

Java Operators

Bitwise Operators: `&`, `|`, `>>`, and `<<<`

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Heads off to...

- 1 Preamble
- 2 Deep Dive
- 3 In the end



Start-UP

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Wanna explore beamer source code? click to:

Link 1: [Ubuntu pastebin](#)

Link 2: [Github](#) (recommended)

Or, scan(clickable in pdf) the following quick response code:



QR



Basic Beyond

Info

Java store values in memory as a binary string, except char type.

That's why Java provides bitwise operators to operate on them when we are regardless at focusing on original data.





Figure: Java, the Programming Language



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Java's Bitwise Operator

Tabular Illustration

Bitwise Operators	
Operators	Operation
~	Unary NOT
&	AND
	OR
^	XOR
>>	Right Shift
>>>	Unsigned Right Shift
<<	Left Shift



Unary NOT

 \sim

Also known as bitwise complement.

Inverts all the bits that is, if 0 then 1 otherwise 0.

A	\bar{A}
0	1
1	0

Truth Table



Unary NOT

An example

Example

$A \rightarrow 1000\ 1111$

$\bar{A} \rightarrow 0111\ 0000$



Bitwise AND

&

Operates bool logical AND operation on every bit of the given numbers.

A	B	A & B
0	0	0
0	1	0
1	0	0
1	1	1

Truth Table



Bitwise AND

An example

$$\begin{array}{rcl} 42 \rightarrow & 0010 & 1010 \\ 15 \rightarrow & 0000 & 1111 \\ \hline 42 \& 15 = 10 \rightarrow & 0000 & 1010 \end{array}$$



Bitwise OR

Bitwise OR: |

Combine bits such that if at least one bit is 1 then the resultant bit become 1.

A	B	A B
0	0	0
0	1	1
1	0	1
1	1	1

Truth Table



Bitwise OR

An example

$$\begin{array}{rcl} 42 \rightarrow & & 0010\ 1010 \\ 15 \rightarrow & & 0000\ 1111 \\ \hline 42 \mid 15 = 47 \rightarrow & & 0010\ 1111 \end{array}$$



Bitwise XOR

Bitwise XOR: \wedge

Combines bits such that when exactly one bit is 1 then the result is 1 otherwise 0.

- There is a useful property for programmers, if the second bit is 1 then the first bit is inverted.
- Or, if the second bit is 0 then the first bit remains same.

A	B	$A \wedge B$
0	0	0
0	1	1
1	0	1
1	1	0

Truth Table



Bitwise XOR

An example

$$\begin{array}{rcl} 42 \rightarrow & & 0010\ 1010 \\ 15 \rightarrow & & 0000\ 1111 \\ \hline 42 \wedge 15 = 37 \rightarrow & & 0010\ 0101 \end{array}$$



Right Shift

Right Shift: >>

Shifts all the bits in a value to the right a specified number of times.

First of all the value will be promoted to be int and then shifted by the specified number of times.

Right shift is an efficient way for programmers to dividing the number by 2 or multiplying it by 2^{-n} .



Right Shift

An example



Left Shift



Left Shift

An example



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