Java Programming AP Edition
U1C2 Elementary Programming

DATA TYPES (INT AND DOUBLE)

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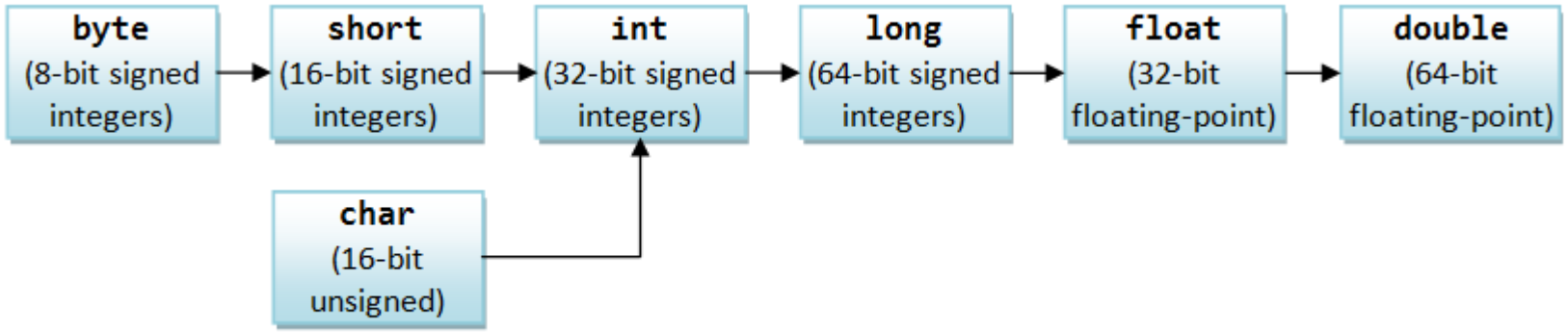
Numeric Data Types and Operations

Java has six numeric types for integers and floating-point numbers with operators +, -, *, . and %

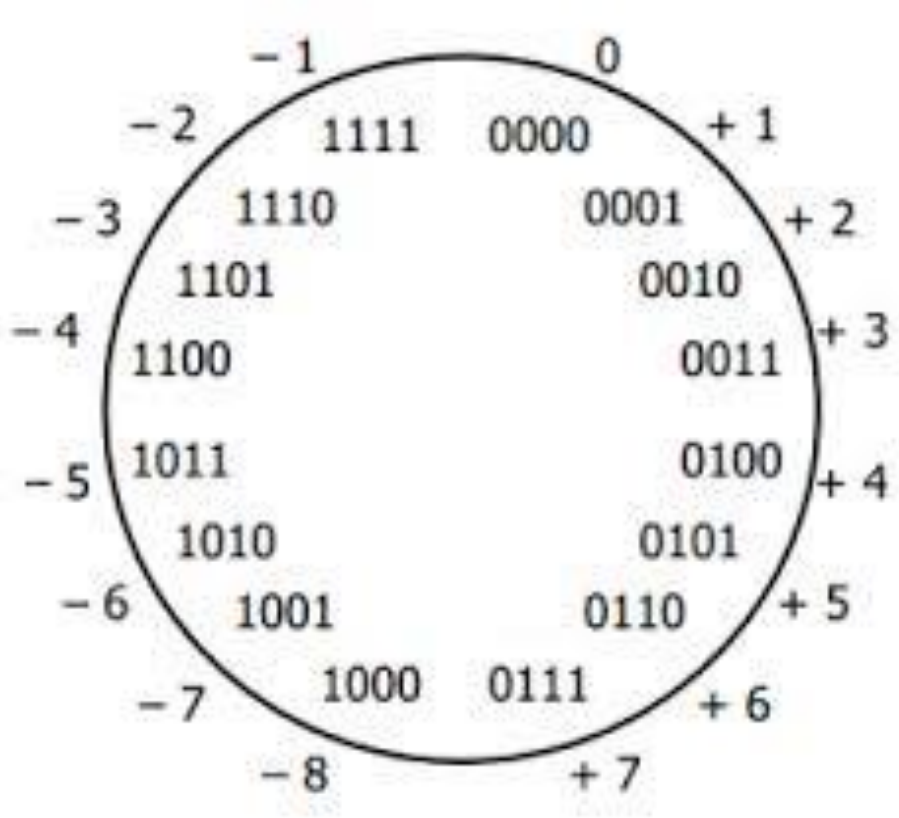
Name	Data	Range	Default Value	Size
byte	signed integer	[-128, 127]	0	8 bits
short	signed integer	[-32768, 32767]	0	16 bits
int	signed integer	[-2147483648, 2147483647]	0	32 bits
long	signed integer	[-9223372036854775808, 9223372036854775807]	0	64 bits
float	floating-point	**MIN:** ±1.4E-45 **MAX:** ±3.4028235E+38	0.0	32 bits
double	floating-point	**MIN:** ±4.9E-324 **MAX:** ±1.79769313486231570E+308	0.0	64 bits
char	Unicode	['\u0000', '\uFFFF']	'\u0000'	16 bits
boolean	logical value	{false, true}	false	≥ 1 bit



