OBJECT ORIENTED PROGRAMMING USING JAVA

Course Type:	Foundation		L	T	P	Credits
			3	1	4	6

COURSE CREDITS

COURSE OUTCOME

Examine	CO1: To examine different programming structures in a platform independent language such as wrapper classes, collections, exceptions, and multithreading.
Explain	CO2: To explain the concepts of object-oriented programming like encapsulation, abstraction, inheritance and polymorphism. Also java specific implementation of features like collection framework and multithreading would be covered.
Implement	CO3:Make use of GUI and database based programming to develop Applications for real life problems.

Course Components	Marks
Lab Continuous evaluation	20
Mid Term	20
End Term	40
Project	10
Certification	5
Quiz	5

EVALUATION COMPONENT

RESOURCES

- Edx-Object Oriented Programming in Java.

https://www.edx.org/course/introduction-to-java-programming-starting-to-code

- Coursera-Object Oriented Programming in Java Specialization.

https://www.coursera.org/specializations/object-oriented-programming

- MIT OpenCourseWare-Introduction to Programming in Java.

https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/

LABTOOL

- **Lab Platform**
- CodeTantra (Continuous Labs & Exams)

- **IDE**
- VS Code
- Eclipse
- Netbeans
- IntelliJ IDEA

FUNDAMENTALS

OUTLINE

- Introduction to Java
- Bytecode
- JVMArchitecture
- Applications of Java
- Types of JavaApplication
- History of Java
- Features of Java
- Simple Java Program

OUTLINE

- Data Type
- Variable
- Variable Name
- Operators
- Precedence of Operators
- Examples of Operators

INTRODUCTION TO JAVA

- ❑ Java is a general purpose programming language.
- ❑ It is High Level language.
- ❑ Java was originally developed by James Gosling at Sun Microsystems in 1995.
- ❑ Java is a language that is platform independent.
- ❑ A platform is the hardware and software environment in which a programs run.
- ❑ Java has its own Java Runtime Environment (JRE) and API.

INTRODUCTION TO JAVA (CONT…)

- Java code is once compiled, it can run on any platform without recompiling or any kind of modification.
  - “Write Once Run Anywhere”
- The aforementioned feature of Java is supported by Java Virtual Machine (JVM).
  - First, Java code is complied into bytecode. This bytecode gets interpreted on different machines. Java bytecode is the result of the compilation of a Java program, an intermediate representation of that program which is machine independent.

BYTECODE

- When we write a program in Java, at first, the compiler compiles the program and a bytecode is generated.
- When we wish to run this .class file on any other platform, we can do so.
- After the first compilation, the generated bytecode is now run by the Java Virtual Machine and the processor is not in consideration (only java installation is required).
- Implementation of JVM is based on stack.

BYTECODE (CONT…)

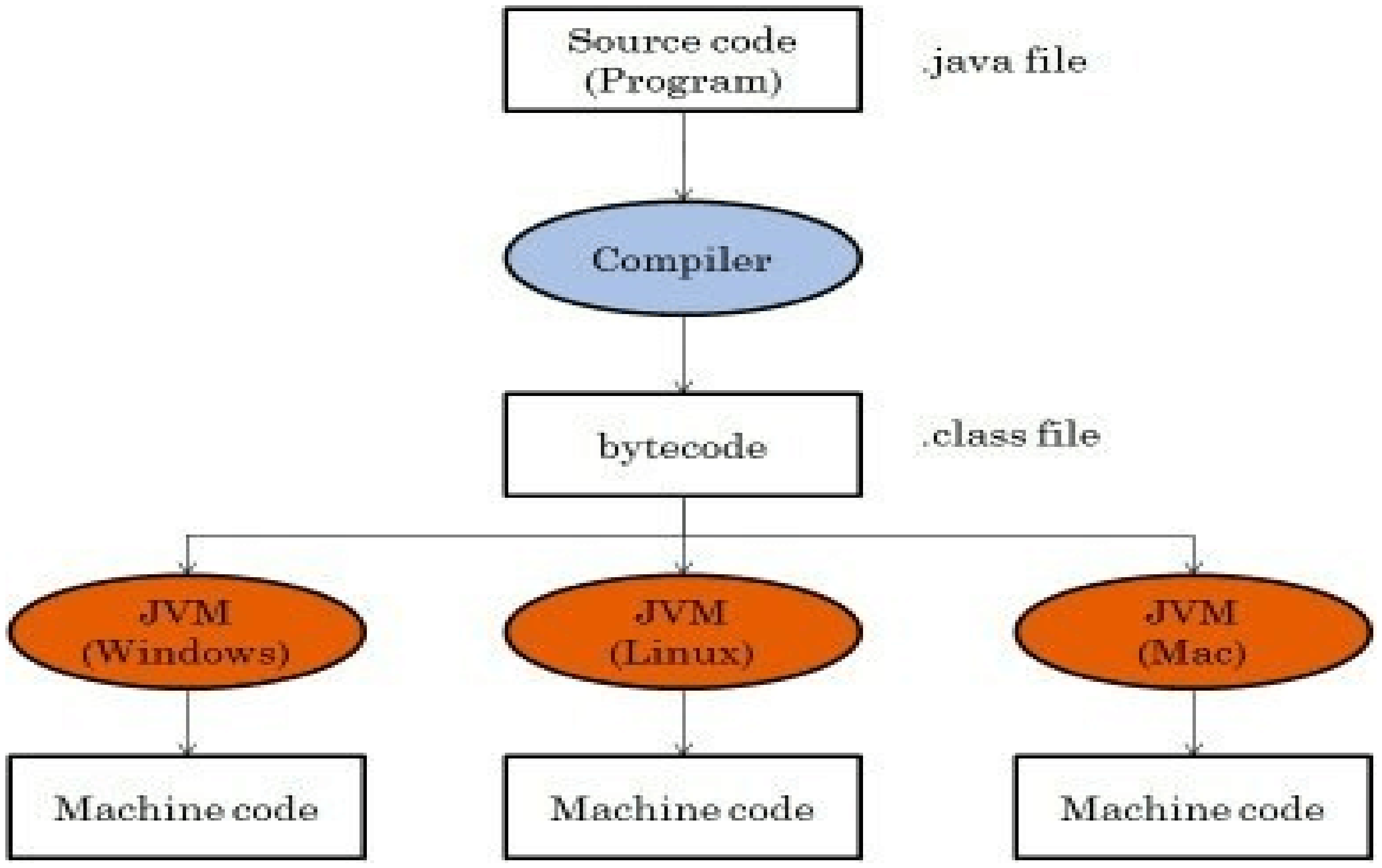


Fig 1: Bytecode

JVMARCHITECTURE

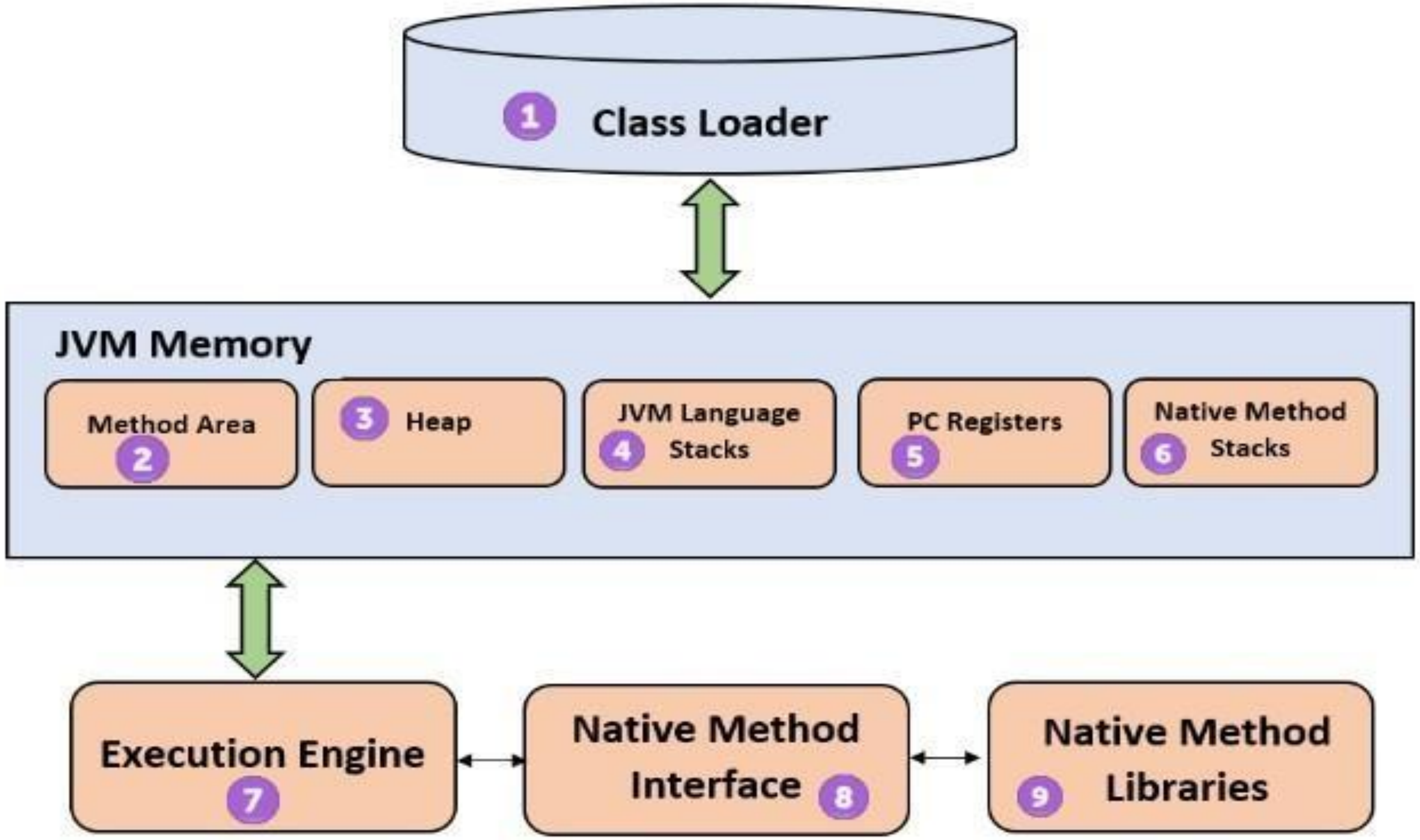


Fig 2: JVM architecture

APPLICATIONS OF JAVA

- Approx. 3 Billion devices run java. Some of them are as follows:
  - Desktop applications
  - Web applications
  - Enterprise applications (banking)
  - Mobile
  - Embedded system
  - Smart card
  - Robotics
  - Games

TYPES OF JAVA APPLICATION

- There are 4 type of java applications:
  - Standalone Application: An application that install on each system (AWT and Swing are used).
  - Web Application: An application that runs on the server side and creates dynamic page (servlet, jsp, etc are used).
  - Enterprise Application: An application that is distributed in nature, such as banking applications. It has the advantage of high level security and load balancing.
  - Mobile Application: An application that is created for mobile devices (Android and Java ME are used).

