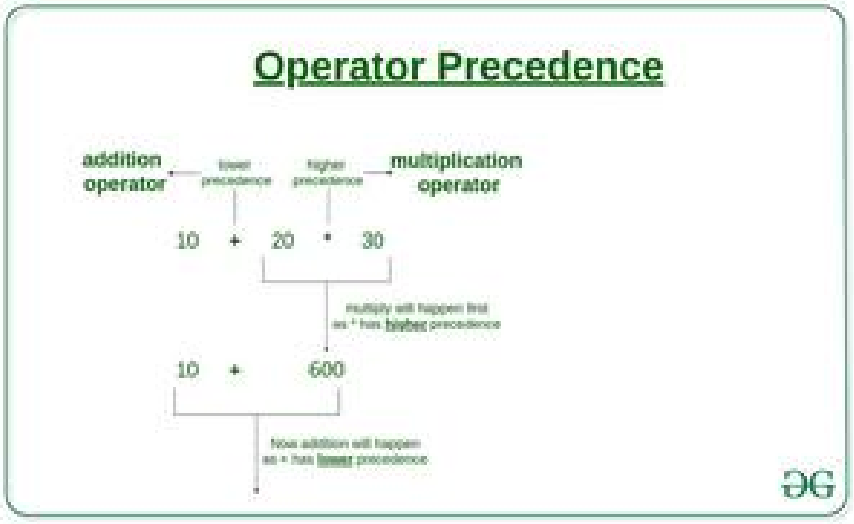
Operator Precedence and Associativity

Operator Precedence determines which operation is performed first in an expression with more than one operators with different precedence.

For example: Solve

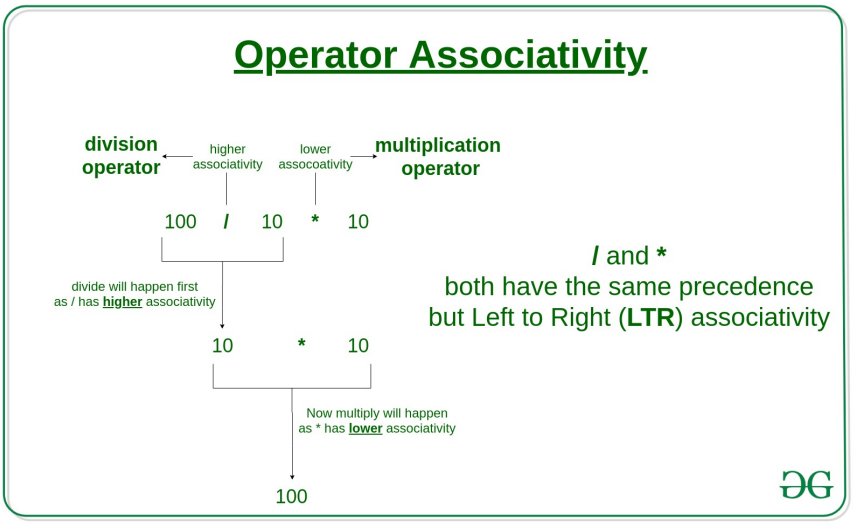
```
10 + 20 * 30
```




```
10 + 20 * 30 is calculated as 10 + (20 * 30)
and not as(10 + 20) * 30
```

Operators Associativity is used when two operators of same precedence appear in an expression. Associativity can be either Left to Right or Right to Left.

