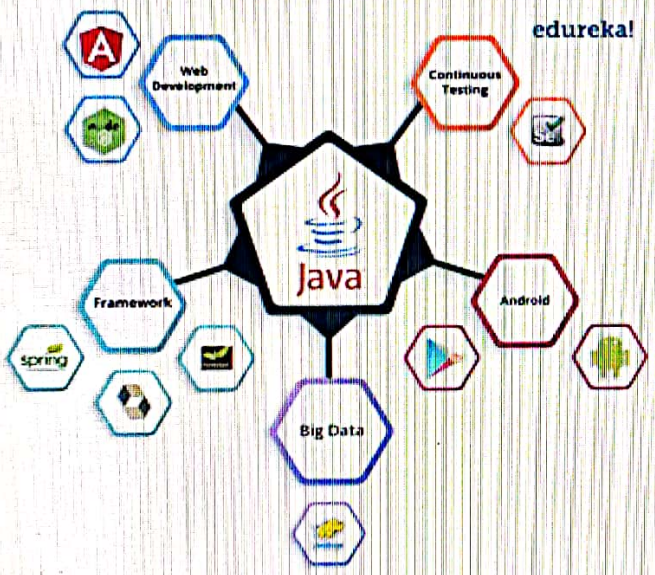
About Java

Java is fast, secure, and reliable. From laptops to datacenters, game consoles to scientific supercomputers, cell phones to the Internet, Java is everywhere!

- Java is a high-level programming language and is platform independent.
- Concurrent where you can execute many statements instead of sequentially executing it.
- Class-based and an object-oriented programming language.
- Independent programming language that follows the logic of "Write once, Run anywhere" i.e. the compiled code can run on all platforms which supports java.



Setting up Java

Choose the Operating System for instructions to install Java:

- ☐ Windows
- ☐ Mac
- ☐ Linux

For Windows:

For Windows:

- ✓ download Java and run the .exe to install Java on your machine.
- ✓ Assuming you have installed Java in c:\Program Files\java\jdk directory –
- ✓ Right-click on 'My Computer' and select 'Properties'.
- ✓ Click the 'Environment variables' button under the 'Advanced' tab.
- ✓ Now, alter the 'Path' variable so that it also contains the path to the Java executable

Features of Java

Simple: Java has made life easier by removing all the complexities such as pointers, operator overloading as you see in C++ or any other programming language.

Portable: Java is platform independent which means that any application written on one platform can be easily ported to another platform.

Object-oriented: Everything is considered to be an "**object**" which possess some state, behavior and all the operations are performed using these objects.

Secured: All the code is converted in **bytecode** after compilation, which is not readable by a human. and java does not use an explicit pointer and run the programs inside the sandbox to prevent any activities from untrusted sources. It enables to develop virus-free, tamper-free systems/applications.

Dynamic: It has the ability to adapt to an evolving environment which supports dynamic memory allocation due to which memory wastage is reduced and performance of the application is increased.

Distributed: Java provides a feature which helps to create distributed applications. Using Remote Method Invocation (RMI), a program can invoke a method of another program across a network and get the output. You can access files by calling the methods from any machine on the internet.

by calling the methods from any machine on the internet.

Robust: Java has a strong memory management system. It helps in eliminating error as it checks the code during compile and runtime.

High Performance: Java achieves high performance through the use of bytecode which can be easily translated into native machine code. With the use of JIT (Just-In-Time) compilers, Java enables high performance.

Interpreted: Java is compiled to bytecodes, which are interpreted by a Java run-time environment.

Multithreaded: Java supports multiple threads of execution (a.k.a., lightweight processes), including a set of synchronization primitives. This makes programming with threads much easier.

Components in Java

JVM (Java Virtual Machine)

It is an abstract machine. It is a specification that provides a run-time environment in which Java bytecode can be executed. It follows three notations:

- **Specification**: It is a document that describes the implementation of the Java virtual machine. It is provided by Sun and other companies and now its officially own by oracle.
- **Implementation**: It is a program that meets the requirements of JVM specification.
- **Runtime Instance**: An instance of JVM is created whenever you write a java command on the command prompt and run the class.