Orders of Implicit Type-Casting for Primitives

Integer.MIN_VALUE
Integer.MAX_VALUE

Two’s Complement



Negative number is represented as two’s complement.

For byte number’s (8 bits):

$-X = (2^8 - 1) - X + 1;$

$X + (-X) = X + (2^8 - X) = 2^8 = 0\ ;$

eg.

A = 0100 -> A’s One’s Complement = 1011 ->

A’s Two’s Complement -> 1100

The number 2^8 is a overflow for the byte format, because unsigned byte number range

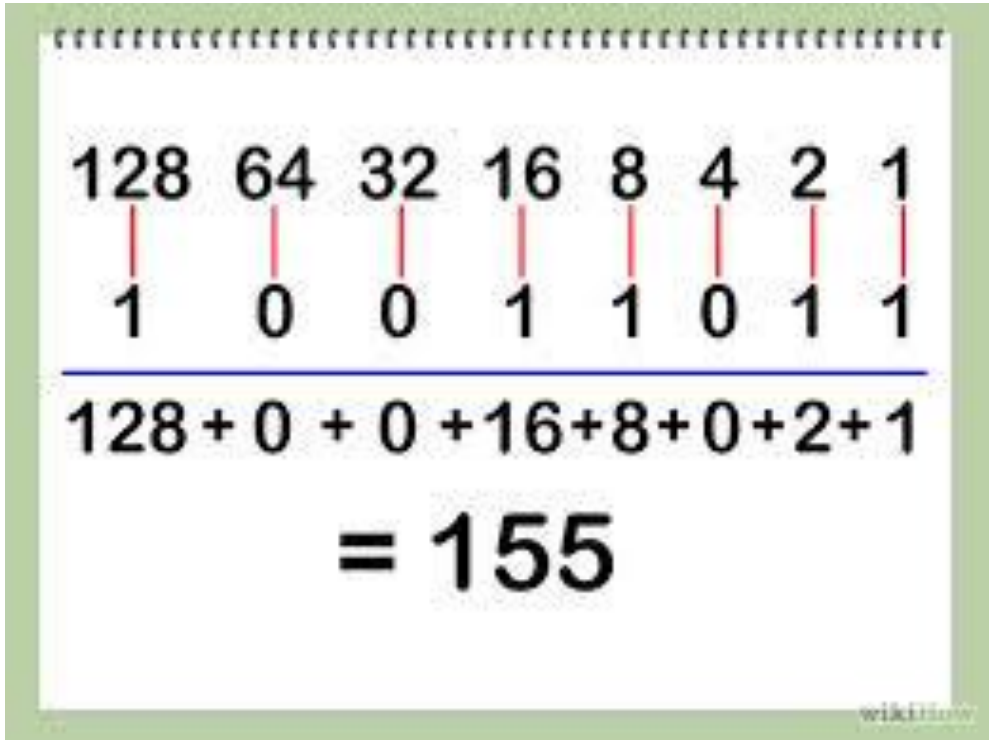
from 0 to $2^8 - 1$ = 11111111.

