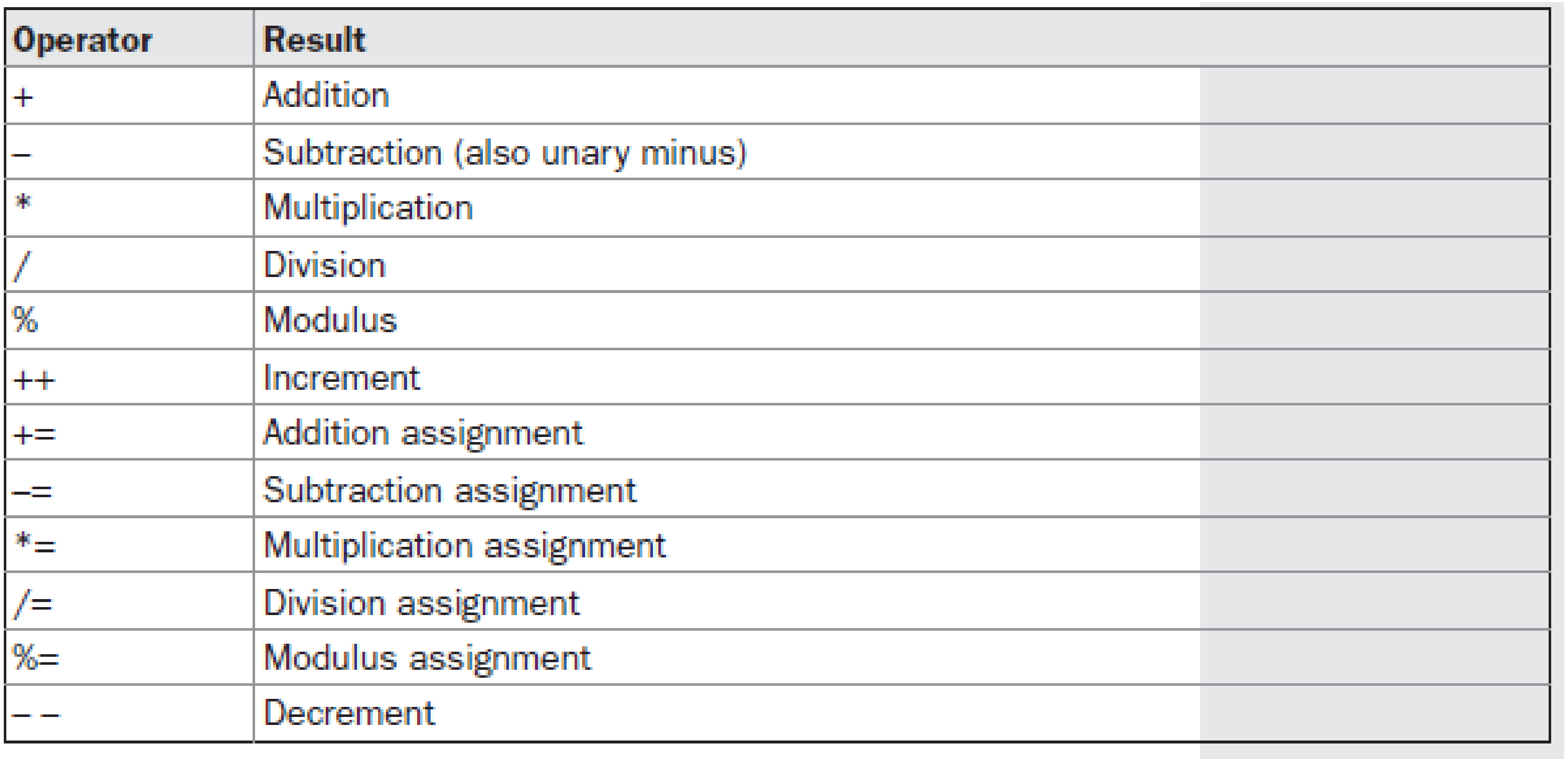
Operators

Arithmetic operators



Operator	Result
+	Addition
–	Subtraction (also unary minus)
*	Multiplication
/	Division
%	Modulus
++	Increment
+=	Addition assignment
–=	Subtraction assignment
*=	Multiplication assignment
/=	Division assignment
%=	Modulus assignment
– –	Decrement