The JVM performs following operation:

- ✓ Loads code
- ✓ Verifies code
- ✓ Executes code
- ✓ Provides runtime environment

JRE (Java Runtime Environment)

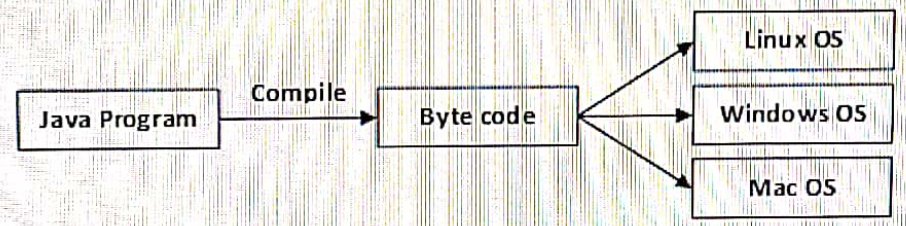
JRE refers to a runtime environment in which Java bytecode can be executed. It implements the JVM (Java Virtual Machine) and provides all the class libraries and other support files that JVM uses at runtime. So JRE is a software package that contains what is required to run a Java program. Basically, it's an implementation of the JVM which physically exists.

JDK(Java Development Kit)

It is the tool necessary to:

- Compile
- Document
- Package Java programs.

The JDK completely includes JRE which contains tools for Java programmers. The Java Development Kit is provided free of charge. Along with JRE, it includes an interpreter/loader, a compiler (javac), an archiver (jar), a documentation generator (Javadoc) and other tools needed in Java development. In short, it contains JRE + development tools.



1. Java Basic Syntax

```
public class MyFirstJavaProgram {

   /* This is my first java program.
    * This will print 'Hello World' as the output
    */

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

- Open notepad and add the code as above.
- Save the file as: MyFirstJavaProgram.java.
- Open a command prompt window and go to the directory where you saved the class. Assume

- Save the file as: MyFirstJavaProgram.java.
- Open a command prompt window and go to the directory where you saved the class. Assume it's C:\.
- Type **'javac MyFirstJavaProgram.java'** and press enter to compile your code. Now, type ' java MyFirstJavaProgram ' to run your program.
- You will be able to see ' Hello World '

Comments in Java

The java comments are statements that are not executed by the compiler and interpreter. The comments can be used to provide information or explanation about the variable, method, class or any statement. It can also be used to hide program code for specific time.

There are 3 types of comments in java.

1. Single Line Comment
2. Multi Line Comment
3. Documentation Comment

Single Line