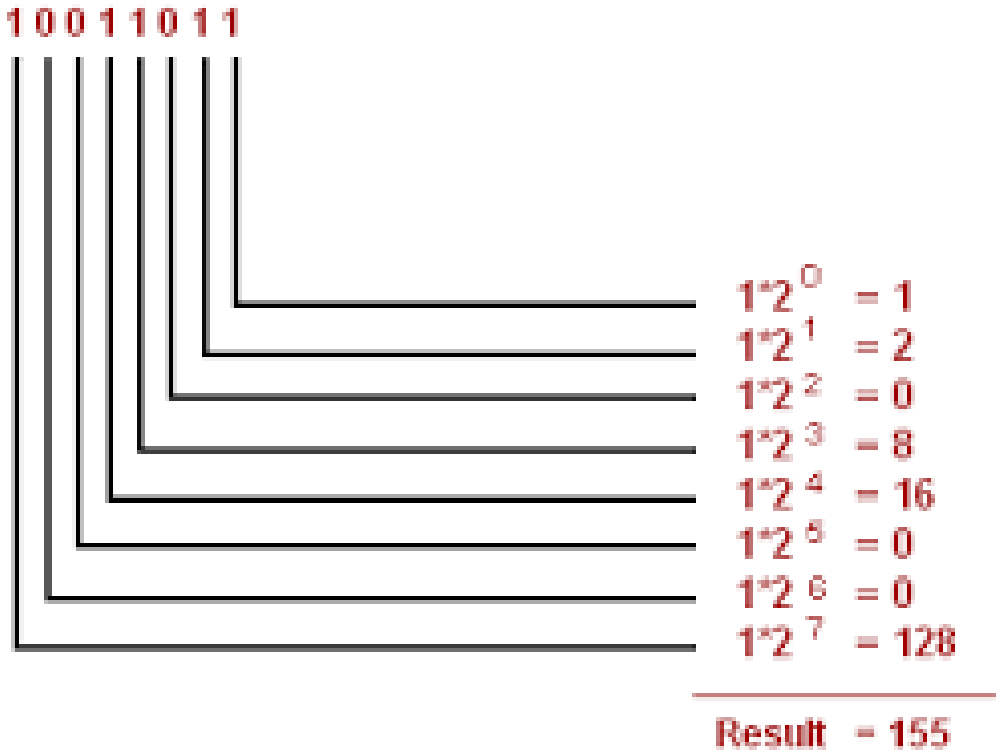
Therefore, this method can work for computer.

Finding 2's Complement

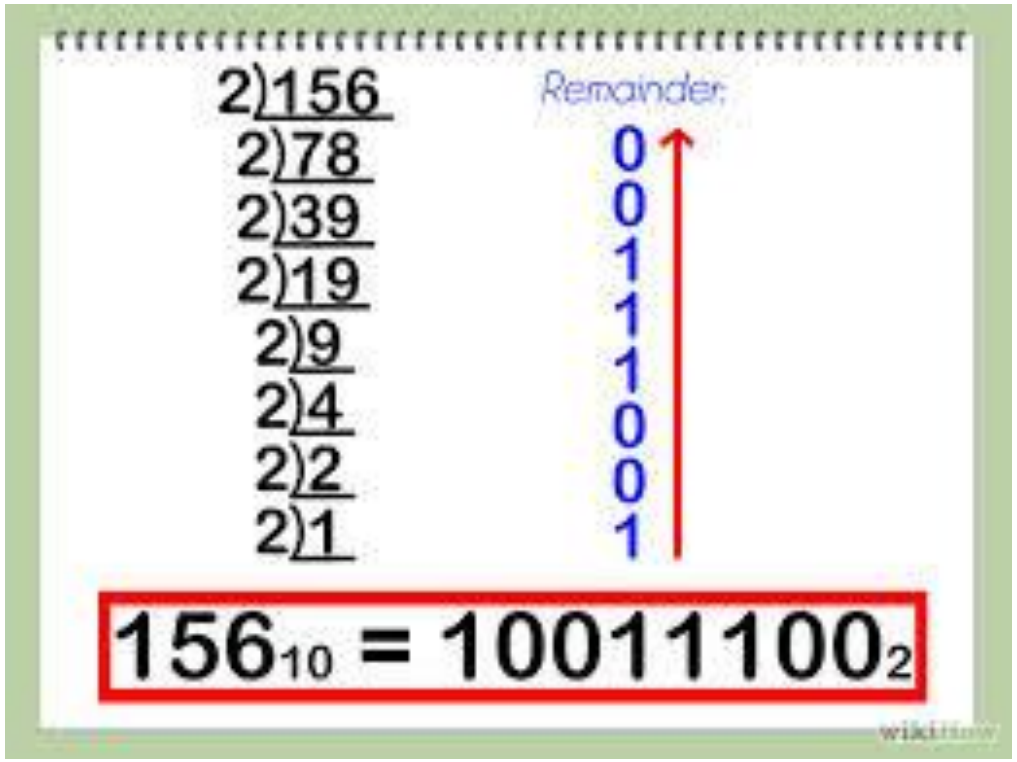
	- 128	64	32	16	8	4	2	1	
X	0	1	0	0	1	1	1	1	**Number : 79 decimal**
$(2^8-1)-X$	1	0	1	1	0	0	0	0	**Flip the bits**
	0	0	0	0	0	0	0	1	**Add 1**
$NegX = (2^8-1)-X+1$	1	0	1	1	0	0	0	1	**Number: -79 in 2's Complement format**