HISTORY OF JAVA

- James Gosling, Mike Sheridan, and Patrick Naughton initiated the Java language project in June 1991. The small team of sun engineers called Green Team.
- Firstly, it was called "Greentalk" by James Gosling and file extension was .gt.
- After that, it was called Oak and developed as a part of the Green project.
- In 1995, Oak was renamed as "Java“.
- JDK 1.0 released in 23 Jan 1996.

FEATURES OF JAVA

- There are many features of Java:
  - Object-oriented
  - Platform independent
  - Secure
  - Robust
  - Portable
  - Dynamic
  - High performance
  - Multithread
  - Distribute

SIMPLE JAVA PROGRAM

- To create a simple java program, you need to create a class that contains main method.

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

SIMPLE JAVA PROGRAM (CONT…)

- **Save:** Save as Hello.java
- **To compile:** javac Hello.java
- **To execute:** java Hello
- **Output:** Hello World

SIMPLE JAVA PROGRAM (CONT…)

- **class** keyword is used to declare a class.
- **public** keyword is an access modifier, which represents visibility. It means it is visible to all.
- **static** is a keyword. If we declare any method as static, it is known as the static method. The core advantage of the static method is that there is no need to create an object to invoke the static method. The main method is executed by the JVM, so it doesn't require to create an object to invoke the main method. Thus, it saves memory.
- **void** is the return type of the method. It means it doesn't return any value.
- **main** represents the starting point of the program.
- **String args []** is an array of strings which stores arguments passed by command line while starting a program.
- **System.out.println()** is used to print statement. Here, System is a class, out is the object of PrintStream class, println() is the method of PrintStream class.

SIMPLE JAVA PROGRAM (CONT…)

- The subscript notation in Java array can be used after type, before the variable or after the variable.

  - public static void main(String[] args)

  - public static void main(String []args)

  - public static void main(String args[])

SIMPLE JAVA PROGRAM (CONT…)

- Valid Java main method signature:
  - public static void main(String[] args)
  - public static void main(String []args)
  - public static void main(String args[])
  - public static void main(String... args)
  - static public void main(String[] args)

SIMPLE JAVA PROGRAM (CONT…)

- Invalid Java main method signature:
  - public void main(String[] args)
  - static void main(String[] args)
  - public void static main(String[] args)

SIMPLE JAVA PROGRAM (CONT…)

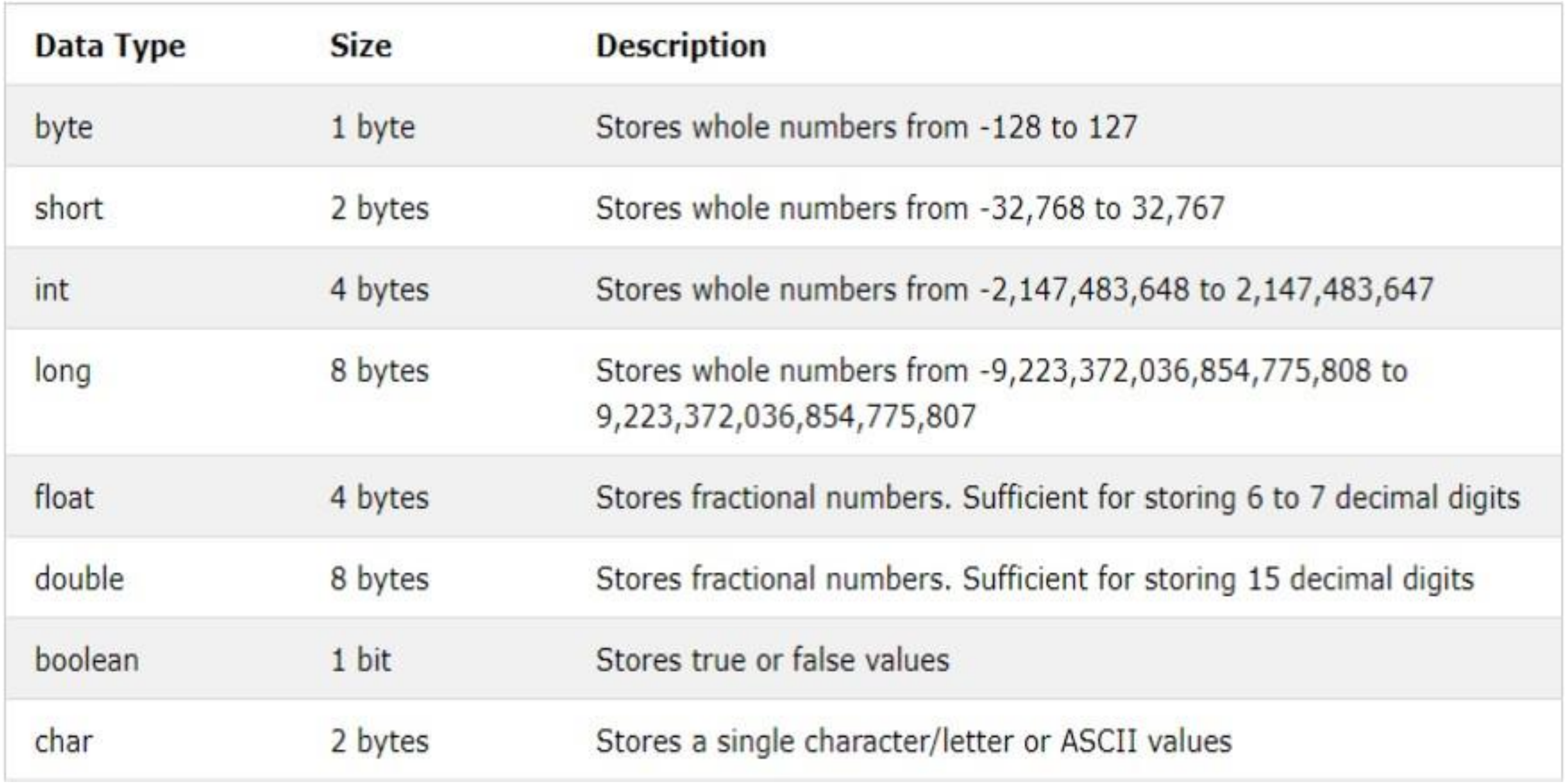
- Giving a semicolon at the end of a class is optional in Java.

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

DATA TYPE

- There are mainly two types of data type:
  - **Primitive:** Byte, short, int, long, float, double, boolean and char.
  - **Non-primitive:** String, arrays and classes

DATA TYPE (CONT.)



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

VARIABLE

- A variables can be considered as a name given to the location in memory where values are stored.\
- **<datatype> <variable_name>**
- Can the value of variable be changed?
- Yes

VARIABLE NAME

- ❑Use only the characters ‘a’ through ‘z’, ‘A’ through ‘Z, ‘0’ through ‘9’, character ‘_’, and character ‘$’.
- ❑ A name can’t contain space character.
- ❑ Do not start with a digit. Variable name can be of any length.
- ❑ Case sensitive.
- ❑ A name can not be a reserved word (A reserved word is a
word which has a predefined meaning in Java. Example: int, double, true, etc.).

VARIABLE NAME (CONT…)

❑Can you answer that whether the below lines are correct or not?

1. int good-bye;
2. int shrift = 0;
3. char thisMustBeTooLong;
4. int bubble = 0, toil = 9, trouble = 8
5. int 8ball;
6. int double;

VARIABLE NAME (CONT…)

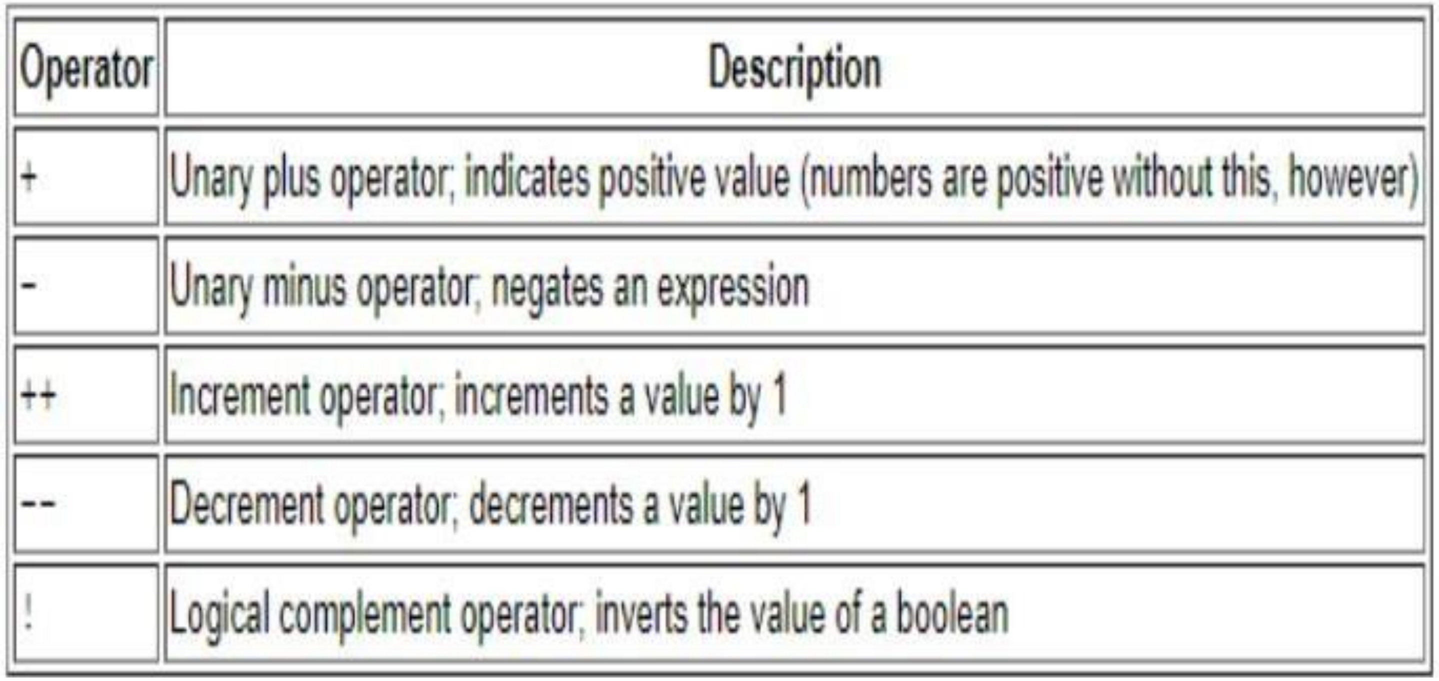
- Answers of the last slide:
  1. int good-bye; //bad variable name
  2. int shrift = 0; //OK
  3. char thisMustBeTooLong; //OK in syntax //but poor choice in variable name
  4. int bubble = 0, toil = 9, trouble = 8 // “;” missing at the end
  5. int 8ball; //can’t start with a digit
  6. int double; //double is a reserve word

OPERATORS

- There are many operators in Java::
  - Unary operators
  - Arithmetic operators
  - Relational operators
  - Bitwise operators
  - Logical operators
  - Assignment operators
  - Ternary operators

OPERATORS (CONT….)

