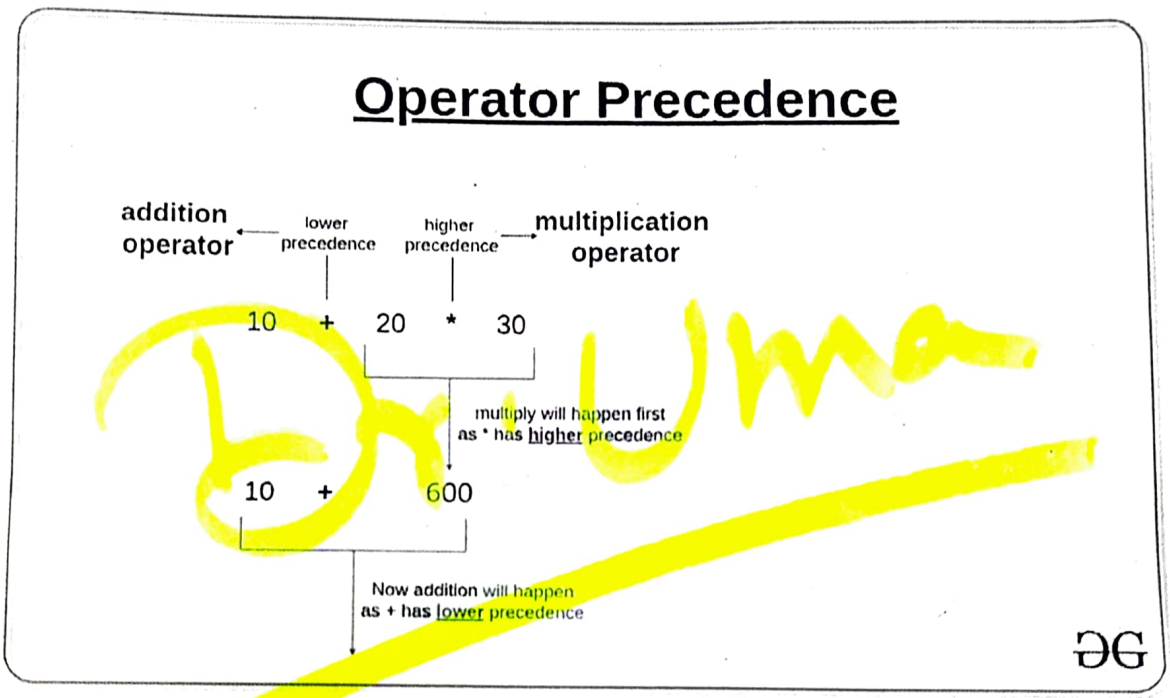
UNIT- 1

Operator Precedence and Associativity in C

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



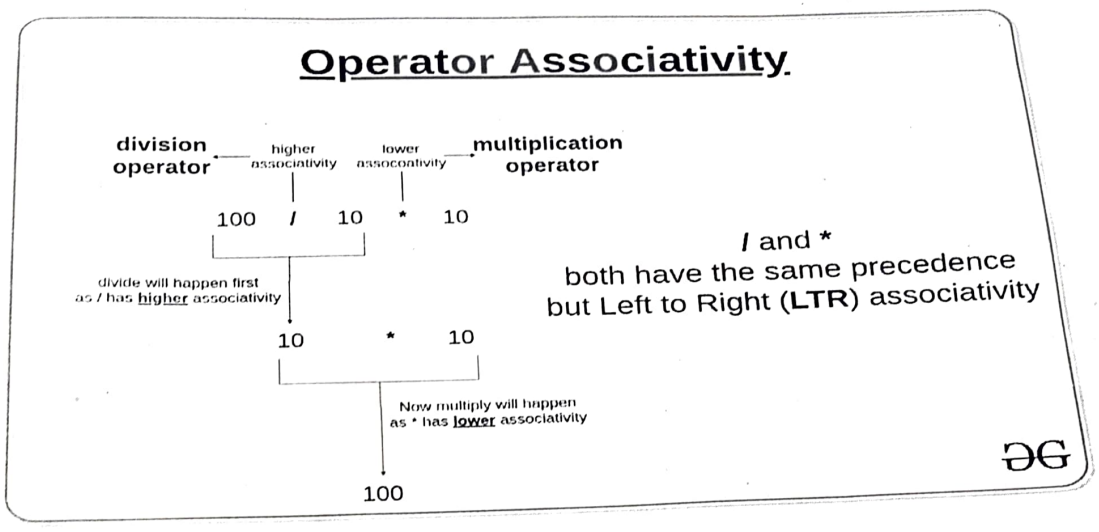
10 + 20 * 30 is calculated as **10 + (20 * 30)**

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".

