

## Copilot

In **C programming**, **bitwise operators** allow low-level manipulation of data stored in a computer's memory. These operators work at the **bit level**, enabling you to perform operations on individual bits within data. Let's explore the main bitwise operators in C:

1. **Bitwise AND (&)**: Takes two numbers as operands and performs an AND operation on each bit. The result is 1 only if both corresponding bits are 1.
2. **Bitwise OR (|)**: Also takes two numbers as operands and performs an OR operation on each bit. The result is 1 if either of the two bits is 1.
3. **Bitwise XOR (^)**: Takes two numbers as operands and performs an XOR (exclusive OR) operation on each bit. The result is 1 if the two bits are different.
4. **Left Shift (<<)**: Shifts the bits of the first operand to the left by a specified number of places (determined by the second operand).
5. **Right Shift (>>)**: Shifts the bits of the first operand to the right by a specified number of places.
6. **Bitwise NOT (~)**: Takes one number and inverts all its bits.

Here's an example program demonstrating the use of these operators:

```
#include <stdio.h>

int main() {
    unsigned char a = 5, b = 9;

    printf("a = %d, b = %d\n", a, b);
    printf("a & b = %d\n", a & b);
    printf("a | b = %d\n", a | b);
    printf("a ^ b = %d\n", a ^ b);
    printf("~a = %d\n", ~a);
    printf("b << 1 = %d\n", b << 1);
    printf("b >> 1 = %d\n", b >> 1);

    return 0;
}
```

Output:

```
a = 5, b = 9
a & b = 1
```

```
a | b = 13
a ^ b = 12
~a = 250
b << 1 = 18
b >> 1 = 4
```

Remember that bitwise operators are essential for low-level operations and can be powerful tools in certain scenarios. However, use them carefully and consider their behavior with negative numbers and integer size limits<sup>1</sup>.

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#### Source(s)

1. [Bitwise Operators in C - GeeksforGeeks](#)
2. [Bitwise Operators in C - Sanfoundry](#)
3. [Bitwise Operators in C - Online Tutorials Library](#)
4. [C Bitwise Operators: AND, OR, XOR, Complement and Shift Operations](#)
5. [github.com](#)
6. [github.com](#)
7. [github.com](#)
8. [github.com](#)
9. [github.com](#)