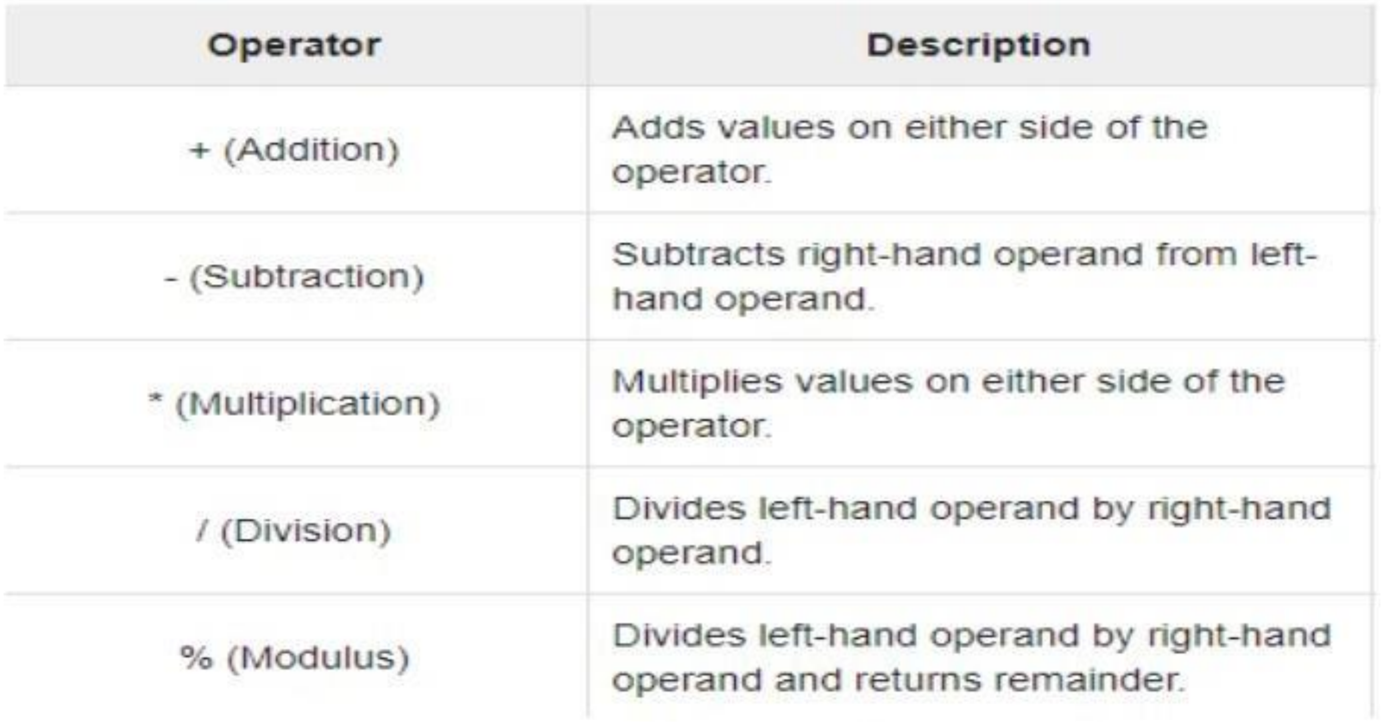
- Unary operators:



Operator	Description
+	Unary plus operator; indicates positive value (numbers are positive without this, however)
-	Unary minus operator; negates an expression
++	Increment operator; increments a value by 1
--	Decrement operator; decrements a value by 1
!	Logical complement operator; inverts the value of a boolean

OPERATORS (CONT.…)

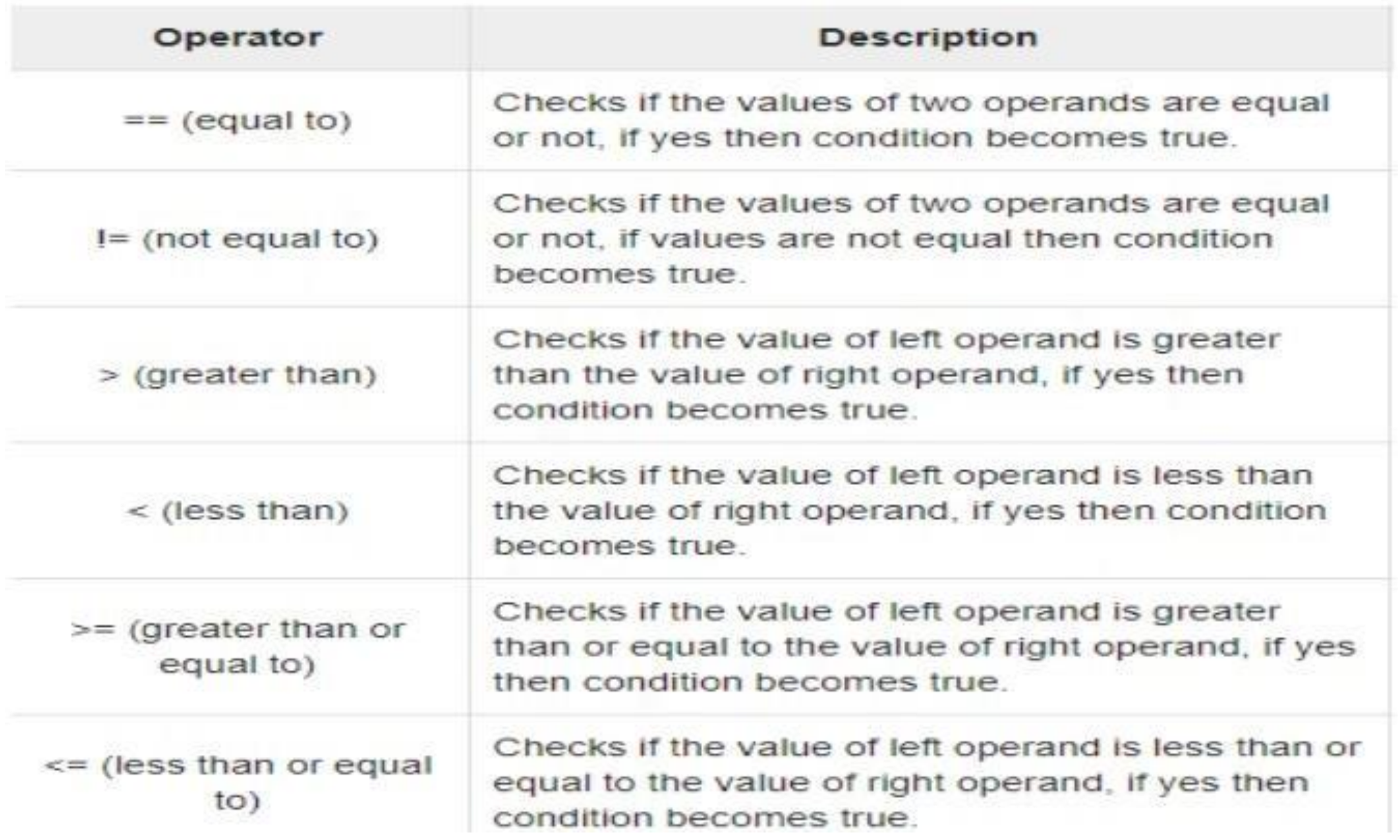
- Arithmetic operators:



Operator	Description
+ (Addition)	Adds values on either side of the operator.
- (Subtraction)	Subtracts right-hand operand from left-hand operand.
* (Multiplication)	Multiplies values on either side of the operator.
/ (Division)	Divides left-hand operand by right-hand operand.
% (Modulus)	Divides left-hand operand by right-hand operand and returns remainder.

OPERATORS (CONT.…)

