

C Programming Operators

In this tutorial, you will learn about different operators in C programming with the help of examples.

An operator is a symbol that operates on a value or a variable. For example: `+` is an operator to perform addition.

C has a wide range of operators to perform various operations.

C Arithmetic Operators

An arithmetic operator performs mathematical operations such as addition, subtraction, multiplication, division etc on numerical values (constants and variables).

Operator	Meaning of Operator
+	addition or unary plus
-	subtraction or unary minus
*	multiplication
/	division
%	remainder after division (modulo division)

Example 1: Arithmetic Operators

```
// Working of arithmetic operators
#include <stdio.h>
int main()
{
    int a = 9, b = 4, c;

    c = a+b;
    printf("a+b = %d \n", c);
    c = a-b;
    printf("a-b = %d \n", c);
    c = a*b;
    printf("a*b = %d \n", c);
    c = a/b;
    printf("a/b = %d \n", c);
    c = a%b;
    printf("Remainder when a divided by b = %d \n", c);

    return 0;
}
```

Output

```
a+b = 13
a-b = 5
a*b = 36
```

```
a/b = 2
Remainder when a divided by b=1
```

The operators `+`, `-` and `*` computes addition, subtraction, and multiplication respectively as you might have expected.

In normal calculation, $9/4 = 2.25$. However, the output is `2` in the program.

It is because both the variables `a` and `b` are integers. Hence, the output is also an integer. The compiler neglects the term after the decimal point and shows answer `2` instead of `2.25`.

The modulo operator `%` computes the remainder. When `a=9` is divided by `b=4`, the remainder is `1`. The `%` operator can only be used with integers.

Suppose `a = 5.0`, `b = 2.0`, `c = 5` and `d = 2`. Then in C programming,

```
// Either one of the operands is a floating-point number

a/b = 2.5

a/d = 2.5

c/b = 2.5

// Both operands are integers

c/d = 2
```

C Increment and Decrement Operators

C programming has two operators increment `++` and decrement `--` to change the value of an operand (constant or variable) by 1.

Increment `++` increases the value by 1 whereas decrement `--` decreases the value by 1. These two operators are unary operators, meaning they only operate on a single operand.

Example 2: Increment and Decrement Operators

```
// Working of increment and decrement operators
#include <stdio.h>
int main()
{
    int a = 10, b = 100;
    float c = 10.5, d = 100.5;
    printf("++a = %d \n", ++a);
    printf("--b = %d \n", --b);
    printf("++c = %f \n", ++c);
    printf("--d = %f \n", --d);

    return 0;
}
```

Output

```
++a = 11
--b = 99
++c = 11.500000
```

```
--d = 99.500000
```

Here, the operators `++` and `--` are used as prefixes. These two operators can also be used as postfixes like `a++` and `a--`. Visit this page to learn more about how [increment and decrement operators work when used as postfix](#).

C Assignment Operators

An assignment operator is used for assigning a value to a variable. The most common assignment operator is `=`.

Operator Example Same as

<code>=</code>	<code>a = b</code>	<code>a = b</code>
<code>+=</code>	<code>a += b</code>	<code>a = a+b</code>
<code>-=</code>	<code>a -= b</code>	<code>a = a-b</code>
<code>*=</code>	<code>a *= b</code>	<code>a = a*b</code>
<code>/=</code>	<code>a /= b</code>	<code>a = a/b</code>
<code>%=</code>	<code>a %= b</code>	<code>a = a%b</code>

Example 3: Assignment Operators

```
// Working of assignment operators
#include <stdio.h>
int main()
{
    int a = 5, c;

    c = a;      // c is 5
    printf("c = %d\n", c);
    c += a;     // c is 10
    printf("c = %d\n", c);
    c -= a;     // c is 5
    printf("c = %d\n", c);
    c *= a;     // c is 25
    printf("c = %d\n", c);
    c /= a;     // c is 5
    printf("c = %d\n", c);
    c %= a;     // c = 0
    printf("c = %d\n", c);

    return 0;
}
```

Output

```
c = 5
c = 10
c = 5
c = 25
c = 5
```

```
c = 0
```

C Relational Operators

A relational operator checks the relationship between two operands. If the relation is true, it returns 1; if the relation is false, it returns value 0.

Relational operators are used in [decision making](#) and [loops](#).