```
//This is single line comment -
```

Multiline

```
/* Let's declare and print variable in java. */
```

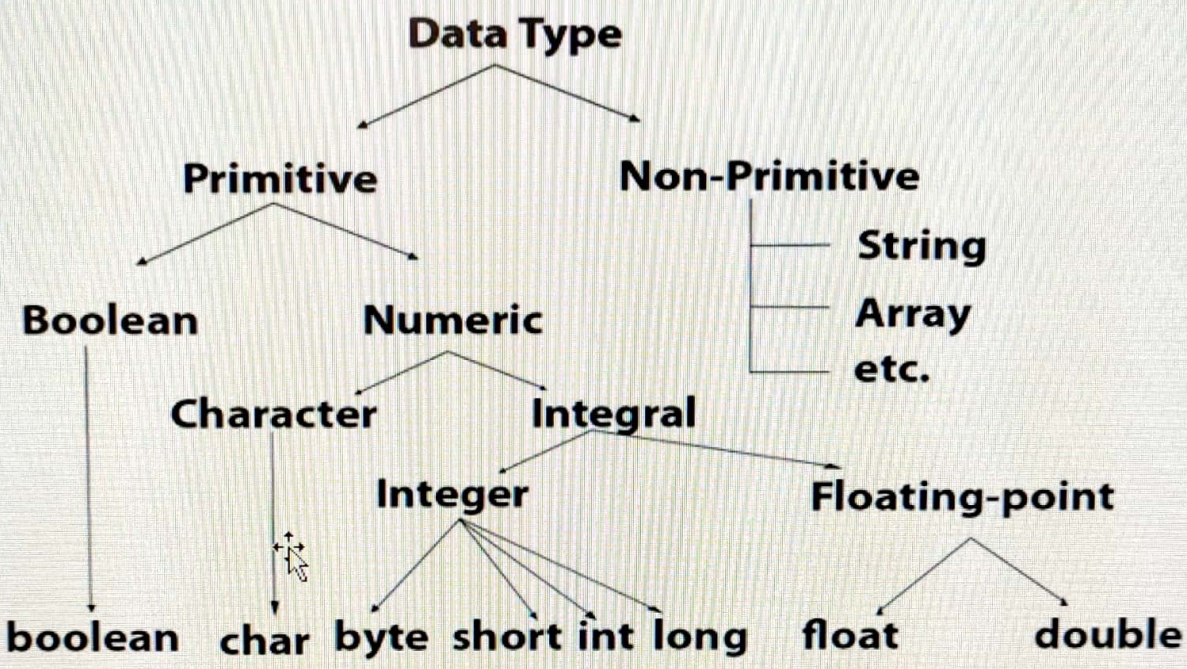
Documentation

/** The Calculator class provides methods to get addition and subtraction of given 2 numbers. */

Data Types in Java

There are 8 types of primitive data types:

- boolean data type
- byte data type
- char data type
- short data type
- int data type
- long data type
- float data type
- double data type



Data Type	Default Value	Default size
boolean	false	1 bit
char	'\u0000'	2 byte
byte	0	1 byte
short	0	2 byte
int	0	4 byte
long	0L	8 byte
float	0.0f	4 byte
double	0.0d	8 byte

Boolean Data Type

The Boolean data type is used to store only two possible values: true and false. This data type is used for simple flags that track true/false conditions.

The Boolean data type specifies one bit of information, but its "size" can't be defined precisely.

Example: Boolean one = false

Byte Data Type

The byte data type is an example of primitive data type. It isan 8-bit signed two's complement integer. Its value-range lies between -128 to 127 (inclusive). Its minimum value is -128 and maximum value is 127. Its default value is 0.

The byte data type is used to save memory in large arrays where the memory savings is most required. It saves space because a byte is 4 times smaller than an integer. It can also be used in place of "int" data type.

Example: byte a = 10, byte b = -20

Short Data Type

The short data type is a 16-bit signed two's complement integer. Its value-range lies between -32,768 to 32,767 (inclusive). Its minimum value is -32,768 and maximum value is 32,767. Its default value is 0.

The short data type can also be used to save memory just like byte data type. A short data type is 2 times smaller than an integer.

Example: short s = 10000, short r = -5000

Int Data Type

The int data type is a 32-bit signed two's complement integer. Its value-range lies between - 2,147,483,648 (-2^31) to 2,147,483,647 (2^31 -1) (inclusive). Its minimum value is - 2,147,483,648and maximum value is 2,147,483,647. Its default value is 0.

The int data type is generally used as a default data type for integral values unless if there is no problem about memory.

Example: int a = 100000, int b = -200000

Long Data Type

Example: int a = 100000, int b = -200000

Long Data Type

The long data type is a 64-bit two's complement integer. Its value-range lies between -9,223,372,036,854,775,808(-2^63) to 9,223,372,036,854,775,807(2^63 -1) (inclusive). Its minimum value is - 9,223,372,036,854,775,808and maximum value is 9,223,372,036,854,775,807. Its default value is 0. The long data type is used when you need a range of values more than those provided by int.

Example: long a = 100000L, long b = -200000L

Float Data Type

The float data type is a single-precision 32-bit IEEE 754 floating point. Its value range is unlimited. It is recommended to use a float (instead of double) if you need to save memory in large arrays of floating point numbers. The float data type should never be used for precise values, such as currency. Its default value is 0.0F.

Example: float f1 = 234.5f

Double Data Type

The double data type is a double-precision 64-bit IEEE 754 floating point. Its value range is unlimited. The double data type is generally used for decimal values just like float. The double data type also should never be used for precise values, such as currency. Its default value is 0.0d.

Example: double d1 = 12.3

Char Data Type

The char data type is a single 16-bit Unicode character. Its value-range lies between '\u0000' (or 0) to '\uffff' (or 65,535 inclusive). The char data type is used to store characters.

Example: char letterA = 'A'

Example: char letterA = 'A'

Unicode System

Unicode is a universal international standard character encoding that is capable of representing most of the world's written languages.

Why java uses Unicode System?

Before Unicode, there were many language standards:

- **ASCII** (American Standard Code for Information Interchange) for the United States.
- **ISO 8859-1** for Western European Language.
- **KOI-8** for Russian.
- **GB18030 and BIG-5** for Chinese, and so on.

Problem

This caused two problems:

- A particular code value corresponds to different letters in the various language standards.

- The encodings for languages with large character sets have variable length. Some

- The encodings for languages with large character sets have variable length. Some common characters are encoded as single bytes, other require two or more byte.

Java Variables

A variable is a container which holds the value while the java program is executed. A variable is assigned with a datatype.

Variable is a name of memory location. There are three types of variables in java:

local, instance and static.