Binary/Decimal Conversion



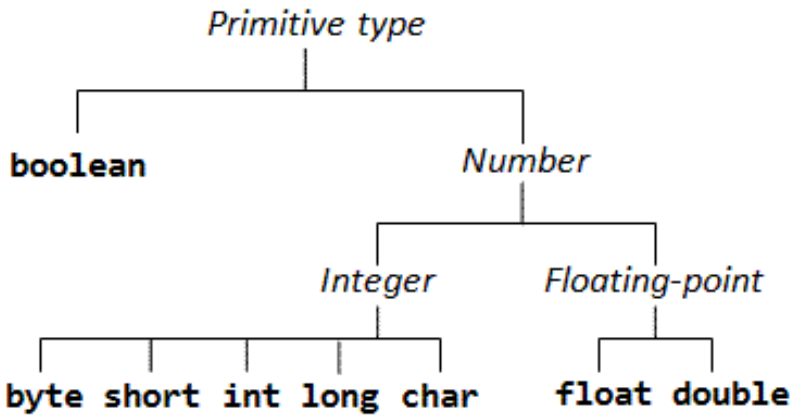


Decimal to Binary



Divider	Dividend	Remainder
2	202	0
2	101	1
2	50	0
2	25	1
2	12	0
2	6	0
2	3	1
		1

Java's special number rules
(different from other languages)



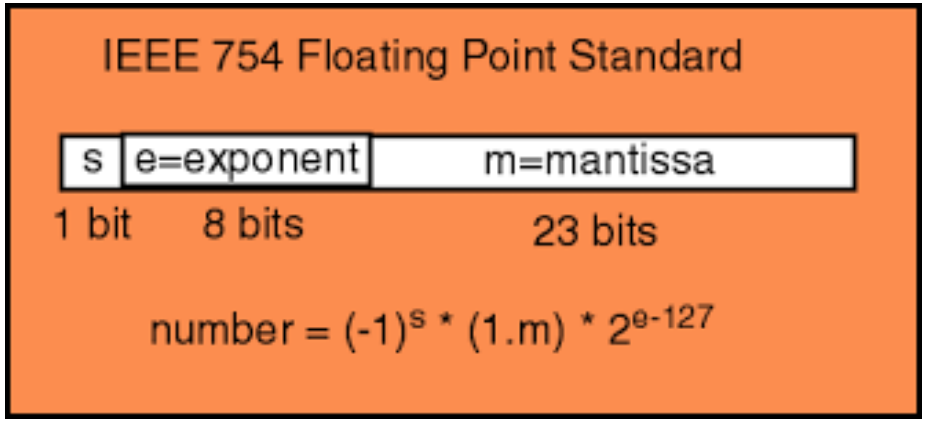
Java doesn't have unsigned number primitives.

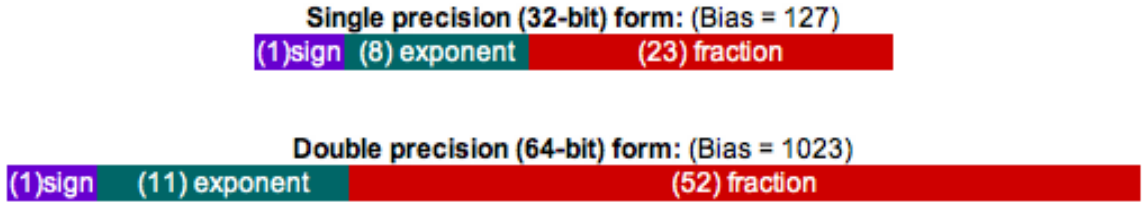
unsigned number is seldom used.

If you need to use unsigned number, use **char** data type instead. Because char does not follow the number operation rules while **char** can still operate the **bit-wise** operations.

Java's char is 16 bit. (supporting Unicode: UTF-16)

IEEE 754 binary floating point representation. (Java's Float Standard)





Named Constants

A named constant is an identifier that represents a permanent value.

Syntax:

final <datatype> CONSTANTNAME = <value> ;

The word final is a Java reserved keyword for declaring a constant.

A constant in Java (or most of other language) is usually in all **UPPERCASE**.

Benefits for using constants:

- (1) you don't have to repeatedly type the same value over over again if it is used multiple times;
- (2) if you have to change the constant value, you need to change it only in a single location in the source code; and
- (3) a descriptive name for a constant makes the program easier to read.

Named Constants


```
final datatype CONSTANTNAME = VALUE;


final double PI = 3.14159;
final int SIZE = 3;
```