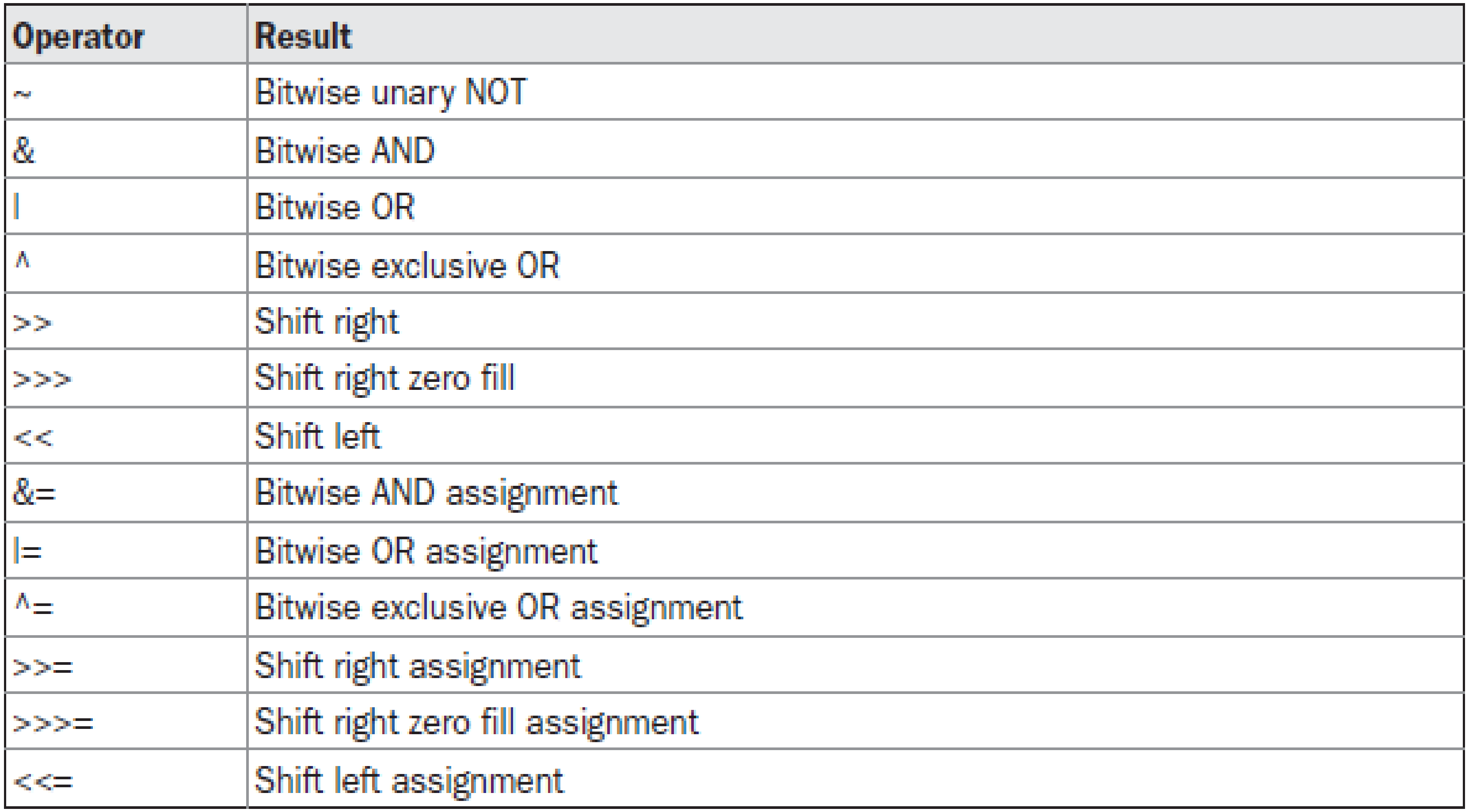
The Modulus Operator

- The modulus operator, %, can be applied to floating-point types as well as integer types

```
// Demonstrate the % operator.
class Modulus {
  public static void main(String args[]) {
    int x = 42;
    double y = 42.25;

    System.out.println("x mod 10 = " + x % 10);
    System.out.println("y mod 10 = " + y % 10);
  }
}
```

The Bitwise Operators

- Java defines several bitwise operators that can be applied to the integer types, long, int, short, char, and byte.
- These operators act upon the individual bits of their operands
- Note: Java uses two’s complement to represent the negative numbers



Operator	Result
~	Bitwise unary NOT
&	Bitwise AND
|	Bitwise OR
^	Bitwise exclusive OR
>>	Shift right
>>>	Shift right zero fill
<<	Shift left
&=	Bitwise AND assignment
|=	Bitwise OR assignment
^=	Bitwise exclusive OR assignment
>>=	Shift right assignment
>>>=	Shift right zero fill assignment
<<=	Shift left assignment

Left Shift operator

- The left shift operator, <<, shifts all of the bits in a value to the left a specified number of times.
  - value << num
- For each shift left, the high-order bit is shifted out (and lost), and a zero is brought in on the right
- Java's may produce unexpected results when you are shifting **byte** and **short** values.