```
int data=50;//Here data is variable
```

1) Local Variable

A variable declared inside the body of the method is called local variable. You can use this variable only within that method and the other methods in the class aren't even aware that the variable exists.

A local variable cannot be defined with "static" keyword.

2) Instance Variable

A variable declared inside the class but outside the body of the method, is called instance variable. It is not declared as static.

It is called instance variable because its value is instance specific and is not shared among instances.

3) Static variable

A variable which is declared as static is called static variable. It cannot be local. You can create a single copy of static variable and share among all the instances of the class. Memory allocation for static variable happens only once when the class is loaded in the memory.

```
1. class A{
2. int data=50;//instance variable
3. static int m=100;//static variable
4. void method(){
5. int n=90;//local variable
6. }
```

```
}
}//end of class
```

Java Keywords

Java keywords are also known as **reserved words**. Keywords are particular words which acts as a key to a code. These are predefined words by Java so it cannot be used as a variable or object name.

List of Java Keywords

A list of Java keywords or reserved words are given below:

1. **abstract:** Java abstract keyword is used to declare abstract class. Abstract class can provide the implementation of interface. It can have abstract and non-abstract methods.
2. **boolean:** Java boolean keyword is used to declare a variable as a boolean type. It can hold True and False values only.
3. **break:** Java break keyword is used to break loop or switch statement. It breaks the current flow of the program at specified condition.
4. **byte:** Java byte keyword is used to declare a variable that can hold an 8-bit data values.
5. **case:** Java case keyword is used to with the switch statements to mark blocks of text.
6. **catch:** Java catch keyword is used to catch the exceptions generated by try statements. It must be used after the try block only.
7. **char:** Java char keyword is used to declare a variable that can hold unsigned 16-bit Unicode characters

8. **class:** Java class keyword is used to declare a class.
9. **continue:** Java continue keyword is used to continue the loop. It continues the current flow of the program and skips the remaining code at the specified condition.
10. **default:** Java default keyword is used to specify the default block of code in a switch statement.
11. **do:** Java do keyword is used in control statement to declare a loop. It can iterate a part of the program several times.
12. **double:** Java double keyword is used to declare a variable that can hold a 64-bit floating-point numbers.
13. **else:** Java else keyword is used to indicate the alternative branches in an if statement.
14. **enum:** Java enum keyword is used to define a fixed set of constants. Enum constructors are always private or default.
15. **extends:** Java extends keyword is used to indicate that a class is derived from another class or interface.
16. **final:** Java final keyword is used to indicate that a variable holds a constant value. It is applied with a variable. It is used to restrict the user.
17. **finally:** Java finally keyword indicates a block of code in a try-catch structure. This block is always executed whether exception is handled or not.

18. **float:** Java float keyword is used to declare a variable that can hold a 32-bit floating-point number.
19. **for:** Java for keyword is used to start a for loop. It is used to execute a set of instructions/functions repeatedly when some conditions become true. If the number of iteration is fixed, it is recommended to use for loop.
20. **if:** Java if keyword tests the condition. It executes the if block if condition is true.
21. **implements:** Java implements keyword is used to implement an interface.

21. **implements:** Java implements keyword is used to implement an interface.
22. **import:** Java import keyword makes classes and interfaces available and accessible to the current source code.
23. **instanceof:** Java instanceof keyword is used to test whether the object is an instance of the specified class or implements an interface.
24. **int:** Java int keyword is used to declare a variable that can hold a 32-bit signed integer.
