combine both text and a variable, use the + character.

## Example ↴

```
String name = " John";  
System.out.println(" Hello " + name);
```

## JAVA DATA Types:

A variable in Java must be a specified data type.

## Example ↴

```
int myNum = 5; // Integer (whole number)
float myFloatNum = 5.99f; // floating point number
char myLetter = 'Q'; // character
boolean myBool = true; // Boolean
String myText = "Hello"; // String
```

## JAVA Type Casting :

Type casting is when you assign a value of one primitive data types to another type.

### - Widening Casting (automatically) -

Converting a smaller type to a larger type size

byte → short → char → int →  
long → float → double

## Widening Casting

Widening casting is done automatically when passing a smaller size type to a longer size type.



## Example ↴

```
public class Main {  
    public static void main (String [] args) {  
        int myInt = 9;  
        double myDouble = myInt; // Automatic  
        casting int to double  
  
        System.out.println (myInt); // Outputs 9  
        System.out.println (myDouble); // Outputs 9.0  
    }  
}
```

## JAVA Operators :

Operators are used to perform operations on variables and values.

In the example below, we use the + Operator to add together two values.

## Example ↴

```
int x = 100 + 50;
```



## JAVA Strings :

Strings are use for Storing text.

A **String** variable contains a collection of characters surrounded by quotes.

### Example ↴

Create a variable of **String** and assign it a value:

```
String greeting = "Hello";
```

### String length

A **String** in JAVA is actually an object, which contain methods that can perform certain operations on strings. for example, the length of a **String** can be found with the **length()** method.

### Example ↴

```
String txt = "ABCDEFGHIJKLMNOPQRSTUVWXYZ";
System.out.println("The length of the string is:
" + txt.length());
```



## JAVA Booleans :

Very often, in programming, you will need a data type that can only have one of two values, like;

- YES / NO
- ON / OFF
- TRUE / FALSE

for this JAVA has a boolean data type, which can store True or False values.

### Boolean Values

A boolean type is declared with the boolean keyword and can only take the values True or False.

### Example ↴

boolean isJavaFun = true;

boolean isFishTasty = false;

System.out.println(isJavaFun); // Outputs true

System.out.println(isFishTasty); // Outputs false



## JAVA IF...Else :

### JAVA Conditions and IF Statements

- Less than :  $a < b$
- Less than or equal to :  $a \leq b$
- Greater than :  $a > b$
- Greater than or equal to :  $a \geq b$
- Equal to :  $a == b$
- Not Equal to :  $a != b$

Java has the following conditional statements:

- Use **if** to specify a block of code to be executed, if a specified condition is true.
- Use **else** to specify a block of code to be executed, if the same condition is false.
- Use **else if** to specify a new condition to test, if the first condition is false.
- Use **switch** to specify many alternative blocks of code to be executed.

### The if Statement

Use the **if** Statement to specify a block of JAVA code to be executed if a condition



is True.

Syntax

if (condition) {

// block of code to be executed if the  
condition is true

}

Example ↴

if (20 > 18) {

    System.out.println ("20 is greater than 18");

JAVA Switch :

JAVA Switch Statement

Instead of writing many if... else statements,  
you can use the **Switch** Statement.

The **Switch** Statement selects one of many  
code blocks to be executed.



## Syntax

```
switch ( expression ) {  
    case x :  
        // code block  
        break ;  
    case y :  
        // code block  
        break ;  
    default :  
        // code block  
}
```

This is how it works:

- The **switch** expression is evaluated once.
- The value of expression is compared with the values of each **case**.
- If there is a match, the associated block of code is executed.
- The **break** and **default** keywords are optional, and will be described later in this chapter.



Example ↴

```
int day = 4;  
switch (day) {
```

case 1:

```
    System.out.println ("Monday");  
    break;
```

case 2:

```
    System.out.println ("Tuesday");  
    break;
```

case 3:

```
    System.out.println ("Wednesday");  
    break;
```

case 4:

```
    System.out.println ("Thursday");  
    break;
```

case 5:

```
    System.out.println ("Friday");  
    break;
```

case 6:

```
    System.out.println ("Saturday");  
    break;
```

case 7:

```
    System.out.println ("Sunday");  
    break;
```

} // Outputs " Thursday " (day 4)

## JAVA While Loop :

### Loops

Loops can execute a block of code as long as a specified condition is reached.

Loops are handy because they save time, reduce errors, and they make code more readable.

### JAVA While Loop

The While loop loops through a block of code as long as a specified condition is True.

### Syntax

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

### Example ↴

```
int i = 0;  
while (i < 5) {
```



```
System.out.println(i);  
int;  
{
```

## JAVA FOR Loop :

When you know exactly how many times you want to loop through a block of code, use the **for** loop instead of a **while** loop.