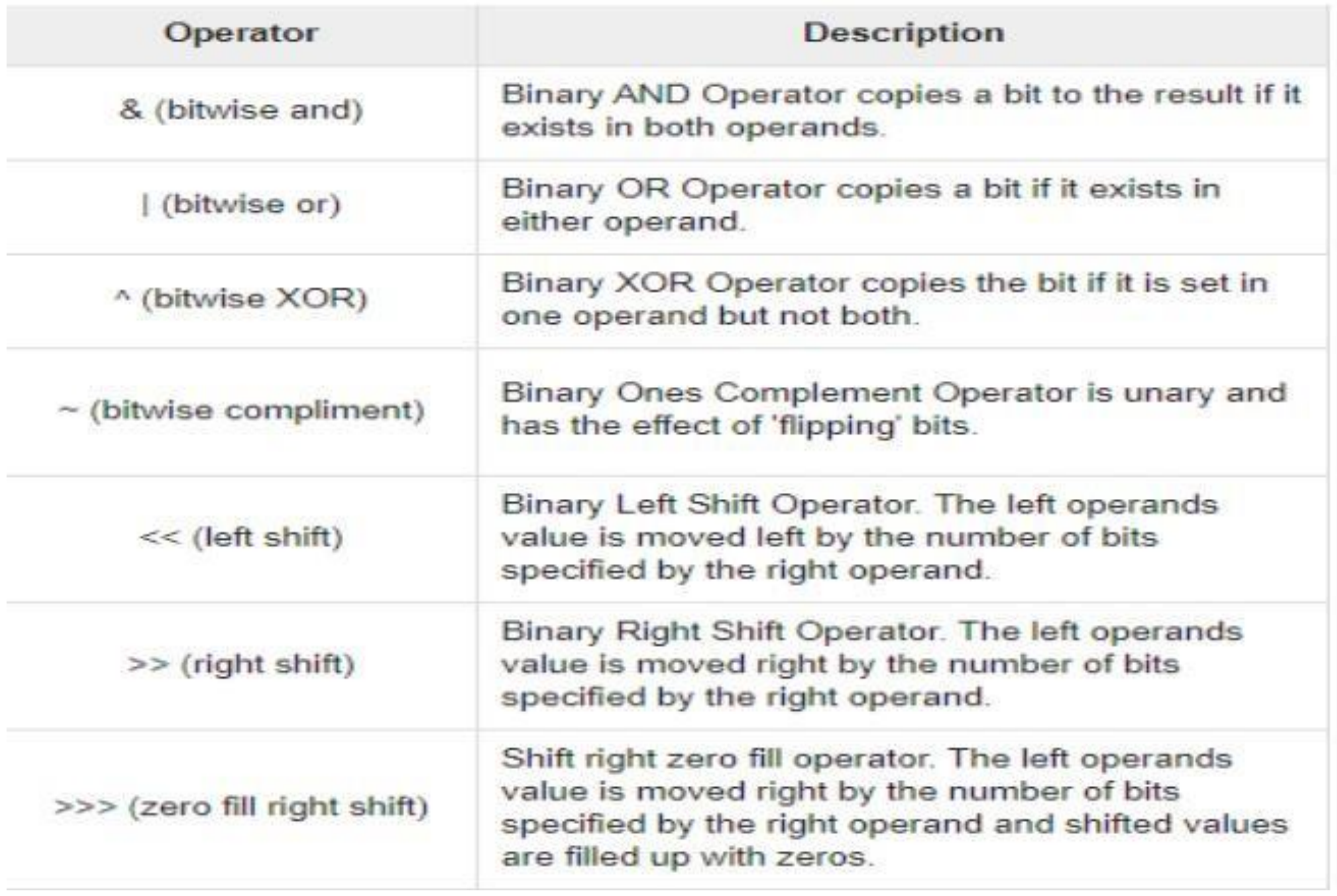
❑ Relational operators:



Operator	Description
== (equal to)	Checks if the values of two operands are equal or not, if yes then condition becomes true.
!= (not equal to)	Checks if the values of two operands are equal or not, if values are not equal then condition becomes true.
> (greater than)	Checks if the value of left operand is greater than the value of right operand, if yes then condition becomes true.
< (less than)	Checks if the value of left operand is less than the value of right operand, if yes then condition becomes true.
>= (greater than or equal to)	Checks if the value of left operand is greater than or equal to the value of right operand, if yes then condition becomes true.
<= (less than or equal to)	Checks if the value of left operand is less than or equal to the value of right operand, if yes then condition becomes true.

OPERATORS (CONT….)

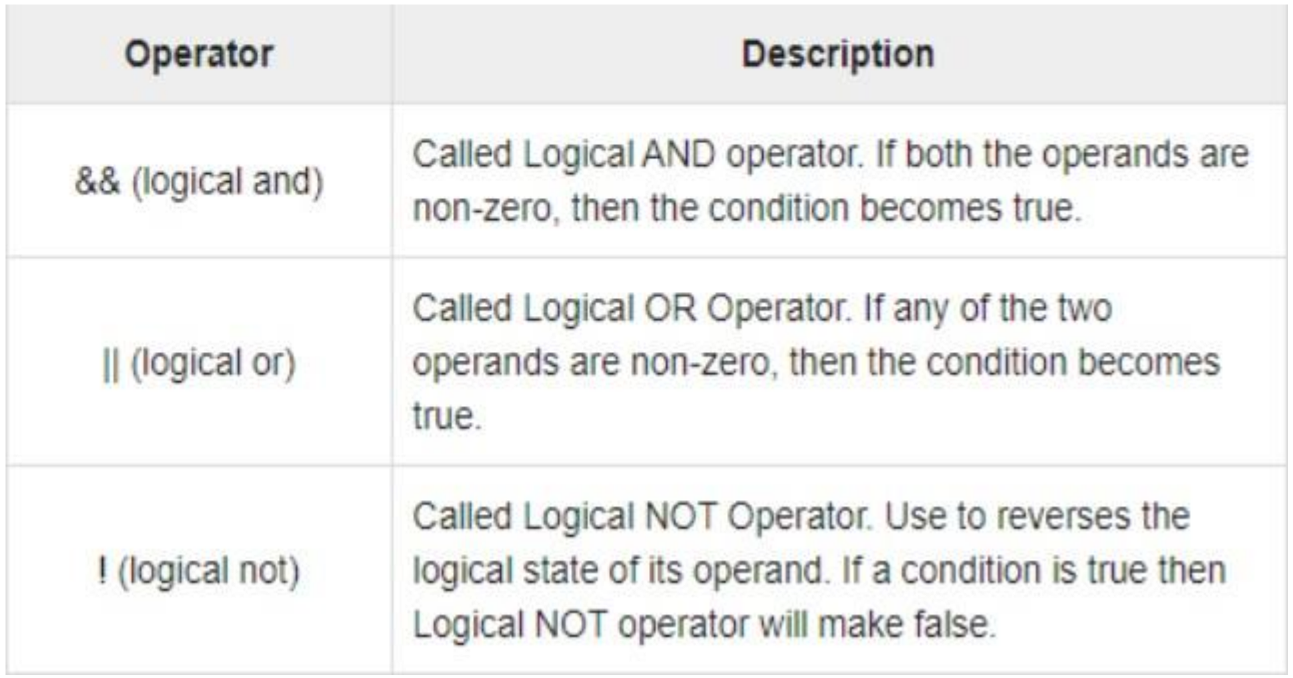
- Bitwise operators:



Operator	Description
& (bitwise and)	Binary AND Operator copies a bit to the result if it exists in both operands.
| (bitwise or)	Binary OR Operator copies a bit if it exists in either operand.
^ (bitwise XOR)	Binary XOR Operator copies the bit if it is set in one operand but not both.
~ (bitwise compliment)	Binary Ones Complement Operator is unary and has the effect of 'flipping' bits.
<< (left shift)	Binary Left Shift Operator. The left operands value is moved left by the number of bits specified by the right operand.
>> (right shift)	Binary Right Shift Operator. The left operands value is moved right by the number of bits specified by the right operand.
>>> (zero fill right shift)	Shift right zero fill operator. The left operands value is moved right by the number of bits specified by the right operand and shifted values are filled up with zeros.

OPERATORS (CONT.…)

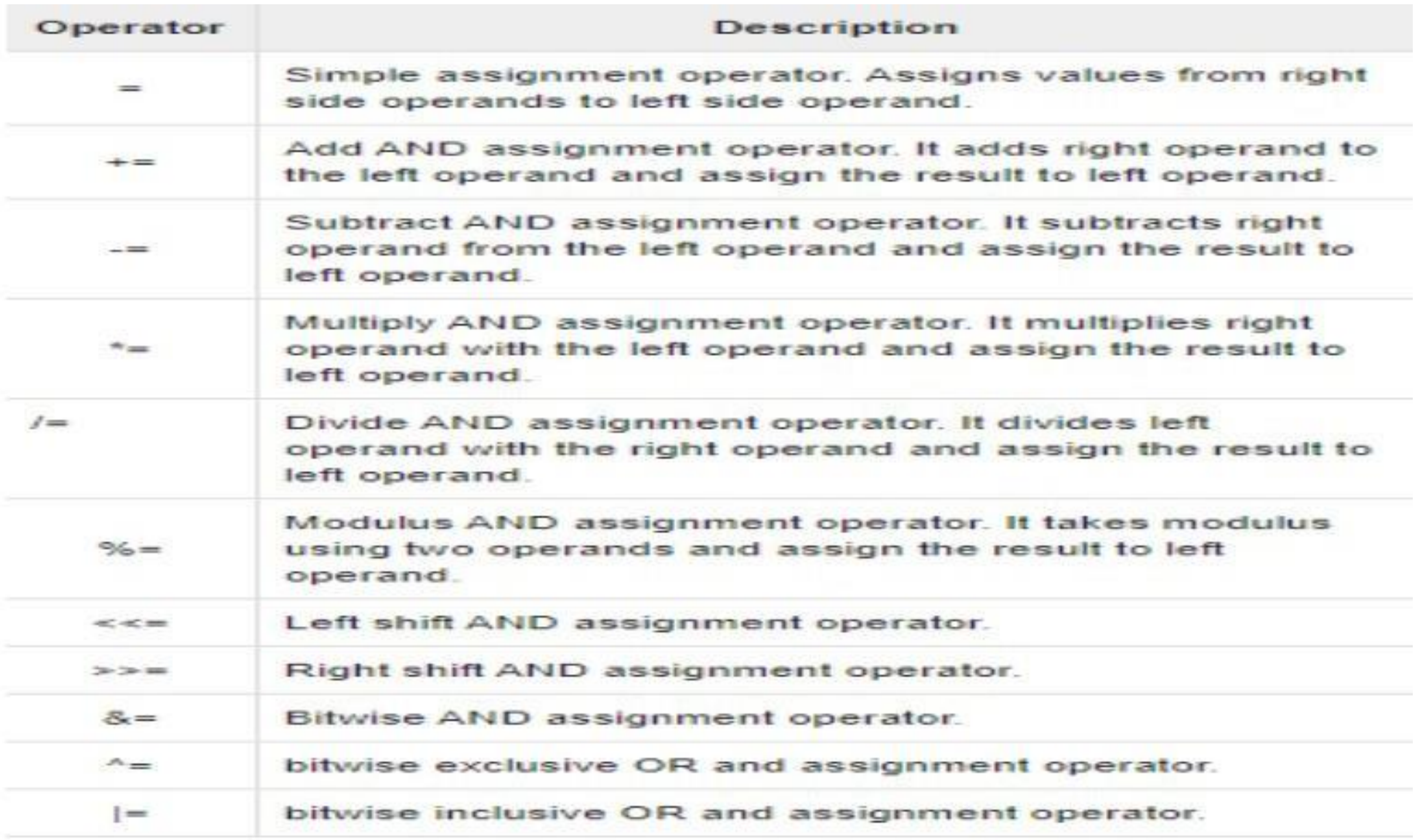
- Logical operators:



Operator	Description
&& (logical and)	Called Logical AND operator. If both the operands are non-zero, then the condition becomes true.
|| (logical or)	Called Logical OR Operator. If any of the two operands are non-zero, then the condition becomes true.
! (logical not)	Called Logical NOT Operator. Use to reverses the logical state of its operand. If a condition is true then Logical NOT operator will make false.