Example

```
class ByteShift {
  public static void main(String args[]) {
    byte a = 64, b;
    int i;

    i = a << 2;
    b = (byte) (a << 2);

    System.out.println("Original value of a: " + a);
    System.out.println("i and b: " + i + " " + b);
  }
}
```

Right shift

- The right shift operator, >>, shifts all of the bits in a value to the right a specified number of times.
  - value >> num
  - 00100011 (35) when applied >> 2 results in 00001000 (8)
- During shifting right, the top (leftmost) bits exposed by the right shift are filled in with the previous contents of the top bit.
- This is called sign extension. It aims to preserve the sign of negative numbers
  - 11111000 (-8) when applied >>1 results in 11111100 (-4)

The Unsigned Right Shift

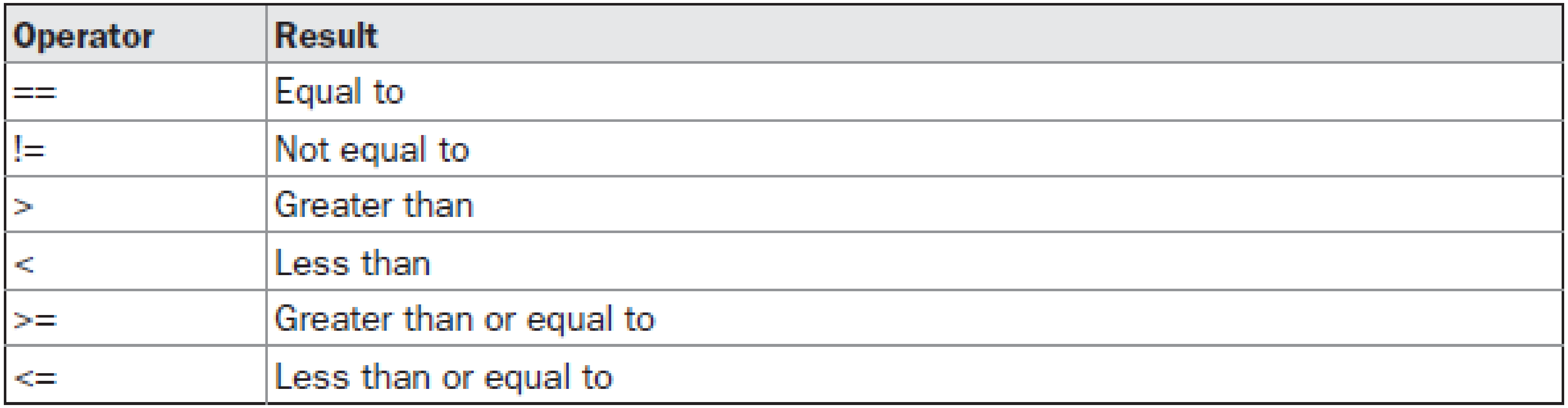
- We mostly want to insert a zero into the high-order bit no matter what its initial value was.
- This is called an unsigned shift.
- In java, the unsigned shift-right operator, >>>, always shifts zeros into the high-order bit.

```
11111111 11111111 11111111 11111111  (-1)
>>> 24
00000000 00000000 00000000 11111111 (255)
```