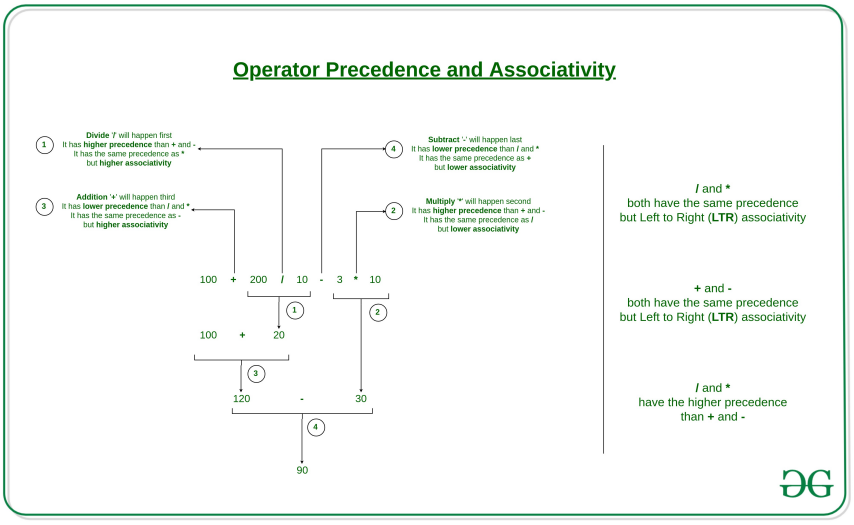
For example: '*' and '/' have same precedence and their associativity is Left to Right, so the expression "100 / 10 * 10" is treated as "(100 / 10) * 10".




```
Operators Precedence and Associativity are two characterist
ics of operatorsthat determine the evaluation order of sub-
expressions in absence of brackets.
```

For example: Solve

```
100 + 200 / 10 - 3 * 10
```



1) Associativity is only used when there are two or more operators of same precedence.

2) All operators with the same precedence have same associativity

3) Precedence and associativity of postfix ++ and prefix ++ are different

4) Comma has the least precedence among all operators and should be used carefully

5) There is no chaining of comparison operators

Example 1: Operators Precedence

```
#include <iostream>
using namespace std;

int main() {

  // evaluates 17 * 6 first
  int num1 = 5 - 17 * 6;

  // equivalent expression to num1
  int num2 = 5 - (17 * 6);

  // forcing compiler to evaluate 5 - 17 first
  int num3 = (5 - 17) * 6;

  cout << "num1 = " << num1 << endl;
  cout << "num2 = " << num2 << endl;
  cout << "num3 = " << num3 << endl;

  return 0;
}
```

Output

```
num1 = -97
num2 = -97
num3 = -72
```

Example 2: Operators Associativity

```
#include <iostream>
using namespace std;

int main() {
  int a = 1;
  int b = 4;
```

```
// a -= 6 is evaluated first
    b += a -= 6;

  cout << "a = " << a << endl; ;
  cout << "b = " << b;
}
```

Output

```
a = -5
b = -1
```

Operator	**Description**	**Associativity**
( ) [ ] . -> ++ – –	Parentheses (function call) (see Note 1) Brackets (array subscript) Member selection via object name Member selection via pointer Postfix increment/decrement (see Note 2)	left-to-right
++ – – + – ! ~ (*type*) * & sizeof	Prefix increment/decrement Unary plus/minus Logical negation/bitwise complement Cast (convert value to temporary value of *type*) Dereference Address (of operand) Determine size in bytes on this implementation	right-to-left
* / %	Multiplication/division/modulus	left-to-right
+ –	Addition/subtraction	left-to-right
<< >>	Bitwise shift left, Bitwise shift right	left-to-right
< <= > >=	Relational less than/less than or equal to Relational greater than/greater than or equal to	left-to-right
== !=	Relational is equal to/is not equal to	left-to-right
&	Bitwise AND	left-to-right
^	Bitwise exclusive OR	left-to-right
|	Bitwise inclusive OR	left-to-right

&&	Logical AND	left-to-right
||	Logical OR	left-to-right
? :	Ternary conditional	right-to-left
= += -= *= /= %= &= ^= |= <<= >>=	Assignment Addition/subtraction assignment Multiplication/division assignment Modulus/bitwise AND assignment Bitwise exclusive/inclusive OR assignment Bitwise shift left/right assignment	right-to-left
,	Comma (separate expressions)	left-to-right

It is good to know precedence and associativity rules, but the best thing is to use brackets, especially for less commonly used operators (operators other than +, -, *.. etc). Brackets increase the readability of the code as the reader doesn’t have to see the table to find out the order.