OPERATORS (CONT.…)

- Assignment operators:



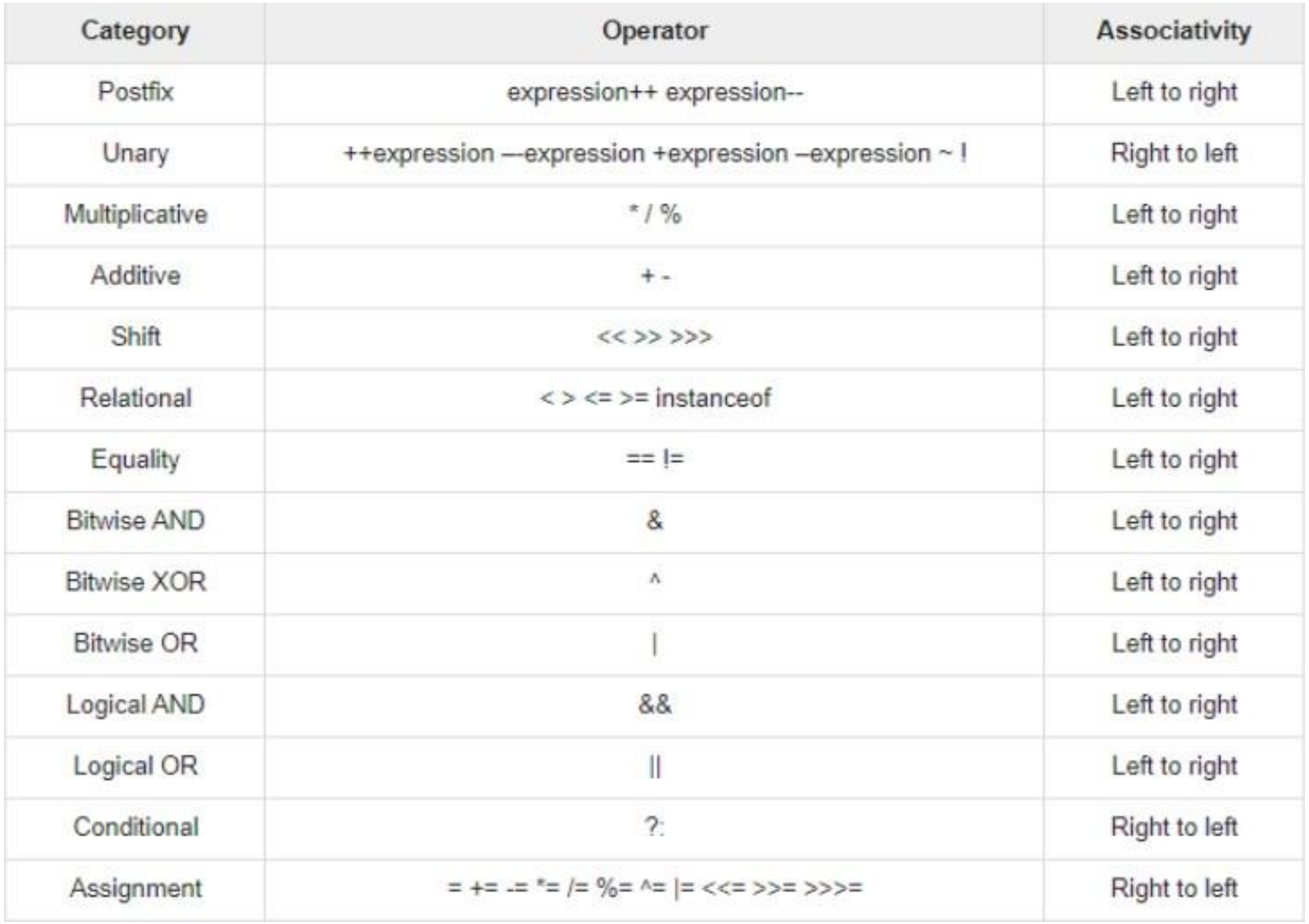
Operator	Description
=	Simple assignment operator. Assigns values from right side operands to left side operand.
+=	Add AND assignment operator. It adds right operand to the left operand and assign the result to left operand.
-=	Subtract AND assignment operator. It subtracts right operand from the left operand and assign the result to left operand.
*=	Multiply AND assignment operator. It multiplies right operand with the left operand and assign the result to left operand.
/=	Divide AND assignment operator. It divides left operand with the right operand and assign the result to left operand.
%=	Modulus AND assignment operator. It takes modulus using two operands and assign the result to left operand.
<<=	Left shift AND assignment operator.
>>=	Right shift AND assignment operator.
&=	Bitwise AND assignment operator.
^=	bitwise exclusive OR and assignment operator.
|=	bitwise inclusive OR and assignment operator.

OPERATORS (CONT.…)

- Ternary operators:

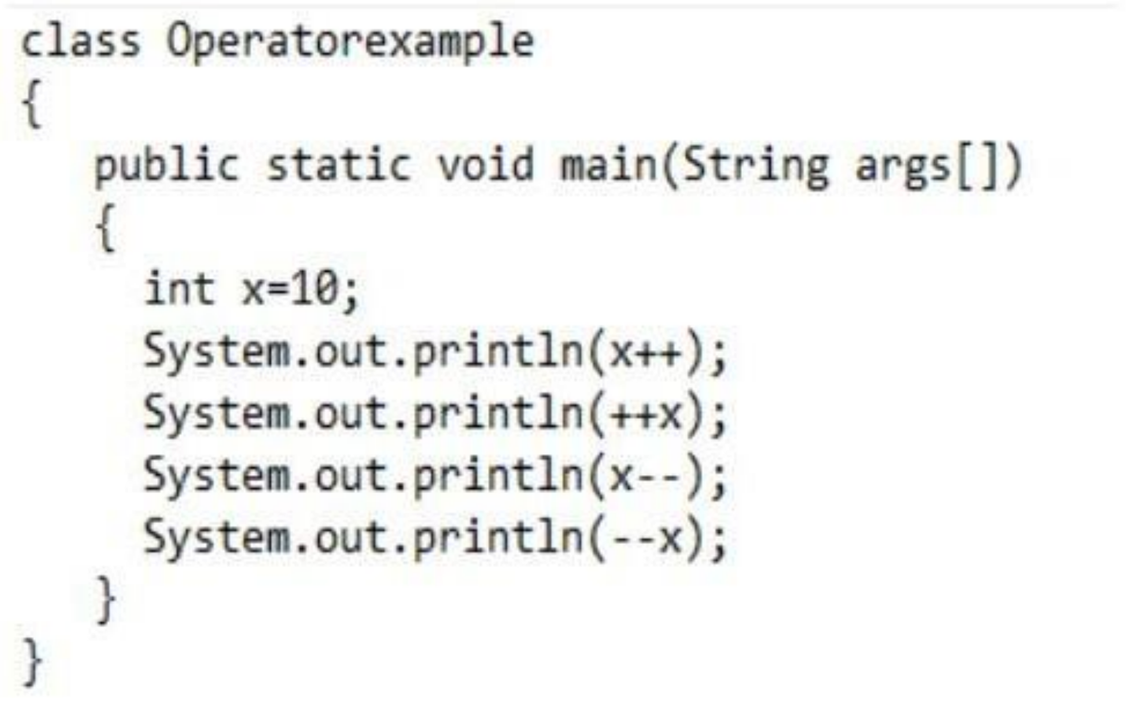
- Conditional Operator (? :)

PRECEDENCE OF THE OPERATORS



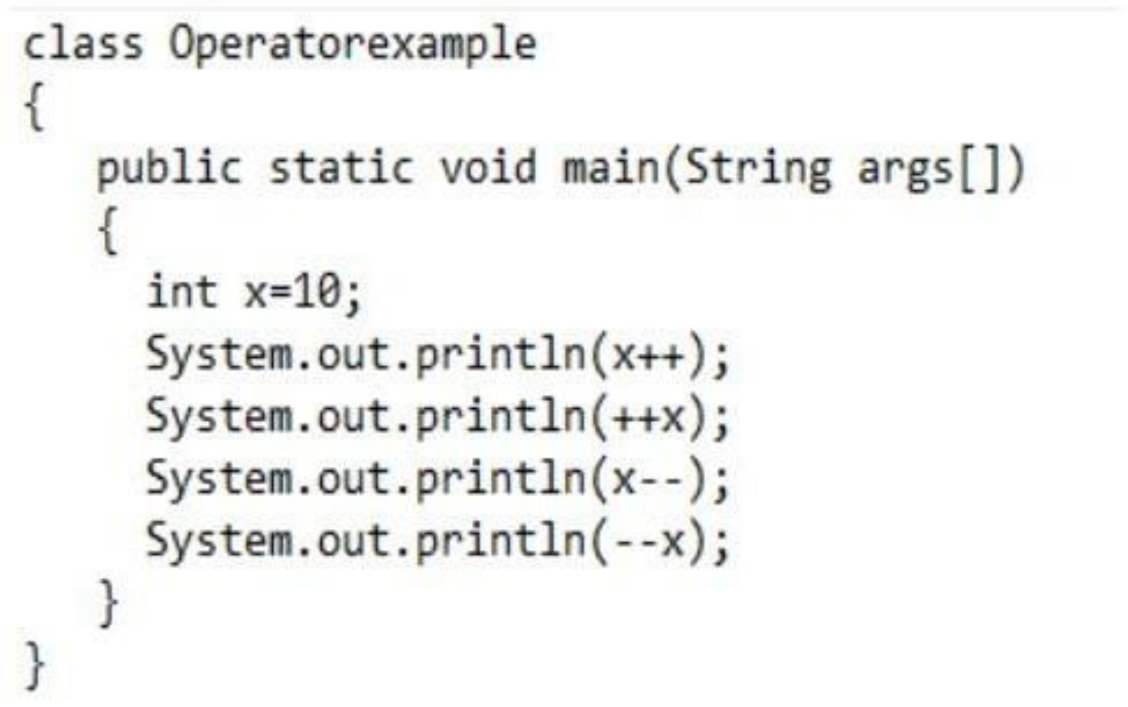
Category	Operator	Associativity
Postfix	expression++ expression--	Left to right
Unary	++expression —expression +expression –expression ~ !	Right to left
Multiplicative	* / %	Left to right
Additive	+ -	Left to right
Shift	<< >> >>>	Left to right
Relational	< > <= >= instanceof	Left to right
Equality	== !=	Left to right
Bitwise AND	&	Left to right
Bitwise XOR	^	Left to right
Bitwise OR	|	Left to right
Logical AND	&&	Left to right
Logical OR	||	Left to right
Conditional	?:	Right to left
Assignment	= += -= *= /= %= ^= |= <<= >>= >>>=	Right to left