### Syntax

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

### Example ↴

```
for (int i = 0 ; i < 5 ; i++) {  
    System.out.println(i);  
}
```

## JAVA Break And Continue :

### JAVA Break

We already seen the **break** Statement used

in an earlier chapter of this tutorial. It was used to "jump out" of a **switch** statement.

The **break** statement can also be used to jump out of loop.

### Example ↴

```
for (int i = 0; i < 10; i++) {  
    if (i == 4) {  
        break;  
    }  
    System.out.println(i);
```

### JAVA Arrays :

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

To declare an array, define the variable type with square brackets.

```
String[] cars;
```



## Example ↴

```
String [] cars = { "Volvo", "BMW", "Ford", "Mazda" };  
System.out.println (cars[0]);  
// Outputs Volvo
```

## JAVA METHODS :

### JAVA Methods :

A Method is a block of code which only runs when it is called.

You can pass data, known as parameters, into a method.

Methods are used to perform certain actions, and they are also known as functions.

### Create a Method

- A Method must be declared within a class. It is define with the name of the Method, followed by parentheses () .



Java provides some pre-defined Methods,  
such as

`System.out.println()`, but you can also create  
your own Methods to perform certain  
actions.

### Example ↴

```
public class Main {  
    static void mymethod () {  
        // code to be executed  
    }  
}
```

### JAVA Method parameters:

#### Parameters And Arguments

Parameters act as variables inside the  
Method.

Parameters are specified after the method  
name, inside the Parenthese. We can add  
as many parameters as you want, Just  
separate them with comma.

`String`



called `fname` as parameter. When the method is called, we pass along a first name, which is used inside the method to print the full name.

### Example ↴

```
public class Main {  
    static void mymethod ( String fname ) {  
        System.out.println ( fname + " Refsnes" );  
    }  
    public static void main ( String [ ] args ) {  
        mymethod ( "Liam" );  
        myMethod ( "Jenny" );  
        myMethod ( "Ania" );  
    }  
}  
// Liam Refsnes  
// Jenny Refsnes  
// Ania Refsnes
```

## JAVA Method Overloading :

### Method Overloading

With Method Overloading, multiple methods can

have the same name with different parameters.

Example ↴

```
int myMethod ( int x )
float myMethod ( float x )
double myMethod ( double x , double y )
```

JAVA Scope :

In Java, variables are only accessible inside the region they are created. This is called scope.

Example ↴

```
public class Main {
    public static void main ( String [ ] args ) {
```

// Code here CANNOT use x

```
    int x = 100 ;
```

// Code here CAN use x

```
    System.out.println ( x );
```



}

## JAVA Recursion :

Recursion is the technique of making a function call itself. This Technique provides a way to break complicated problems down into simple problems which are easier to solve.

Example ↴

```
public class Main {  
    public static void main (String [] args) {  
        int result = sum (10);  
        System.out.println (result);  
    }  
  
    public static int sum (int k) {  
        if (k > 0) {  
            return k + sum (k - 1);  
        } else {  
            return 0;  
        }  
    }  
}
```



## JAVA CLASSES :

## JAVA OOP :

JAVA - What is OOP ?

OOP stands for Object - Oriented programming.

Procedural programming is about writing procedures or methods that perform operations on the data, while Object-oriented programming is about creating objects that contain both data and methods.

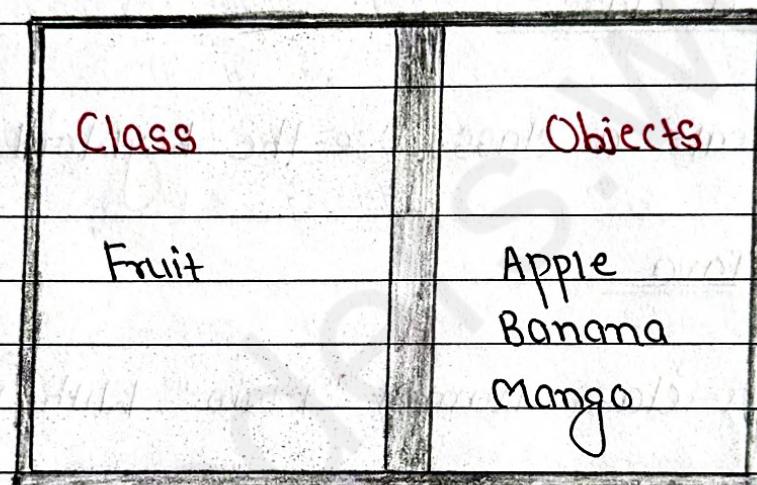
Object Oriented Programming has several advantages over procedural programming.

- OOP is faster and easier to execute.
- OOP provides a clear structure for the programs.
- OOP helps to keep the Java code DRY ("Don't Repeat yourself"), and makes the code easier to maintain, modify and debug.
- OOP makes it possible to create full reusable applications with less code and shorter development time.