Operator	Meaning of Operator	Example
==	Equal to	5 == 3 is evaluated to 0
>	Greater than	5 > 3 is evaluated to 1
<	Less than	5 < 3 is evaluated to 0
!=	Not equal to	5 != 3 is evaluated to 1
>=	Greater than or equal to	5 >= 3 is evaluated to 1
<=	Less than or equal to	5 <= 3 is evaluated to 0

Example 4: Relational Operators

```
// Working of relational operators
#include <stdio.h>
int main()
{
    int a = 5, b = 5, c = 10;

    printf("%d == %d is %d \n", a, b, a == b);
    printf("%d == %d is %d \n", a, c, a == c);
    printf("%d > %d is %d \n", a, b, a > b);
    printf("%d > %d is %d \n", a, c, a > c);
    printf("%d < %d is %d \n", a, b, a < b);
    printf("%d < %d is %d \n", a, c, a < c);
    printf("%d != %d is %d \n", a, b, a != b);
    printf("%d != %d is %d \n", a, c, a != c);
    printf("%d >= %d is %d \n", a, b, a >= b);
    printf("%d >= %d is %d \n", a, c, a >= c);
    printf("%d <= %d is %d \n", a, b, a <= b);
    printf("%d <= %d is %d \n", a, c, a <= c);

    return 0;
}
```

Output

```
5 == 5 is 1
5 == 10 is 0
5 > 5 is 0
5 > 10 is 0
5 < 5 is 0
5 < 10 is 1
```

```
5 != 5 is 0
5 != 10 is 1
5 >= 5 is 1
5 >= 10 is 0
5 <= 5 is 1
5 <= 10 is 1
```

C Logical Operators

An expression containing logical operator returns either 0 or 1 depending upon whether expression results true or false. Logical operators are commonly used in [decision making in C programming](#).

Operator	Meaning	Example
&&	Logical AND. True only if all operands are true	If c = 5 and d = 2 then, expression <code>((c==5) && (d>5))</code> equals to 0.
	Logical OR. True only if either one operand is true	If c = 5 and d = 2 then, expression <code>((c==5) (d>5))</code> equals to 1.
!	Logical NOT. True only if the operand is 0	If c = 5 then, expression <code>!(c==5)</code> equals to 0.

Example 5: Logical Operators

```
// Working of logical operators

#include <stdio.h>
int main()
{
    int a = 5, b = 5, c = 10, result;

    result = (a == b) && (c > b);
    printf("(a == b) && (c > b) is %d \n", result);

    result = (a == b) && (c < b);
    printf("(a == b) && (c < b) is %d \n", result);

    result = (a == b) || (c < b);
    printf("(a == b) || (c < b) is %d \n", result);

    result = (a != b) || (c < b);
    printf("(a != b) || (c < b) is %d \n", result);

    result = !(a != b);
    printf("(a != b) is %d \n", result);

    result = !(a == b);
    printf("(a == b) is %d \n", result);

    return 0;
}
```

Output

```
(a == b) && (c > b) is 1
(a == b) && (c < b) is 0
(a == b) || (c < b) is 1
(a != b) || (c < b) is 0
!(a != b) is 1
!(a == b) is 0
```

Explanation of logical operator program

- `(a == b) && (c > b)` evaluates to 1 because both operands `(a == b)` and `(c > b)` is 1 (true).
- `(a == b) && (c < b)` evaluates to 0 because operand `(c < b)` is 0 (false).
- `(a == b) || (c < b)` evaluates to 1 because `(a == b)` is 1 (true).
- `(a != b) || (c < b)` evaluates to 0 because both operand `(a != b)` and `(c < b)` are 0 (false).
- `!(a != b)` evaluates to 1 because operand `(a != b)` is 0 (false). Hence, `!(a != b)` is 1 (true).
- `!(a == b)` evaluates to 0 because `(a == b)` is 1 (true). Hence, `!(a == b)` is 0 (false).

C Bitwise Operators

During computation, mathematical operations like: addition, subtraction, multiplication, division, etc are converted to bit-level which makes processing faster and saves power.

Bitwise operators are used in C programming to perform bit-level operations.

Operators	Meaning of operators
&	Bitwise AND
	Bitwise OR
^	Bitwise exclusive OR
~	Bitwise complement
<<	Shift left
>>	Shift right

Other Operators

Comma Operator

Comma operators are used to link related expressions together. For example:

```
int a, c = 5, d;
```

The sizeof operator

The `sizeof` is a unary operator that returns the size of data (constants, variables, array, structure, etc).

Example 6: sizeof Operator

```
#include <stdio.h>
int main()
{
    int a;
    float b;
    double c;
    char d;
    printf("Size of int=%lu bytes\n",sizeof(a));
    printf("Size of float=%lu bytes\n",sizeof(b));
    printf("Size of double=%lu bytes\n",sizeof(c));
    printf("Size of char=%lu byte\n",sizeof(d));

    return 0;
}
```

Output

```
Size of int = 4 bytes
Size of float = 4 bytes
Size of double = 8 bytes
Size of char = 1 byte
```

Other operators such as ternary operator `?:`, reference operator `&`, dereference operator `*` and member selection operator `→` will be discussed in later tutorials.