EXAMPLES OF OPERATORS



```
class Operatorexample
{
   public static void main(String args[])
   {
     int x=10;
     System.out.println(x++);
     System.out.println(++x);
     System.out.println(x--);
     System.out.println(--x);
   }
}
```

EXAMPLES OF OPERATORS



```
class Operatorexample
{
   public static void main(String args[])
   {
     int x=10;
     System.out.println(x++);
     System.out.println(++x);
     System.out.println(x--);
     System.out.println(--x);
   }
}
```

Output:

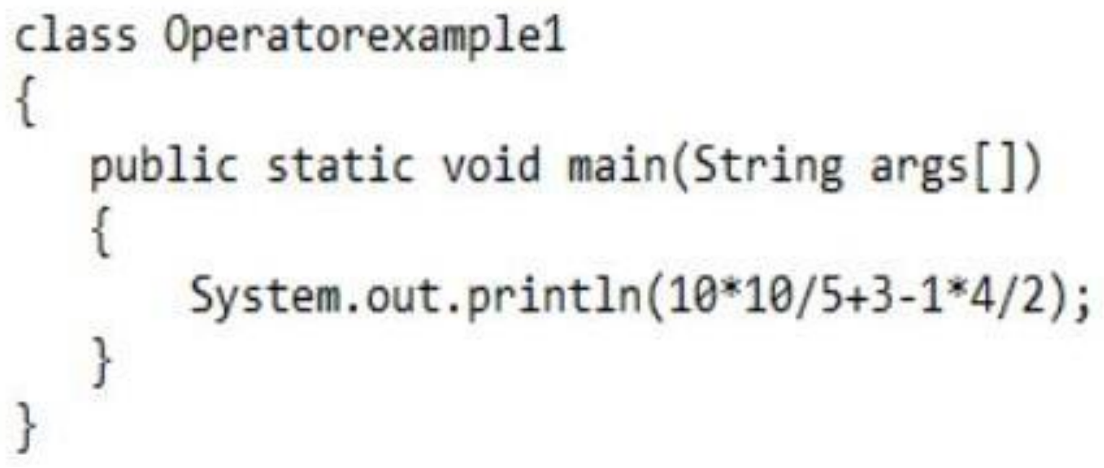
❖10

❖12

❖12

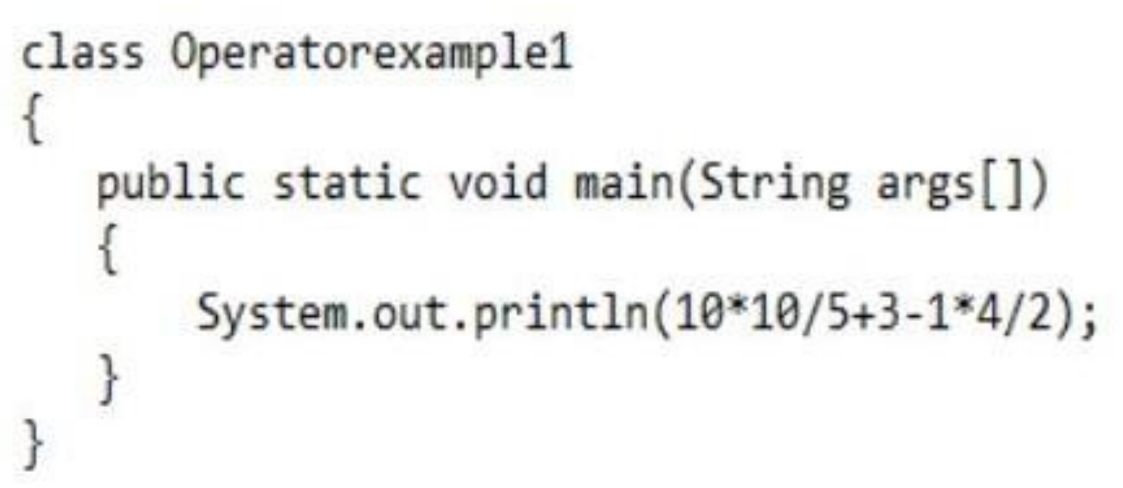
❖10

EXAMPLES OF OPERATORS (CONT.…)



```
class Operatorexample1
{
   public static void main(String args[])
   {
       System.out.println(10*10/5+3-1*4/2);
   }
}
```

EXAMPLES OF OPERATORS (CONT….)

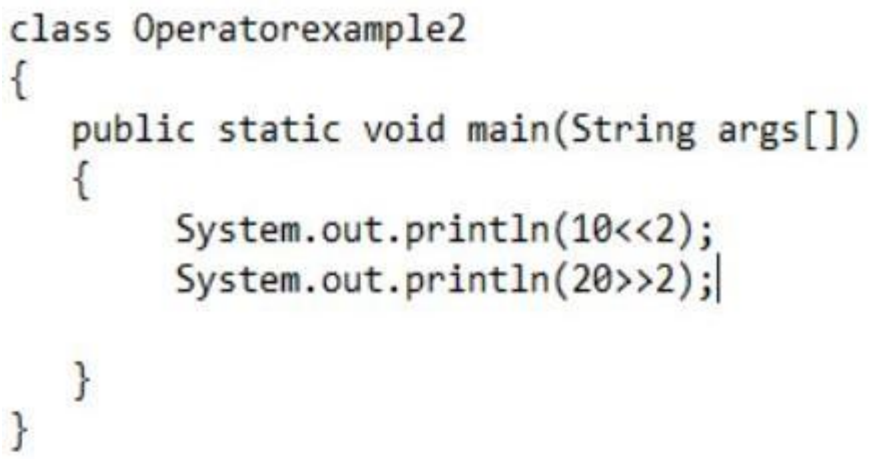


```
class Operatorexample1
{
   public static void main(String args[])
   {
       System.out.println(10*10/5+3-1*4/2);
   }
}
```

Output:

❖21

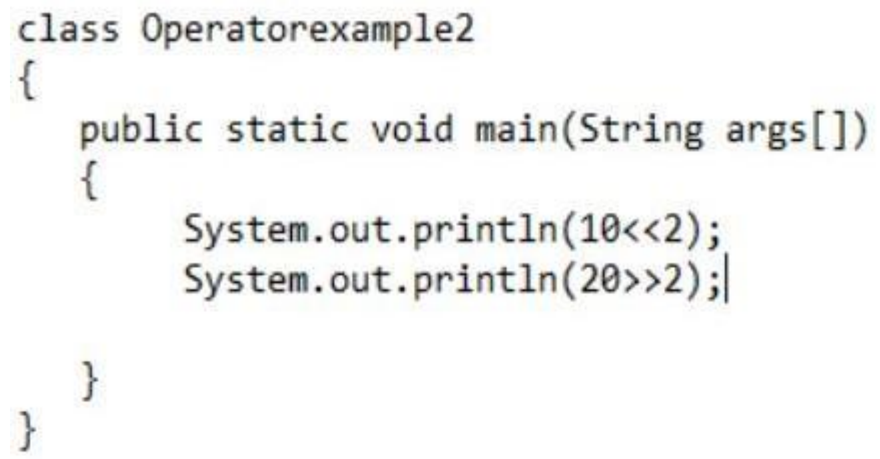
EXAMPLES OF OPERATORS (CONT….)



```
class Operatorexample2
{
   public static void main(String args[])
   {
         System.out.println(10<<2);
         System.out.println(20>>2);

   }
}
```

EXAMPLES OF OPERATORS (CONT.…)



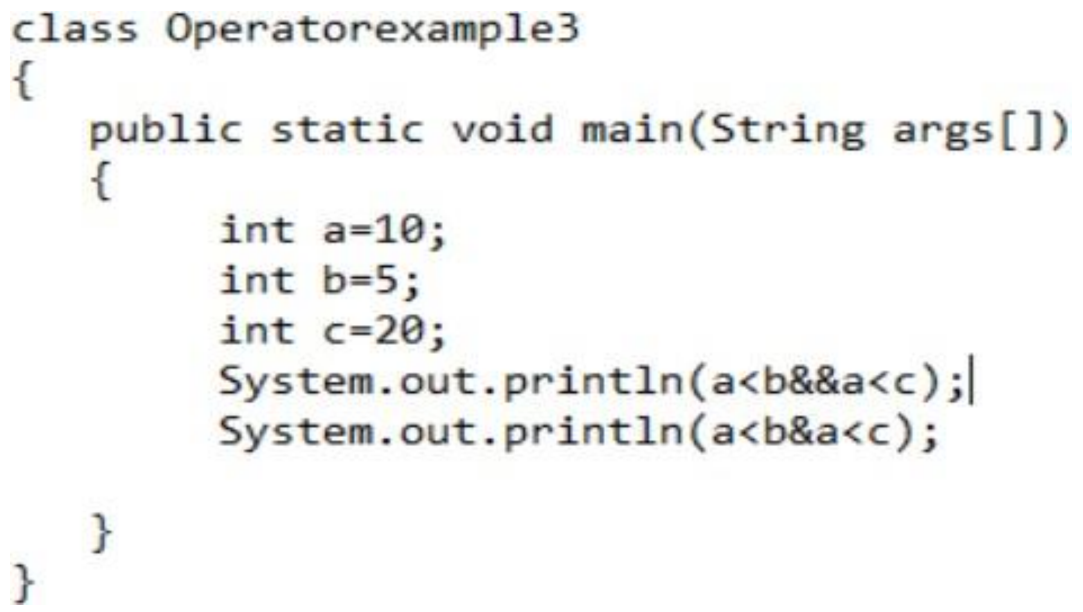
```
class Operatorexample2
{
   public static void main(String args[])
   {
        System.out.println(10<<2);
        System.out.println(20>>2);

   }
}
```

Output:

- ❖40
- ❖5

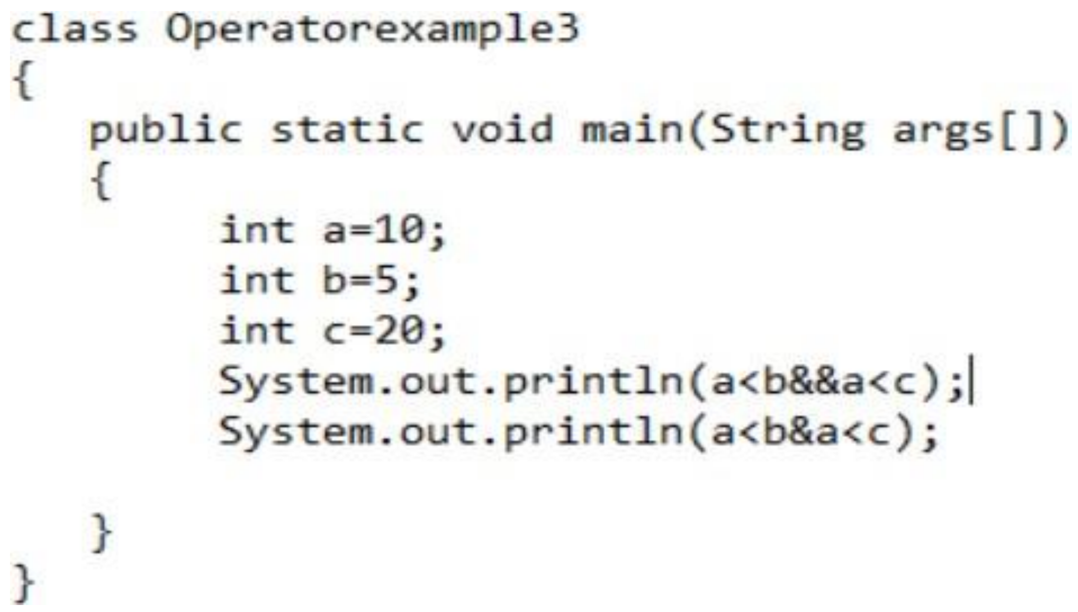
EXAMPLES OF OPERATORS (CONT….)



```
class Operatorexample3
{
   public static void main(String args[])
   {
        int a=10;
        int b=5;
        int c=20;
        System.out.println(a<b&&a<c);
        System.out.println(a<b&a<c);

   }
}
```

EXAMPLES OF OPERATORS (CONT….)



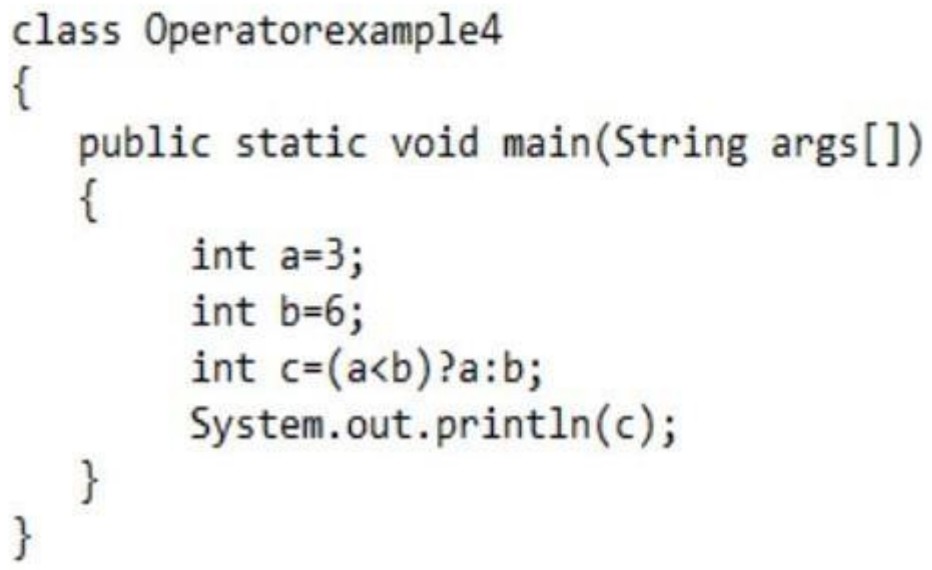
```
class Operatorexample3
{
   public static void main(String args[])
   {
         int a=10;
         int b=5;
         int c=20;
         System.out.println(a<b&&a<c);
         System.out.println(a<b&a<c);

   }
}
```

Output:

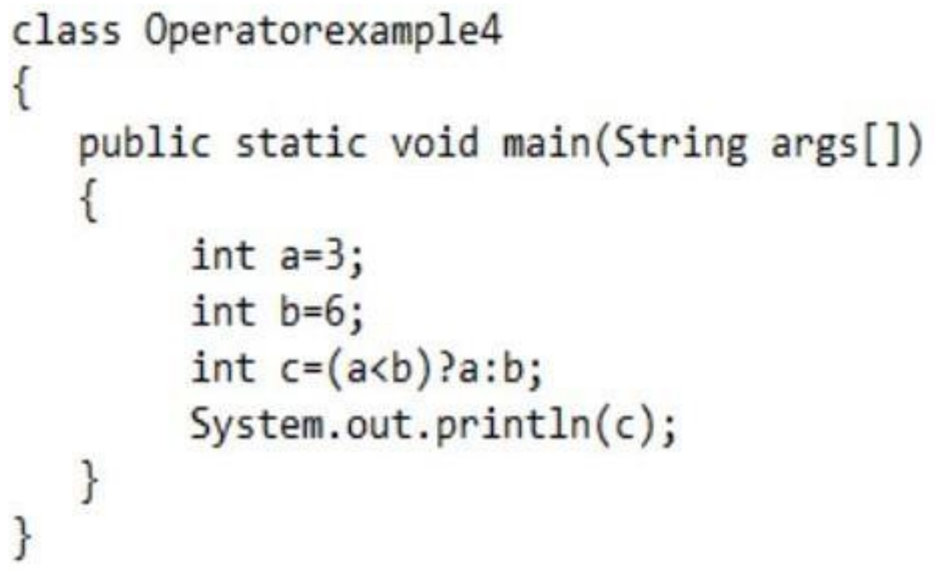
- ❖false
- ❖false

EXAMPLES OF OPERATORS (CONT….)



```
class Operatorexample4
{
   public static void main(String args[])
   {
        int a=3;
        int b=6;
        int c=(a<b)?a:b;
        System.out.println(c);
   }
}
```

EXAMPLES OF OPERATORS (CONT….)

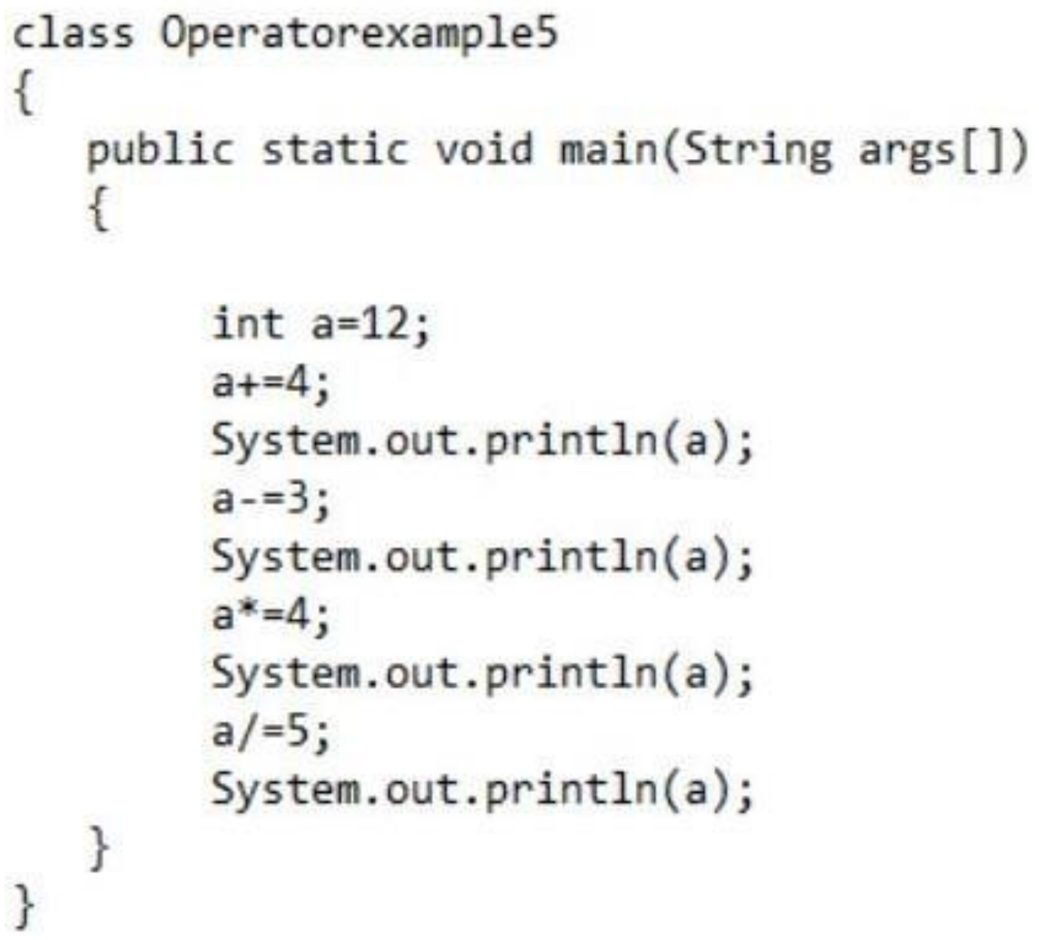


```
class Operatorexample4
{
   public static void main(String args[])
   {
        int a=3;
        int b=6;
        int c=(a<b)?a:b;
        System.out.println(c);
   }
}
```

Output:

❖3

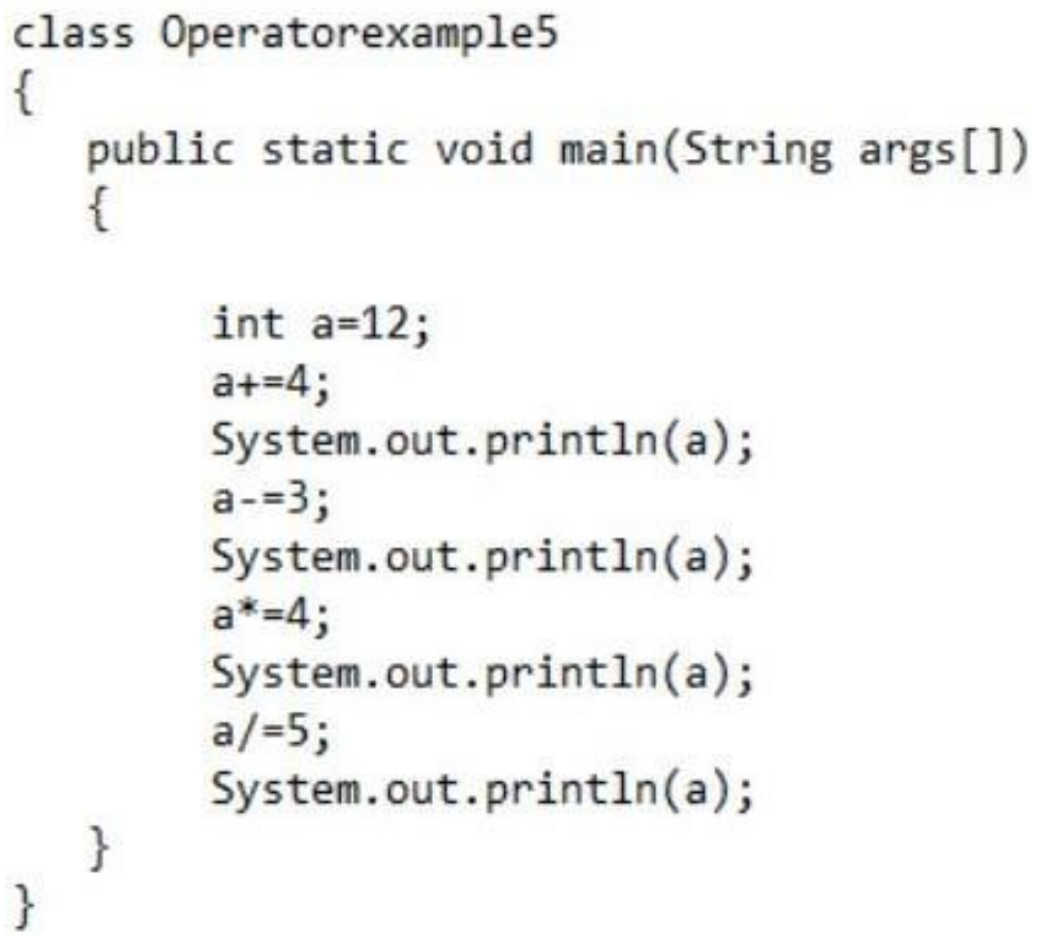
EXAMPLES OF OPERATORS (CONT….)



```
class Operatorexample5
{
   public static void main(String args[])
   {

        int a=12;
        a+=4;
        System.out.println(a);
        a-=3;
        System.out.println(a);
        a*=4;
        System.out.println(a);
        a/=5;
        System.out.println(a);
   }
}
```

EXAMPLES OF OPERATORS (CONT….)



```
class Operatorexample5
{
   public static void main(String args[])
   {

        int a=12;
        a+=4;
        System.out.println(a);
        a-=3;
        System.out.println(a);
        a*=4;
        System.out.println(a);
        a/=5;
        System.out.println(a);
   }
}
```

Output:

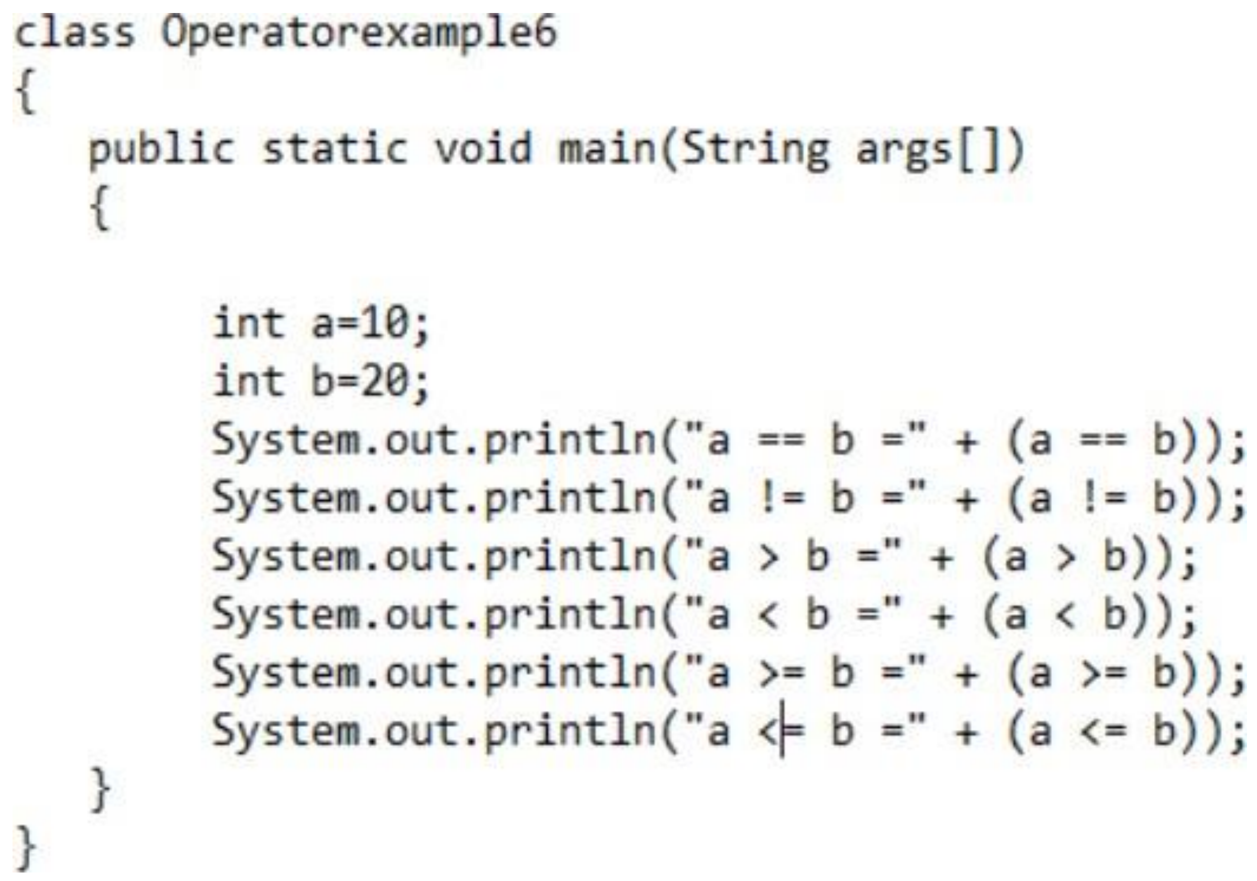
❖16

❖13

❖52

❖10

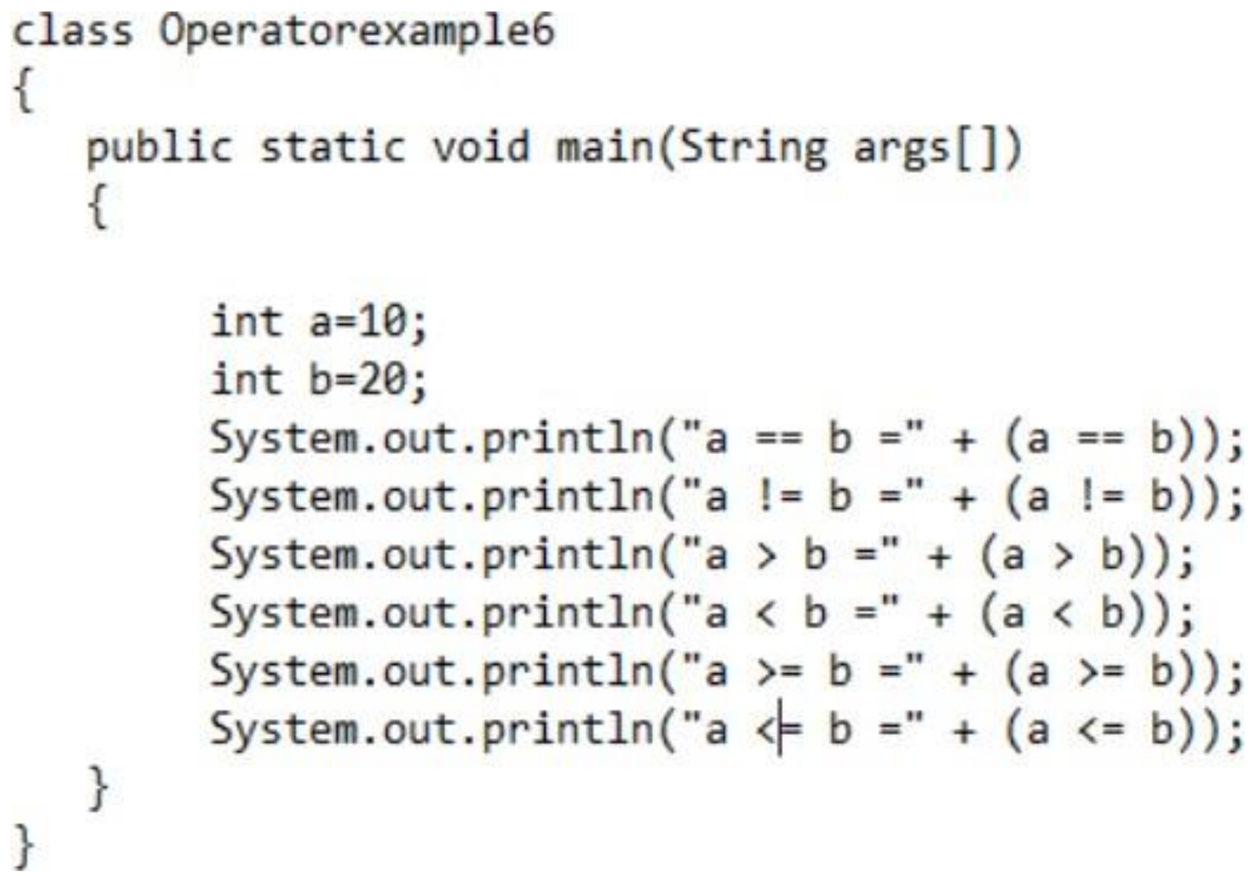
EXAMPLES OF OPERATORS (CONT….)



```
class Operatorexample6
{
   public static void main(String args[])
   {

        int a=10;
        int b=20;
        System.out.println("a == b =" + (a == b));
        System.out.println("a != b =" + (a != b));
        System.out.println("a > b =" + (a > b));
        System.out.println("a < b =" + (a < b));
        System.out.println("a >= b =" + (a >= b));
        System.out.println("a <= b =" + (a <= b));
   }
}
```

EXAMPLES OF OPERATORS (CONT….)



```
class Operatorexample6
{
   public static void main(String args[])
   {

        int a=10;
        int b=20;
        System.out.println("a == b =" + (a == b));
        System.out.println("a != b =" + (a != b));
        System.out.println("a > b =" + (a > b));
        System.out.println("a < b =" + (a < b));
        System.out.println("a >= b =" + (a >= b));
        System.out.println("a <= b =" + (a <= b));
   }
}
```

Output:

❖a == b = false

❖a != b =true

❖a > b =false

❖a < b =true

❖a >= b =false

❖a <= b =true

THANK YOU