25. **interface:** Java interface keyword is used to declare an interface. It can have only abstract methods.
26. **long:** Java long keyword is used to declare a variable that can hold a 64-bit integer.
27. **native:** Java native keyword is used to specify that a method is implemented in native code using JNI (Java Native Interface).
28. **new:** Java new keyword is used to create new objects.
29. **null:** Java null keyword is used to indicate that a reference does not refer to anything. It removes the garbage value.
30. **package:** Java package keyword is used to declare a Java package that includes the classes.
31. **private:** Java private keyword is an access modifier. It is used to indicate that a method or variable may be accessed only in the class in which it is declared.
32. **protected:** Java protected keyword is an access modifier. It can be accessible within package and outside the package but through **inheritance only**. It can't be applied on the class.
33. **public:** Java public keyword is an access modifier. It is used to indicate that an item is accessible anywhere. It has the widest scope among all other modifiers.
34. **return:** Java return keyword is used to return from a method when its execution is complete.
35. **short:** Java short keyword is used to declare a variable that can hold a 16-bit integer.
36. **static:** Java static keyword is used to indicate that a variable or method is a class method. The static keyword in Java is used for memory management mainly.
37. **strictfp:** Java strictfp is used to restrict the floating-point calculations to ensure portability.
38. **super:** Java super keyword is a reference variable that is used to refer parent class object. It can be used to invoke immediate parent class method.

39. **switch**: The Java switch keyword contains a switch statement that executes code based on test value. The switch statement tests the equality of a variable against multiple values.
40. **synchronized**: Java synchronized keyword is used to specify the critical sections or methods in multithreaded code.
41. **this**: Java this keyword can be used to refer the current object in a method or constructor.
42. **throw**: The Java throw keyword is used to explicitly throw an exception. The throw keyword is mainly used to throw custom exception. It is followed by an instance.
43. **throws**: The Java throws keyword is used to declare an exception. Checked exception can be propagated with throws.
44. **transient**: Java transient keyword is used in serialization. If you define any data member as transient, it will not be serialized.
45. **try**: Java try keyword is used to start a block of code that will be tested for exceptions. The try block must be followed by either catch or finally block.
46. **void**: Java void keyword is used to specify that a method does not have a return value.
47. **volatile**: Java volatile keyword is used to indicate that a variable may change asynchronously.
48. **while**: Java while keyword is used to start a while loop. This loop iterates a part of the program several times. If the number of iteration is not fixed, it is recommended to use while loop.

Operators in java

Operator in java is a symbol that is used to perform operations. For example: +, -, *, / etc.

There are many types of operators in java which are given below:

- Unary Operator,
- Arithmetic Operator,
- Shift Operator,
- Relational Operator,
- Bitwise Operator,
- Logical Operator,
- Ternary Operator and

ted States)

- Ternary Operator and
- Assignment Operator.

Java Operator Precedence

Operator Type	Category	Precedence
Unary	postfix	*expr++ expr--*
	prefix	*++expr --expr +expr -expr* ~ !
Arithmetic	multiplicative	* / %
	additive	+ -
Shift	shift	<< >> >>>
Relational	comparison	< > <= >= instanceof
	equality	== !=
Bitwise	bitwise AND	&

Operator Type	Category	Precedence
Unary	postfix	*expr++ expr--*
	prefix	*++expr --expr +expr -expr ~ !*
Arithmetic	multiplicative	* / %
	additive	+ -
Shift	shift	<< >> >>>
Relational	comparison	< > <= >= instanceof
	equality	== !=
Bitwise	bitwise AND	&
	bitwise exclusive OR	^
	bitwise inclusive OR	|
Logical	logical AND	&&
	logical OR	||
Ternary	ternary	? :
Assignment	assignment	= += -= *= /= %= &= ^= |= <<= >>= >>>=

Java Unary Operator

The Java unary operators require only one operand. Unary operators are used to perform various operations i.e.:

- incrementing/decrementing a value by one
- negating an expression
- inverting the value of a Boolean