JAVA - What are Classes and Objects?  
Classes and Objects are the two main aspects of Object-oriented programming.

Look at following illustration to see the difference class and objects.



### JAVA classes And Objects :

#### JAVA classes / Objects

JAVA is an Object-Oriented programming language.

Everything in JAVA is associated with classes and objects, along with its attributes and methods. For example: in real life, a car is an object. The car has attributes, such as



height and color, and methods, such as drive and brake.

A class is like an object constructor, or a "blueprint" for creating objects.

### Create a class

To create a class, use the keyword **class**:

#### Main.java

Create a class named "Main" with variable x:

```
public class Main {  
    int x = 5;  
}
```

### Create An Object

In Java, an object is created from a class. We have already created the class named **Main**, so now we can use this to create objects.

To create an object of **Main**, specify the



Class name, followed by the object name, and use the keyword **new**:

Example ↴

Create an object called "myObj" and print the value of x.

```
public class Main {  
    int x = 5;
```

```
public static void main (String [] args) {  
    Main myObj = new Main ();  
    System.out.println (myObj.x);  
}
```

Multiple Objects

Example ↴

```
public class Main {  
    int x = 5
```

```
public static void main (String [] args) {  
    Main myObj1 = new Main (); // Object 1
```

```
Main myobj2 = new Main(); // Object 2
System.out.println(myobj1.x);
System.out.println(myobj2.x);
```

## JAVA Class Attributes:

### Example 1

Create a class called "Main" with two attributes  
x and y.

```
public class Main {
    int x = 5;
    int y = 3;
}
```

## Accessing Attributes

### Example 1

```
public class Main {
    int x = 5;
}

public static void main(String[] args) {
    Main myobj = new Main()
```



```
System.out.println(myobj.x);  
}  
}
```

### Modify Attributes

Example,

```
public class Main {  
    int x;  
  
    public static void main (String [] args) {  
        Main myobj = new Main ();  
        myobj.x = 40;  
        System.out.println (myobj.x);  
    }  
}
```

### Multiple Attributes

```
public class Main {  
    String fname = "John";  
    String fname = "Doe";  
    int age = 24;
```



```
public static void main (String [] args ) {  
    Main myobj = new Main ();  
    System.out.println ("Name : " + myobj.fname +  
                       " " + myobj.lname );  
    System.out.println ("Age : " + myobj.age );  
}  
}
```

## JAVA Class Methods :

Example ↴

```
Public class Main {  
    Static void myMethod () {  
        System.out.println ("Hello World !");  
    }  
}
```

## Static v-s public

JAVA programs have either **Static** or **public** attributes and methods.

The example below, we created a **Static**.



Method, which means that it can be accessed without creating an object of the class, unlike public, which can only be accessed by objects.

### Example ↴

```
public class Main {  
    // Static method  
    static void mystaticMethod () {  
        System.out.println ("Static methods can be  
        called without creating  
        objects");  
    }  
}
```

```
// public Method  
public void mypublicMethod () {  
    System.out.println ("public methods must be  
    called by creating objects");  
}  
}
```

```
// Main Method  
public static void main (String [] args) {  
    mystaticMethod (); // Call the static method  
    // mypublicMethod (); This would compile an error
```



```
Main myobj = new Main(); // Create an object main
myobj.mypublicMethod(); // Call the public
                        Method on the object
}
}
```

## JAVA Constructors:

A constructor in Java is a special method that is used to initialize objects. The constructor is called when an object of a class is created. It can be used to set values for object attributes.

### Example ↴

```
// Create a Main class
public class Main {
    int x; // Create a class attribute

    // Create a class constructor for the Main
    // class
    public Main() {
        x = 5; // Set the initial value for the
                Class attribute x
    }
}
```



```
public static void main (String [] args ) {  
    Main myobj = new Main (); // Create an object  
    class Main ( This will call the constructor )  
    System.out.println (myobj.x); // print the value  
    of x  
}  
}  
// Outputs 5
```

### Constructor parameters

Constructor can also take parameters, which is used to initialize attributes.

The following example adds an **int y** parameter to the constructor. Inside the constructor we set x to y ( $x=y$ ). When we call the constructor,

### Example ↴

```
public class Main {  
    int x;
```



```
public main(int y) {  
    x = y;  
}
```

```
public static void Main (String [] args) {  
    Main myobj = new Main (5);  
    System.out.println (myobj.x);  
}
```

// outputs 5

## JAVA Modifiers :

### Modifiers

```
public class Main
```

The **public** keyword is an access modifier, meaning that it is used to set the access level for classes, attributes, methods and constructors.

- Access Modifiers - Controls the access level



- Non - Access Modifiers - do not control access level but provides other functionality.

