

Operators and Expression

byte b=10;
short s=15;
int i=7;
long l=501;
float f=12.5f;
double d=17.5d;
char c=65;

byte + byte
short + short
byte + short
int + int
short + int

Jab ham in mai sai kisi bhi type par koi operation karenge tab always hama integer value hi milta hai as a result.

Increment / Decrement

post ++, post --
++pre, --pre

Arithmetic

$*, /, \%$ → High precedence

$+, -$ → Low precedence

Bitwise

$\&, |, \sim, ^, \ll, \gg, \ggg$

Relational

$<, <=, >, >=, ==, !=$

Logical

$\&\&, ||, !$

Coercion

int X = b + s int X = c + s;
int X = s + i int X = c + i;
float X = i + f double X = f + d;
float X = l + f double X = l + d;

⊙ Post increment

Ise mai phela value use hota ha then update hota hai.

⊙ Pre increment

Ise mai phela value update hota ha then use hota hai

Operators and Expression

```
int x=5;
x++; - 6
++x; - 7
```

```
float x=5.3;
x++;
6.3
```

```
byte x=4;
x++;
5
```

```
char x='A';
x++; 65 66 'B'
s.o.p(x);
0
```

```
int a=2, b=5, x=4, c
c = a * ++x + b
```

Increment/Decrement

post ++, post --

++pre, --pre

Arithmetic

*, /, %

+, -

Bitwise

&, |, ~, ^, <<, >>, >>>

Relational

<, <=, >, >=, ==, !=

Logical

&&, ||, !

Post increment

```
int x=5, y;
y = x++;
y=5 x=6
```

Pre increment

```
int x=5, y;
y = ++x;
6 6
y=6 x=6
```


Chapter 2 - operators and Expressions

Operators are used to perform operations on variables and values.

$$\begin{array}{ccccccc} 7 & + & 11 & = & 18 \\ \swarrow & \downarrow & \searrow & & \downarrow \\ \text{operand} & \text{operator} & \text{operand} & & \text{Result} \end{array}$$

Types of operators

- Arithmetic Operators → $+, -, *, /, \%, ++, --$
- Assignment operators → $=, +=$
- Comparison operators → $==, >=, <=$
- Logical operators → $\&\&, \|\|, !$
- Bitwise Operators → $\&, \|\|$ (operates bitwise)

Arithmetic operators cannot work with booleans
 $\%$ operator can work on floats & doubles

Precedence of operators

The operators are applied and evaluated based on precedence. For example $(+, -)$ has less precedence compared to $(*, /)$. Hence $* \& /$ are evaluated first.

In case we like to change this order, we use parenthesis

Associativity

Associativity tells the direction of execution of operators. It can either be Left to Right or Right to left.

$* / \rightarrow$ L to R

$+ - \rightarrow$ L to R

$++, = \rightarrow$ R to L

Quick Quiz: How will you write the following expressions in Java?

$$\frac{x-y}{2}, \frac{b^2-4ac}{2a}, v^2-u^2, a*b-d$$

Resulting data type after arithmetic operation
Following table summarizes the resulting data types after arithmetic operation on them

$R = b + s \rightarrow \text{int}$	$b \rightarrow \text{byte}$	$f \rightarrow \text{float}$
$R = s + i \rightarrow \text{int}$	$s \rightarrow \text{short}$	$d \rightarrow \text{double}$
$R = l + f \rightarrow \text{float}$	$i \rightarrow \text{integer}$	$c \rightarrow \text{character}$
$R = i + f \rightarrow \text{float}$	$l \rightarrow \text{long}$	
$R = c + i \rightarrow \text{int}$		
$R = c + s \rightarrow \text{int}$		
$R = l + d \rightarrow \text{double}$		
$R = f + d \rightarrow \text{double}$		

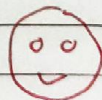
Increment and Decrement Operators

$a++$, $++a \rightarrow$ Increment operators \rightarrow Data type remains same
 $a--$, $--a \rightarrow$ Decrement operators \rightarrow remains same

These will operate on all data types except booleans

Quick Quiz: Try increment and decrement operators on a Java variable

$a++ \rightarrow$ first use the value and then increment
 $++a \rightarrow$ first increment the value then use it



```
1 package incdec;
2
3 public class IncDec
4 {
5     public static void main(String[] args)
6     {
7         byte b=5;
8         b=b+1;
9
10        System.out.println(b);
11    }
12 }
```