Example

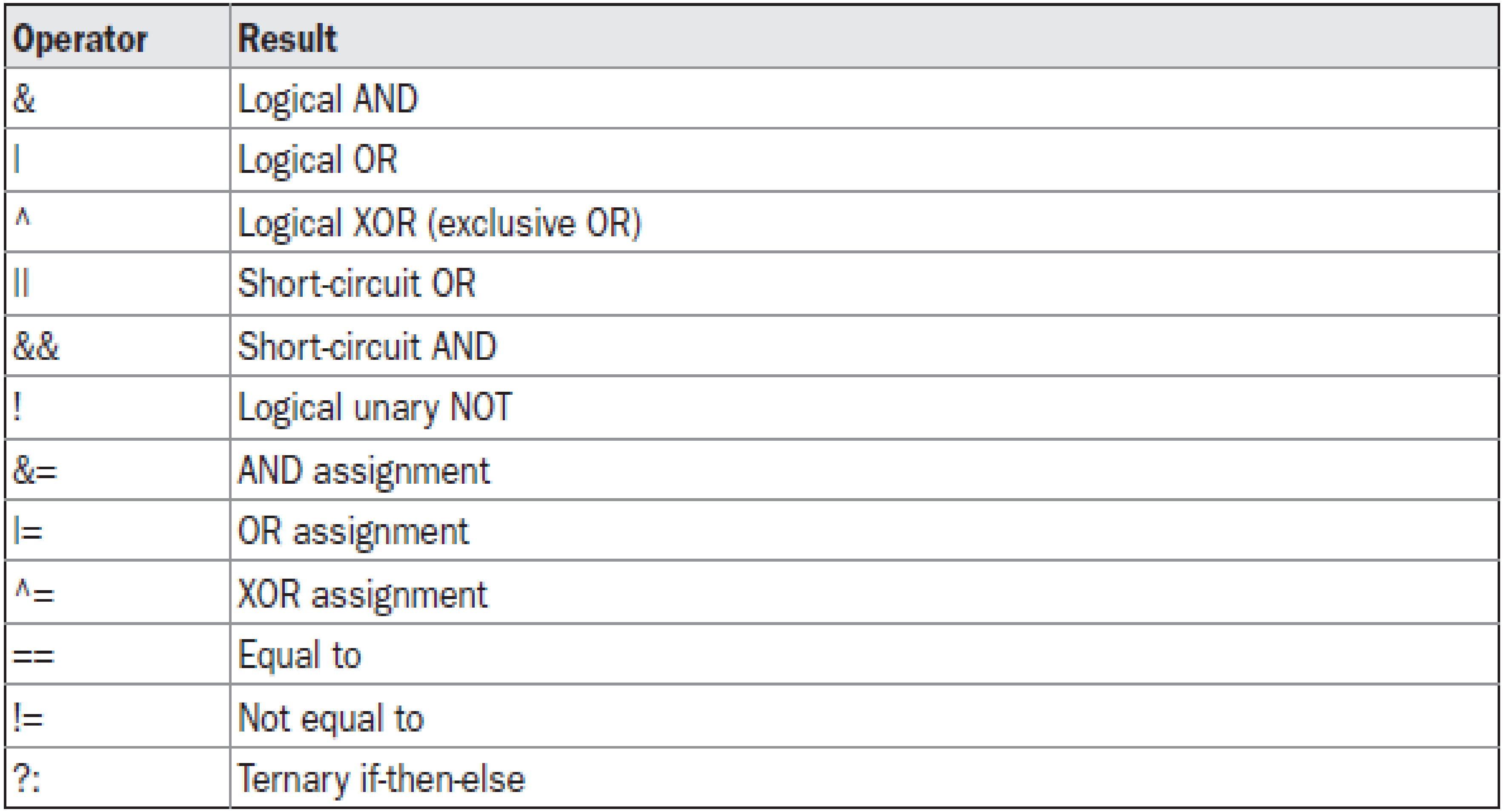
```
// Unsigned shifting a byte value.
class ByteUShift {
  static public void main(String args[]) {
    char hex[] = {
      '0', '1', '2', '3', '4', '5', '6', '7',
      '8', '9', 'a', 'b', 'c', 'd', 'e', 'f'
    };
    byte b = (byte) 0xf1;
    byte c = (byte) (b >> 4);
    byte d = (byte) (b >>> 4);
    byte e = (byte) ((b & 0xff) >> 4);

    System.out.println("  b = 0x"+ hex[(b >> 4) & 0x0f] + hex[b & 0x0f]);
    System.out.println("  b >> 4 = 0x"+ hex[(c >> 4) & 0x0f] + hex[c & 0x0f]);
    System.out.println(" b >>> 4 = 0x"+ hex[(d >> 4) & 0x0f] + hex[d & 0x0f]);
    System.out.println("(b & 0xff) >> 4 = 0x"+ hex[(e >> 4) & 0x0f] + hex[e & 0x0f]);
  }
}
```

Relational Operators



Operator	Result
==	Equal to
!=	Not equal to
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to