```
1. class OperatorExample{
2. public static void main(String args[]){
3. int x=10;
4. System.out.println(x++);//10 (11)  1 2
5. System.out.println(++x);//12  23
6. System.out.println(x--);//12 (11)
7. System.out.println(--x);//10
8. }}
```

Java Arithmetic Operators

Java arithmetic operators are used to perform addition, subtraction, multiplication, and division. They act as basic mathematical operations.

```
1. class OperatorExample{
2. public static void main(String args[]){
3. int a=10;
4. int b=5;
5. System.out.println(a+b);//15
6. System.out.println(a-b);//5
7. System.out.println(a*b);//50
8. System.out.println(a/b);//2
9. System.out.println(a%b);//0
10. }}
```

Java Left Shift Operator

The Java left shift operator << is used to shift all of the bits in a value to the left side of a specified number of times.

```
1. class OperatorExample{
2. public static void main(String args[]){
3. System.out.println(10<<2); //10*2^2=10*4=40
4. System.out.println(10<<3); //10*2^3=10*8=80
5. System.out.println(20<<2); //20*2^2=20*4=80
6. System.out.println(15<<4); //15*2^4=15*16=240
7. }}
```

Java Right Shift Operator

The Java right shift operator >> is used to move left operands value to right by the number of bits specified by the right operand.

```
1. class OperatorExample{
2. public static void main(String args[]){
3. System.out.println(10>>2);//10/2^2=10/4=2
4. System.out.println(20>>2);//20/2^2=20/4=5
5. System.out.println(20>>3);//20/2^3=20/8=2
6. }}
```

Java AND Operator Example: Logical && and Bitwise &

The logical && operator doesn't check second condition if first condition is false.

It checks second condition only if first one is true.

The bitwise & operator always checks both conditions whether first condition is true or false.

```
1. class OperatorExample{
```

```
1. class OperatorExample{
2. public static void main(String args[]){
3. int a=10;
4. int b=5;
5. int c=20;
6. System.out.println(a<b&&a<c);//false && true = false
7. System.out.println(a<b&a<c);//false & true = false
8. }}
```

Java OR Operator Example: Logical || and Bitwise |

The logical || operator doesn't check second condition if first condition is true. It checks second condition only if first one is false.

The bitwise | operator always checks both conditions whether first condition is true or false.

```
1. class OperatorExample{
2. public static void main(String args[]){
3. int a=10;
4. int b=5;
5. int c=20;
6. System.out.println(a>b||a<c);//true || true = true
7. System.out.println(a>b|a<c);//true | true = true
8. //|| vs |
9. System.out.println(a>b||a++<c);//true || true = true
```

Java OR Operator Example: Logical || and Bitwise |

The logical || operator doesn't check second condition if first condition is true. It checks second condition only if first one is false.

The bitwise | operator always checks both conditions whether first condition is true or false.

```
1. class OperatorExample{
2. public static void main(String args[]){
3. int a=10;
4. int b=5;
5. int c=20;
6. System.out.println(a>b||a<c);//true || true = true
7. System.out.println(a>b|a<c);//true | true = true
8. //|| vs |
9. System.out.println(a>b||a++<c);//true || true = true
10. System.out.println(a);//10 because second condition is not checked
11. System.out.println(a>b|a++<c);//true | true = true
12. System.out.println(a);//11 because second condition is checked
13. }}
```