## Access Modifiers

Modifier	Description
----------	-------------

public	The class is accessible by any other class.
--------	---

default	The class is only accessible by classes in the same package. This is used when you don't specify a modifier.
---------	--

for attributes , methods and constructors , you can use the one of following.

Modifier	Description
----------	-------------

public	This code is accessible for all classes.
--------	--

**private**

The code is only accessible within the declared class.

**default**

The code is only accessible in the same package.

This is used

when you don't specify a modifier.

**protected**

The code is accessible in the same package and subclasses.

## Non-Access Modifiers

**Modifier**

**Description**

**Final**

The class cannot be inherited by other classes

**Abstract**

The class cannot



be used to  
create objects ( To  
Access An abstract  
class, it must be  
inherited from  
another class.)

For attributes and Methods, you can use the one  
of the following.

Modifier

Description

Final

Attributes and Methods  
cannot be overridden/  
modified.

(Static)

Attributes and Methods  
belongs, to the class,  
rather than on  
Object.

Abstract

Can only be used in  
an abstract class, and  
can only be used on  
Methods! The method  
does not have a body.



for example

abstract void run();

The body is provided  
by the subclass.

## Final

### Example ↴

```
public class Main {  
    final int x = 10;  
    final double PI = 3.14;
```

```
public static void main (String [] args) {
```

```
    Main myobj = new Main ();
```

```
    myobj.x = 50; // Will generate an error: Cannot  
                  assign a value to final variable
```

```
    myobj.PI = 25; // Will generate an error:  
                  Cannot be assign a value  
                  to a final variable.
```

```
    System.out.println (myobj.x);
```

```
}
```



## JAVA Encapsulation:

### Encapsulation

The meaning of Encapsulation, is to make sure that "sensitive" data is hidden from users. To achieve this, you must:

- declare class Variables/ attributes as **private**
- provide public get and set methods to access and update the value of **private** variable.

### Get And Set

**Private Variables** can only be accessed within the same class (an outside class has no access to it). However, it is possible to access them if we provide public get and set method.

The **get** Method return the variable value, and the **set** Method sets the value.

Syntax for both is that they start with either



get or set, followed by the name of the variable, with the first letter in upper case.

### Example

```
public class person {  
    private String name; // private = restricted access  
    // Getter  
    public String getName () {  
        return name;  
    }  
    // Setter  
    public void setName (String newName) {  
        this.name = newName;  
    }  
}
```

### JAVA Inheritance:

In Java, it is possible to inherit attributes and methods from one class to another. We group the "inheritance concept" into two categories:



- Subclass (child) - the class that inherits from another class
- Superclass (parent) - the class being inherited from

To inherit from a class, use the **extends** keyword.

In the example below, the **Car** class (Subclass) inherits the attributes and methods from the **Vehicle** class. (Superclass).

Example ↴

```
class Vehicle {  
    protected String brand = "Ford"; // vehicle Attributes  
    public void honk () { // vehicle Method  
        System.out.println("Tuut, tuut");  
    }  
}
```

```
class Car extends Vehicle  
{  
    private String modelName = "Mustang"; // Car Attribute  
    public static void main (String [] args) {
```



// Create a myCar object

Car mycar = new Car();

// Call the honk() method (from the vehicle class) on the mycar object.

mycar.honk();

// Display the value of the brand Attribute (from the vehicle class) and the modelName from the car class.

System.out.println(mycar.brand + " " + mycar.modelName);  
}

}

}

\* Why And When TO Use " Inheritance " ?

- It is useful for code reusability. reusing attributes and Methods of an existing class when you create a new class.

### The Final Keyword

final class vehicle {

...

}

class Car extends vehicle {



{ ...

Output will be something like this ↴

```
Main.java:9: error: Cannot
inherit from final Vehicle
class Main extends Vehicle {  
    ^
1 error)
```

## JAVA Polymorphism :

Polymorphism means "many forms", and it occurs when we have many classes that are related to each other by inheritance.

Like we specified in the previous chapter, Inheritance lets us inherit attributes and methods from another class. Polymorphism uses those methods to perform different tasks. This allows us to perform a single action in different ways.

## Example ↴

```
class Animal {  
    public void animalsound () {  
        System.out.println ("The animal makes  
a sound");  
    }  
}
```

```
class Pig extends Animal {  
    public void animalsound () {  
        System.out.println ("The pig says:  
Wee Wee");  
    }  
}
```

```
class Dog extends Animal {  
    public void animalsound () {  
        System.out.println ("The dog says:  
bow bow");  
    }  
}
```

\* Why And When To Use "Inheritance" and  
"Polymorphism"?

→ It is useful for code reusability: reuse



Attributes and Methods of an existing class when you create a new class.

## JAVA Abstraction :

### Abstract classes AND Methods

DATA Abstraction is the process of hiding certain details and showing Only essential information to the user.

Abstraction can be achieved With either abstract classes or interfaces.