Remember:

b=b+1 & b++ is not same in case of byte. Because jab ham 'b+1' karta ha then 'b' is byte data type and '1' is integer data type then 'b+1' give integer data type but we declare 'b' as byte so we invalid data type error aata hai.

```
compile:
run:
6
BUILD SUCCESSFUL (total time: 2 seconds)
```

Bitwise Operators

AND	\wedge	$\&$
OR	\vee	$ $
NOT	\neg	\sim
XOR	\oplus	\wedge
RIGHT SHIFT		\gg
UNSIGNED RIGHT SHIFT		\ggg
LEFT SHIFT		\ll

S₀ - - d: 0.90x

$\&$

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

$|$

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

\wedge

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

Bitwise Operators

int x=10, y=6, z;

x → 00001010

y → 00000110

z = x & y

00000010

2

&

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

!

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

^

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

$x \rightarrow$ 0 0 0 0 1 0 1 0

$y \rightarrow$ 0 0 0 0 0 1 1 0

$$z = x \mid y \quad \begin{array}{cccccccc} 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\ \hline & & & & 8 & 4 & 2 & 1 \end{array}$$

$$z = 14$$

Bitwise Operators

int x=10, y=6, z;

int x=-10;

10 → 00001010

1's comp 11110101

2's comp +1

-10 → 11110110

x → 11110110

x >> 1 → 1011011

x >>> 1 → 0111011

64 32 16 8 4 2 1

123

&

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

|

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

^

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

⊗ Java mai koi bhi '-ve' integer hmasa 2's compliment ka form mai save hota hai.

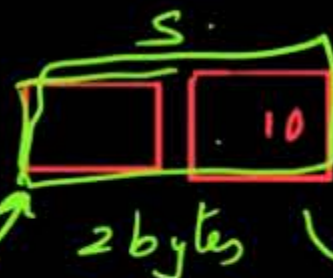
⊗ Note: 1's compliment ka liya ham phela sabhi value koi uska opp. digit sa replace kar deta hai. Then for 2's compliment add '1' in 1's compliment.

Widening and Narrowing

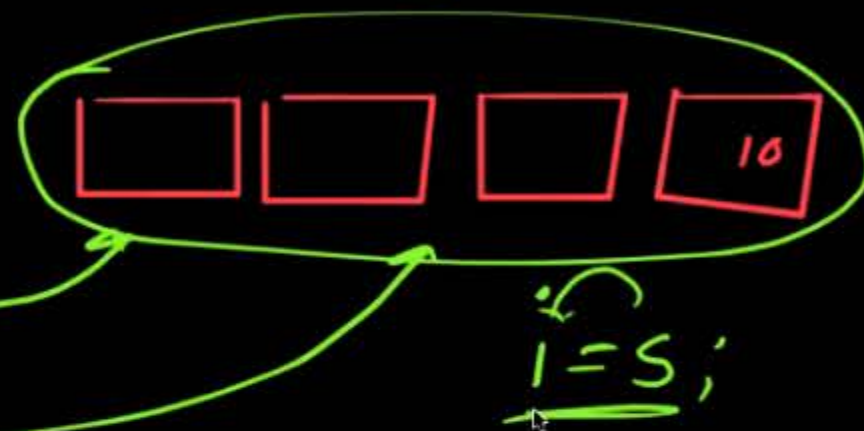
byte b = 10;



short s = 10;



int i = 10;



implicitly $s = b;$

float f = 12.5;



Widening (Implicit Conversion):

Widening is a process where a value of a smaller data type is automatically converted into a value of a larger data type without any data loss.

Narrowing (Explicit Conversion or Type Casting):

Narrowing is a process where a value of a larger data type is manually converted into a value of a smaller data type. Since this conversion may lead to data loss or loss of precision.

Source

right side
↓
=

	Destination		left side ↗ =						
		byte	short	int	long	float	double	char	boolean
byte		✓	✓	✓	✓	✓	✓	✗	✗
short		✗	✓	✓	✓	✓	✓	✗	?
int		✗	✗	✓	✓	✓	✓	✓	✗
long		✗	✗	✗	✓	✓	✓	✗	✗
float		✗	✗	✗	✗	✓	✓	✗	✗
double		✗	✗	✗	✗	✗	✓	✗	✗
char		✗	✗	✓	✓	✓	✓	✓	✗
boolean		✗	✗	✗	✗	✗	✗	✗	✓

※. Ise table mai ya show kiya gya hai ki ham kis data type ko kisi mai easily convert kar sakta hai.