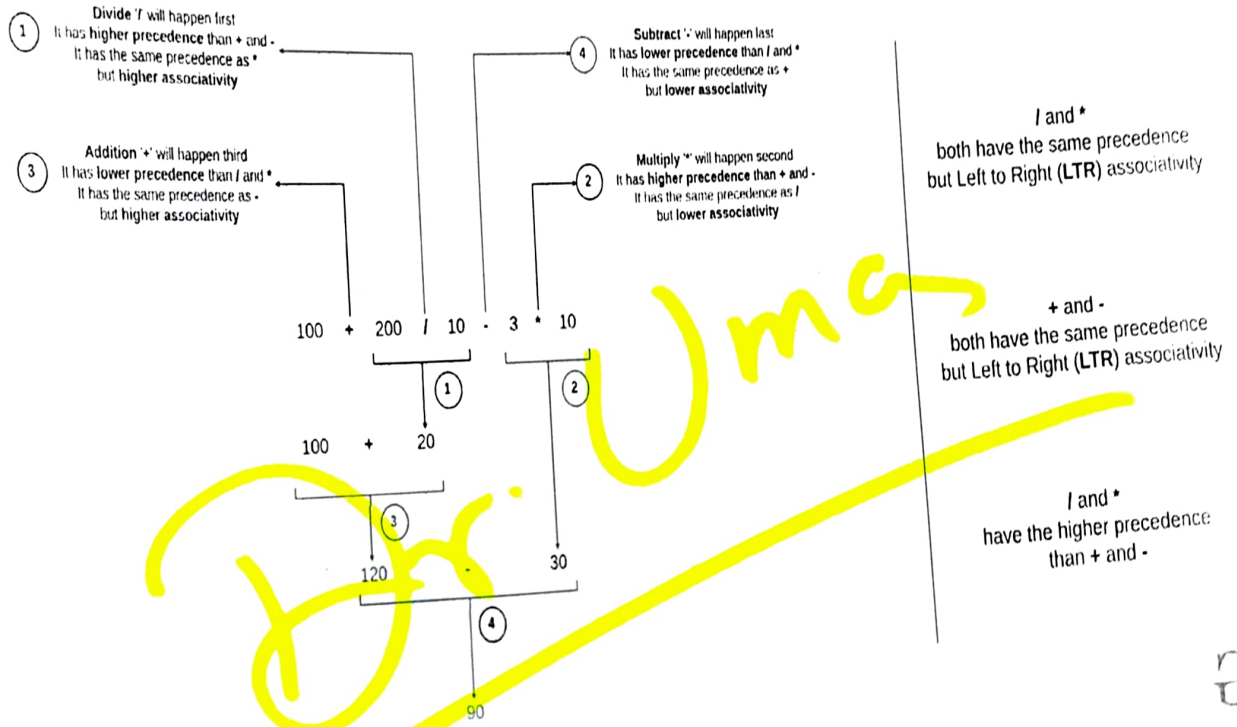


Operators Precedence and Associativity are two characteristics of operators that determine the evaluation order of sub-expressions in absence of brackets

For example: Solve

100 + 200 / 10 - 3 * 10

Operator Precedence and Associativity



1) Associativity is only used when there are two or more operators of same precedence. The point to note is associativity doesn't define the order in which operands of a single operator are evaluated. For example, consider the following program, associativity of the + operator is left to right, but it doesn't mean f1() is always called before f2(). The output of the following program is in-fact compiler dependent.

- C

```
// Associativity is not used in the below program.

// Output is compiler dependent.
```

```
#include <stdio.h>

int x = 0;
int f1()
{
   x = 5;
   return x;
}
int f2()
{
   x = 10;
   return x;
}
int main()
{
   int p = f1() + f2();
   printf("%d ", x);
   return 0;
}
```

2) All operators with the same precedence have same associativity

This is necessary, otherwise, there won't be any way for the compiler to decide evaluation order of expressions which have two operators of same precedence and different associativity. For example + and – have the same associativity.

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

Precedence of postfix ++ is more than prefix ++, their associativity is also different.

Associativity of postfix ++ is left to right and associativity of prefix ++ is right to left.

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

For example C

```
#include <stdio.h>
int main()
{
   int a;
   a = 1, 2, 3; // Evaluated as (a = 1), 2, 3
   printf("%d", a);
   return 0;
}
```

5) There is no chaining of comparison operators in C

In Python, expression like "c > b > a" is treated as "c > b and b > a", but this type of chaining doesn't happen in C. For example consider the following program. The output of following program is "FALSE".

- C

```
#include <stdio.h>
int main()
{
  int a = 10, b = 20, c = 30;

  // (c > b > a) is treated as ((c  > b) > a), associativity of '>'
  // is left to right. Therefore the value becomes ((30 > 20) > 10)
  // which becomes (1 > 10)
  if (c > b > a)
    printf("TRUE");
```

```
  else
    printf("FALSE");
  return 0;
}
```

Please see the following precedence and associativity table for reference.

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
++ – –	Prefix increment/decrement	
+ –	Unary plus/minus	
! ~	Logical negation/bitwise complement	
(*type*)	Cast (convert value to temporary value of *type*)	
*	Dereference	
&	Address (of operand)	
sizeof	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.