The **abstract** keyword is an non-access Modifier, used for classes And methods:

- Abstract class - is a restricted class that cannot be used to create Objects (to access it, it must be inherit from another class).
- Abstract method - can only be used in an abstract class. And it does not have a body. The body is provided by the subclass. (inherit from)



## Example ↴

```
// Abstract class
```

```
abstract class Animal {
```

```
    // Abstract method (does not have a body)
```

```
    public abstract void animalSound();
```

```
    // Regular method
```

```
    public void sleep() {
```

```
        System.out.println("Zzz");
```

```
}
```

```
// Subclass (inherit from Animal)
```

```
class Pig extends Animal {
```

```
    public void animalSound() {
```

```
        // The body of animalSound() is provided here
```

```
        System.out.println("The pig says: wee wee");
```

```
}
```

```
class Main {
```

```
    public static void main (String [] args) {
```

```
        Pig mypig = new Pig(); // Create a pig object
```

```
        mypig.animalSound();
```

```
        mypig.sleep();
```

```
}
```



## JAVA Interface :

### Interfaces

Another way to achieve abstraction in Java is with interfaces.

An **interface** is a completely "abstract class" that is used to group related methods with empty bodies.

### Example ↴

```
// Interface
interface Animal {
    public void animalsound(); // Interface
                           Method (does not have body)
    public void Sleep(); // interface Method
                           (does not have a body)
}
```

```
// pig "implements" the Animal interface
class Pig implements Animal {
    public void animalsound() {
        // The body of animalsound() is provided here
        System.out.println("The pig Says : Inee Inee");
    }
}
```



}

public void sleep () {

// The body of sleep () is provided here

System.out.println ("zzz");

}

class Main {

public static void main (String [] args) {

Pig mypig = new Pig (); // Create a pig object

mypig.animalsound ();

mypig.sleep ();

}

}

## JAVA Enums :

### ENUMS

An enum is a special "class" that represents a group of constants (unchangeable variables like Final Variables).

To create an enum, use the enum keyword separate the constants with a comma.

Example ↴

```
enum Level {  
    LOW,  
    MEDIUM,  
    HIGH,  
}
```

enum constants with dot syntax.

```
Level myVar = Level.MEDIUM;
```

Enum inside a Class

Example ↴

```
public class Main {  
    enum Level {  
        LOW,  
        MEDIUM,  
        HIGH,  
    }
```

```
public static void Main (String [] args) {  
    Level MyVar = Level.MEDIUM;  
    System.out.println (myVar);  
}  
}
```

## JAVA User Input :

The **Scanner** class is used to get user input, and it is found in the **java.util** package.

To use the **Scanner** class, create an object of the class and use any of the available methods found in the **Scanner** class documentation. In our example, we will use the **nextLine()** method, which is used to read strings.

### Example ↴

```
import java.util.Scanner; // Import the Scanner  
class Main {  
    public static void main (String [] args) {
```



```
Scanner myobj = new Scanner (System.in);
// Create a scanner object
System.out.println ("Enter Username");
String username = myobj.nextLine ();
// Read user input
System.out.println ("Username is: " + username);
// Output user input
}
```

## Input Types

### Method

### Description

nextBoolean ()

Reads a boolean value from the user

nextByte ()

Reads a byte value from the user

nextDouble ()

Reads a double value from the user

nextFloat ()

Reads a float value

from the user

**nextInt()** Reads a **int** value from the user

**nextLine()** Reads a **String** value from the user

**nextLong()** Reads a **Long** value from the user

**nextShort()** Reads a **short** value from the user

Example ↴

```
import java.util.Scanner;
```

```
class Main {  
    public static void Main (String []args) {  
        Scanner myobj = new Scanner (System.in);
```

```
        System.out.println ("Enter name, age and  
        Salary : ");
```

```
// string input
```

String name = myobj.nextLine();

// Numerical input

int age = myobj.nextInt();

double salary = myobj.nextDouble();

// Output input by user

System.out.println ("Name: " + name);

System.out.println ("Age: " + age);

System.out.println ("Salary: " + salary);

}

}

## JAVA DATE AND TIME :

### JAVA Dates

Java does not have a built-in Date class, but we can import the `java.time` package to work with the date and time API. The package includes many date and time classes.

## Class

## Description

LocalDate

Represents a date  
(year, month, day).

LocalTime

Represents a time  
(hour, minute, second,  
and nanoseconds)

LocalDateTime

Represents both a  
date and a time

DateTimeFormatter

Formatter for  
displaying and  
parsing date-time  
objects.

## Display current Date

To display the current date, import the `java.time.LocalDate` class, and use the `now()` method.