Boolean Logical Operators



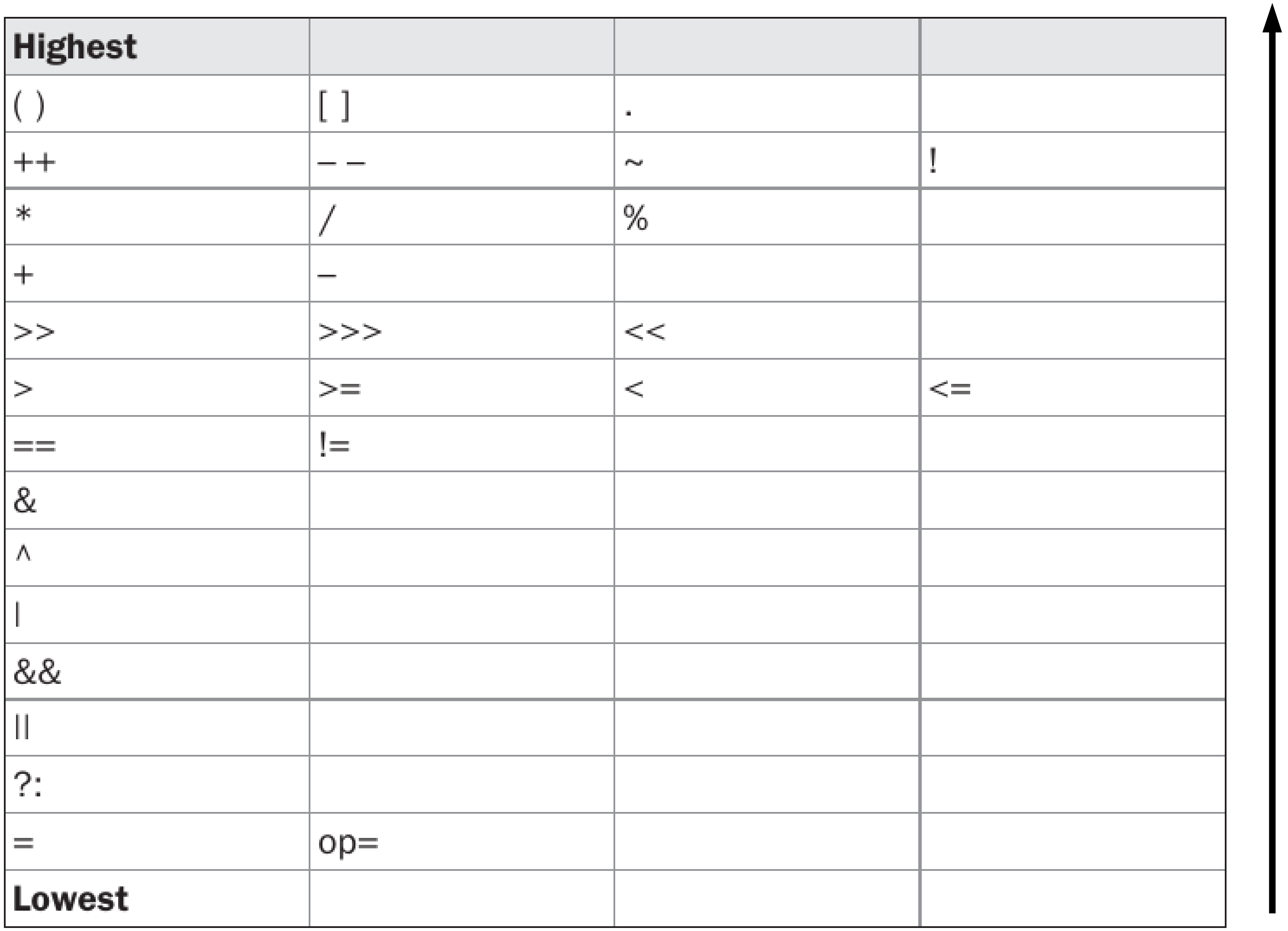
Operator	Result
&	Logical AND
|	Logical OR
^	Logical XOR (exclusive OR)
||	Short-circuit OR
&&	Short-circuit AND
!	Logical unary NOT
&=	AND assignment
|=	OR assignment
^=	XOR assignment
==	Equal to
!=	Not equal to
?:	Ternary if-then-else

- The Boolean logical operators operate only on boolean operands.
- All of the binary logical operators combine two boolean values to form a resultant boolean value.

Short-Circuit Logical Operators

- The && and ||
- If you use the || and && forms, Java will not bother to evaluate the right-hand operand when the outcome of the expression can be determined by the left operand alone.
- This is very useful when the right-hand operand depends on the value of the left one in order to function properly.

Java operators precedence table



Highest			
( )	[ ]	.	
++	– –	~	!
*	/	%	
+	–		
>>	>>>	<<	
>	>=	<	<=
==	!=		
&			
^			
|			
&&			
||			
?:			
=	op=		
Lowest			

Next : control statements and loops