## Example ↴

```
import java.time.LocalDate; import the LocalDate  
class
```

```
public class Main {  
    public static void main (String [] args) {  
        LocalDate myobj = LocalDate.now ();  
        // Create a date object  
        System.out.println (myobj);  
        // Display the current date.  
    }  
}
```

The `ofPattern()` method accepts all sorts of values, if you want to display the date and time in a different format.

### Example

Value

yyyy-MM-dd

dd/MM/yyyy

dd - MMMM - yyyy

E, MMM dd

yyyy

Example

"1988-09-29"

"29/09/1988"

"29 - Sep - 1988"

"Thu, Sep 29  
1988"

## JAVA Array List :

The ArrayList class is a resizable array, which can be found in the java.util package.

The difference between a built-in array and an ArrayList in Java, is that the size of an array cannot be modified. While elements can be added and removed from an ArrayList whenever you want.

### Example ↴

Create an ArrayList object called cars that will store strings.

```
import java.util.ArrayList; // import the ArrayList class
ArrayList<String> cars = new ArrayList<String>();
// Create an ArrayList object.
```

### Add Items

The ArrayList class has many useful methods. For example, to add elements to the

ArrayList, use the add() method.

Example ↴

```
import java.util.ArrayList;
```

```
public class Main {  
    public static void main (String [] args) {  
        ArrayList <String> cars = new ArrayList <  
            String> ();  
        cars.add ("Volvo");  
        cars.add ("BMW");  
        cars.add ("Ford");  
        cars.add ("Mazda");  
        System.out.println (cars);  
    }  
}
```

### Access an Item

To access an element in the ArrayList, use the get() method and refer to the index number.

Example → cars.get (0);



## Change An Item

To modify an element, use the **set()** Method and refer to the index number.

Example → `(cars.set(0, "Opel"));`

## Remove An Item

To remove an element, use the **remove()** method and refer to the index number.

Example → `(cars.remove(0));`

## ArrayList Size

To find out how many elements an ArrayList have, use the **size()** method.

Example → `(cars.size());`

## Loop Through an ArrayList

Loop through the elements of an ArrayList



With a **for** loop, and use the **size()** method to specify how many times the loop should run.

### Example ↴

```
public class Main {  
    public static void main (String [] args) {  
        ArrayList <String> cars = new ArrayList  
            <String> ();  
        cars.add ("Volvo");  
        cars.add ("BMW");  
        cars.add ("Ford");  
        cars.add ("Mazda");  
        for (int i = 0; i < cars.size (); i) {  
            System.out.println (cars.get (i));  
        }  
    }  
}
```

### JAVA LinkedList:

You learned about the **ArrayList** class. The **LinkedList** class is almost identical to the **ArrayList**.



## Example ↴

```
// Import the LinkedList class
import java.util.LinkedList;

public class Main {
    public static void main (String [] args) {
        LinkedList <String> cars = new LinkedList <String> ();
        cars.add ("volvo");
        cars.add ("BMW");
        cars.add ("Ford");
        cars.add ("Mazda");
        System.out.println (cars);
    }
}
```

## ArrayList vs. LinkedList

The **LinkedList** class is a collection which can contain many objects of the same type, just like the **ArrayList**.

The **LinkedList** class has all of the same methods as an **ArrayList** class because they both implement the **List** interface.



This means that you can add items, change items, remove items and clear the list in the same way.

However, while the ArrayList class and the LinkedList class can be used in the same way, they are built very differently.

### How the ArrayList Works

The ArrayList class has a regular array inside it. When an element is added, it is placed into the array. If the array is not big enough, a new, larger array is created to replace the old one and the old one is removed.

### How the LinkedList Works

The LinkedList stores its items in "containers". The list has a link to the first container and each container has a link to the next container in the list. To add an element to the list, the element is placed into a new container and that container



is linked to one of the other containers in the list.

### \* When To Use

Use an **ArrayList** for storing and accessing data, and **LinkedList** to manipulate data.

### LinkedList Methods

For many cases, the **ArrayList** is more efficient as it is common to need access to random items in the list, but the **Linklist** provides several methods to do certain operations more efficiently.

#### Method

#### Description

**addFirst()**

Adds an item to the beginning of the List.

**addLast()**

Add an item to the end of the List.



`removeFirst()`

Remove an item  
from the beginning  
of the list

`removeLast()`

Remove an item  
from the end of  
the list

`getFirst()`

Get the item at  
the beginning of  
the list

`getLast()`

Get the item at  
the end of the  
list

## JAVA HASHMAP :

In the ArrayList chapter, we learned that arrays store items as an ordered collection, and you have to access them with an index number (int type). A HashMap however, stores items in "key/value" pairs, and you can access them by an

index of another type (e.g. a **String**).

One Object is used as a key (index) to another object (value). It can store different types. **String** keys and **Integer** values, or the same type, like **String** keys and **String** values.

### Example ↴

Create a **HashMap** object called **capitalcities** that will store **String** keys and **String** values.

```
import java.util. HashMap; // import the  
                                HashMap class  
HashMap < String , String > capitalcities = new  
                                HashMap < String , String >  
                                ();
```

### Add Items

The **HashMap** class has many useful methods. For example, to add items to it, use the **put()** method.



Example ↴

```
// Import the HashMap class  
import java.util. HashMap;
```

```
public class Main {  
    public static void main (String [] args) {  
        // Create a Hashmap object called Capitalcities  
        HashMap <String, String> Capitalcities = new  
        HashMap <String, String> ();
```

```
// Add keys and values (country, city)
```

```
Capitalcities.put ("England", "London");
```

```
Capitalcities.put ("Germany", "Berlin");
```

```
Capitalcities.put ("Norway", "Oslo");
```

```
Capitalcities.put ("USA", "Washington DC");
```

```
System.out.println (Capitalcities);
```

```
}
```

## Access an Item

To access a value in the **HashMap**, use the **get()** method and refer to its key.

Example → **capitalcities.get ("England")**;

## Remove An Item

To remove an item, use the `remove()` Method and refer to the key.

Example → `capitalcities.remove("England");`

## HashMap (size)

To find out how many items there are, use the `size()` Method.

Example ↴

`capitalcities.size();`

## Loop Through a HashMap

Loop through a HashMap items of a **HashMap** with a for-each loop.

Example ↴

```
// Print keys
for (String i : capitalcities.keySet()) {
    System.out.println(i);
}
```

## JAVA Wrapper classes :

Wrapper classes provide a way to use primitive data types ( int, boolean, etc) as objects.

The table below shows the primitive type and the equivalent wrapper class.

primitive Data Type	Wrapper Class
---------------------	---------------

byte	Byte
------	------

int	Integer
-----	---------

double	Double
--------	--------

char	Character
------	-----------

## Example ↴

`ArrayList <int> myNumbers = new ArrayList <int>()  
; // Invalid`

`ArrayList <Integer> myNumbers = new ArrayList  
<Integer>(); // Valid`

## Creating Wrapper Objects

To create a wrapper object, use the wrapper class instead of the primitive type.

To get the value, you can just print the object.

## Example ↴

```
public class Main {  
    public static void main (String [] args ) {  
        Integer myInt = 5 ;  
        Double myDouble = 5.99 ;  
        Character myChar = 'A' ;  
        System.out.println (myInt);  
        System.out.println (myDouble);  
        System.out.println (myChar);  
    }  
}
```



}

## JAVA Exceptions - Try....catch :

### JAVA Exceptions

When executing Java code, different errors can occur: Coding errors made by the programmer, error due to wrong input, or other unforeseeable things.

When an error occurs, Java will normally stop and generate an error message - The technical term for this is : Java will throw an exception.

### JAVA try and catch

The **try** statement allows you to define a block of code to be tested for errors while it is being executed.

The **catch** statement allows you to define a block of code to be executed, if an error occurs in the try block.



Syntax ↴

```
try {  
} // Block of code to try  
}  
catch (Exception e) {  
} // Block of code to handle errors
```

Example ↴

```
public class Main {  
    public static void main (String [] args) {  
        try {  
            int [] myNumbers = {1, 2, 3};  
            System.out.println (myNumbers [10]);  
        } catch (Exception e) {  
            System.out.println ("Something went wrong.");  
        }  
    }  
}
```

Finally

The finally statement lets you execute code, after try...catch, regardless of the



result.

### Example ↴

```
public class Main {  
    public static void main(String[] args) {  
        try {  
            int[] myNumbers = { 1, 2, 3 };  
            System.out.println(myNumbers[10]);  
        } catch (Exception e) {  
            System.out.println("Something went wrong");  
        } finally {  
            System.out.println("The 'try catch' is finished.");  
        }  
    }  
}
```

Output → Something went wrong.

The 'try catch' is finished.

### The Throw keyword

The Throw statement allows you to create a custom error.



The `throw` statement is used together with an exception type. There are many exception types available in java. `ArithmaticException`, `FileNotFoundException`, `ArrayIndexOutOfBoundsException`, `SecurityException`, etc.

### Example ↴

Throw an exception if age is below 18 (print "Access denied"). If age is 18 or older, print "Access granted".

```
public class Main {  
    static void checkAge( int age ) {  
        if ( age < 18 ) {  
            throw new ArithmaticException( " Access  
denied - you must be at least 18 year old. " );  
        }  
        else {  
            System.out.println( " Access granted - you are  
old enough ! " );  
        }  
    }  
}
```

```
public static void main( String [ ] args ) {  
    checkAge( 15 );  
}
```



// Set age to 15 (which is below 18...)  
    }  
    }

## JAVA Threads :

Threads allows a program to operate more efficiently by doing multiple things at the same time.

Threads can be used to perform complicated tasks in the background without interrupting the main program.

## Creating a Thread

There are two ways to create a thread.

It can be created by extending the **Thread** class and overriding its **run()** method.

Extend Syntax → public class Main extends Thread {  
    public void run () {

        System.out.println ("This code is  
            running in thread");

}

A circular icon containing a cartoon-style portrait of a person with dark hair and glasses, wearing a yellow hoodie with a black banana graphic.



Another way to create a thread is to implement the **Runnable** interface.

## Implement Syntax

## Running Threads

If the class extends the `Thread` class, the thread can be run by creating an instance of the class and calling its `start()` method.

## Extend Example ↴

```
public class Main extends Thread {  
    public static void main (String [] args) {  
        Main thread = new Main ();  
        thread.start ();  
        System.out.println ("This code is outside of  
                           the thread ");
```

```
}

public void run () {
    System.out.println ("This code is running
                        in a thread");
}

}
```

## JAVA File Handling :

### JAVA Files :

File handling is an important part of any application.

Java has several methods for creating, reading, updating, and deleting files.

### JAVA File Handling

The **file** class from the **java.io** package, allows us to work with files.

To use the **file** class, create an object of

the class, and Specify the filename or directory name.

### Example ↴

```
import java.io.File; // Import the file class
```

```
File myobj = new File ("filename.txt");  
//specify the filename
```

The file class has many useful methods for creating and getting information about files. For example.

Method	Type	Description
canRead()	Boolean	Tests whether the file is readable or not
canWrite()	Boolean	Tests whether the file is writable or not.



`createNewFile()` Boolean Creates an empty file

`delete()` Boolean Deletes a file

`exists()` Boolean Tests whether the file exists

`getName()` String Returns the name of the file

`getAbsolutePath()` String Returns the absolute pathname of the file.

`length()` Long Returns the size of the file in bytes

`list()` String[] Returns an array of the files in the dictionary.



mkdir()

Boolean

(creates a directory)

## JAVA Create and Write To Files:

### Create a File

To create a file in Java, you can use the createNewFile() method. This method returns a boolean value. true if the file was successfully created, and false if the file already exists. Note that the method is enclosed in a try....catch block. This is necessary because it throws an IOException if an error occurs.

### Example ↴

```
import java.io.File; // Import the file class
import java.io.IOException; // Import the IOException class to handle error
```

```
public class Createfile {
    public static void main(String[] args) {
        try {
```



```
File myobj = new File ("filename.txt");
if (myobj.createNewFile ()) {
    System.out.println ("file created :" + myobj.
        getName ());
} else {
    System.out.println ("file already exists.");
}

} catch ( IOException e) {
    System.out.println ("An error occurred.");
    e.printStackTrace ();
}
}
```

Output → File created : filename.txt

### Write to a file

Use the **FileWriter** class together with its **write ()** method to write some text to the file we created in the example above.



## Example ↴

```
import java.io.FileWriter; // Import the
                           // FileWriter class
import java.io.IOException;
                           // Import the IOException class
                           // to handle errors

public class WriteToFile {
    public static void main(String[] args) {
        try {
            FileWriter myWriter = new FileWriter
                ("filename.txt");
            myWriter.write("files in java might be
                           tricky, but it is fun
                           enough!");
            myWriter.close();
            System.out.println("Successfully wrote to
                               the file.");
        } catch (IOException e) {
            System.out.println("An error occurred.");
            e.printStackTrace();
        }
    }
}
```

Output → Successfully wrote to the file.

## JAVA Read Files :

Scanner class to read the contents of the text file we created in the previous chapter.

Example ↴

```
import java.io.File; // Import the file class

public class GetfileInfo {
    public static void main(String[] args) {
        File myobj = new File("filename.txt");
        if (myobj.exists()) {
            System.out.println("file name :" + myobj.
                getName());
            System.out.println("Absolute path :" +
                myobj.getAbsolutePath());
            System.out.println("Writetable :" + myobj.
                canWrite());
            System.out.println("Readable " + myobj.
                canRead());
            System.out.println("file size in bytes " +
```



```
    } else { myobj.length());  
    System.out.println("The file does not  
exist.");  
}  
}  
}
```

Output → File name: filename.txt

Absolute path:

C:\Users\myname\filename.txt

Writable : true

Readable : true

file size in bytes : 0

## JAVA Delete Files :

### Delete A File

To delete a file in java, use the  
**delete()** Method.

### Example ↴

```
import java.io.File; // Import the file  
class
```



```
public class Deletefile {
    public static void main (String [] args) {
        File myobj = new File ("filename.txt");
        if (myobj.delete ()) {
            System.out.println ("Deleted the file : "
                + myobj.getName ());
        } else {
            System.out.println ("Failed to delete the file.");
        }
    }
}
```

Output ↴

Deleted the file: filename.txt