**C Keywords**

Keywords are predefined, reserved words used in programming that have special meanings to the compiler. Keywords are part of the syntax and they cannot be used as an identifier. For example:

int money;

Here, int is a keyword that indicates money is a [variable](https://www.programiz.com/c-programming/c-variables-constants) of type int (integer).

As C is a case sensitive language, all keywords must be written in lowercase. Here is a list of all keywords allowed in ANSI C.

## C Identifiers

Identifier refers to name given to entities such as variables, functions, structures etc.

Identifiers must be unique. They are created to give a unique name to an entity to identify it during the execution of the program. For example:

int money;

double accountBalance;

Here, money and accountBalance are identifiers.

Also remember, identifier names must be different from keywords. You cannot use int as an identifier because int is a keyword.

### Rules for naming identifiers

1. A valid identifier can have letters (both uppercase and lowercase letters), digits and underscores.
2. The first letter of an identifier should be either a letter or an underscore.
3. You cannot use keywords like int, while etc. as identifiers.
4. There is no rule on how long an identifier can be. However, you may run into problems in some compilers if the identifier is longer than 31 characters.

You can choose any name as an identifier if you follow the above rule, however, give meaningful names to identifiers that make sense.

## Literals

Literals are data used for representing fixed values. They can be used directly in the code. For example: 1, 2.5, 'c' etc.

Here, 1, 2.5 and 'c' are literals. Why? You cannot assign different values to these terms.

### 1. Integers

An integer is a numeric literal(associated with numbers) without any fractional or exponential part. There are three types of integer literals in C programming:

* decimal (base 10)
* octal (base 8)
* hexadecimal (base 16)

For example:

Decimal: 0, -9, 22 etc

Octal: 021, 077, 033 etc

Hexadecimal: 0x7f, 0x2a, 0x521 etc

In C programming, octal starts with a 0, and hexadecimal starts with a 0x.

### 2. Floating-point Literals

A floating-point literal is a numeric literal that has either a fractional form or an exponent form. For example:

-2.0

0.0000234

-0.22E-5

**Note:** E-5 = 10-5

### 3. Characters

A character literal is created by enclosing a single character inside single quotation marks. For example: 'a', 'm', 'F', '2', '}' etc.

### 4. Escape Sequences

Sometimes, it is necessary to use characters that cannot be typed or has special meaning in C programming. For example: newline(enter), tab, question mark etc.

In order to use these characters, escape sequences are used.

|  |  |
| --- | --- |
| Escape Sequences | |
| Escape Sequences | Character |
| \b | Backspace |
| \f | Form feed |
| \n | Newline |
| \r | Return |
| \t | Horizontal tab |
| \v | Vertical tab |
| \\ | Backslash |
| \' | Single quotation mark |
| \" | Double quotation mark |
| \? | Question mark |
| \0 | Null character |

For example: \n is used for a newline. The backslash \ causes escape from the normal way the characters are handled by the compiler.

### 5. String Literals

A string literal is a sequence of characters enclosed in double-quote marks. For example:

"good" //string constant

"" //null string constant

" " //string constant of six white space

"x" //string constant having a single character.

"Earth is round\n" //prints string with a newline

## Constants

If you want to define a variable whose value cannot be changed, you can use the const keyword. This will create a constant. For example,

const double PI = 3.14;

Notice, we have added keyword const.

Here, PI is a symbolic constant; its value cannot be changed.

const double PI = 3.14;

PI = 2.9; //Error

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##### EXTRA #####

You can always check the size of a variable using the sizeof() operator.

#include <stdio.h>

int main() {

short a;

long b;

long long c;

long double d;

printf("size of short = %d bytes\n", sizeof(a));

printf("size of long = %d bytes\n", sizeof(b));

printf("size of long long = %d bytes\n", sizeof(c));

printf("size of long double= %d bytes\n", sizeof(d));

return 0;

}

-------------------------------------------------------------------------------------------------------------------------------

### signed and unsigned

In C, signed and unsigned are type modifiers. You can alter the data storage of a data type by using them:

* signed - allows for storage of both positive and negative numbers
* unsigned - allows for storage of only positive numbers

For example,

// valid codes

unsigned int x = 35;

int y = -35; // signed int

int z = 36; // signed int

// invalid code: unsigned int cannot hold negative integers

unsigned int num = -35;

**Derived Data Types**

Data types that are derived from fundamental data types are derived types. For example: arrays, pointers, function types, structures, etc.

We will learn about these derived data types in later tutorials.

* bool type
* Enumerated type
* Complex types

## I/O Multiple Values

Here's how you can take multiple inputs from the user and display them.

#include <stdio.h>

int main()

{

int a;

float b;

printf("Enter integer and then a float: ");

// Taking multiple inputs

scanf("%d%f", &a, &b);

printf("You entered %d and %f", a, b);

return 0;

}

**Output**

Enter integer and then a float: -3

3.4

You entered -3 and 3.400000

**Format Specifiers for I/O**

As you can see from the above examples, we use

|  |  |
| --- | --- |
| Data Type | Format Specifier |
| int | %d |
| char | %c |
| float | %f |
| double | %lf |
| short int | %hd |
| unsigned int | %u |
| long int | %li |
| long long int | %lli |
| unsigned long int | %lu |
| unsigned long long int | %llu |
| signed char | %c |
| unsigned char | %c |
| long double | %Lf |

* %d for int
* %f for float
* %lf for double
* %c for char

Here's a list of commonly used C data types and their format specifiers.

# C Comments

In programming, comments are hints that a programmer can add to make their code easier to read and understand. For example,

## Types of Comments

There are two ways to add comments in C:

1. // - Single Line Comment
2. /\*...\*/ - Multi-line Comment

# C Programming Operators

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;

}

[Run Code](https://www.programiz.com/c-programming/online-compiler)

**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](https://www.programiz.com/article/increment-decrement-operator-difference-prefix-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 |
| = | a = b | a = b |
| += | a += b | a = a+b |
| -= | a -= b | a = a-b |
| \*= | a \*= b | a = a\*b |
| /= | a /= b | a = a/b |
| %= | a %= b | a = a%b |

### 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;

}

[Run Code](https://www.programiz.com/c-programming/online-compiler)

**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](https://www.programiz.com/c-programming/c-if-else-statement) and [loops](https://www.programiz.com/c-programming/c-for-loop).

|  |  |  |
| --- | --- | --- |
| 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;

}

[Run Code](https://www.programiz.com/c-programming/online-compiler)

**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](https://www.programiz.com/c-programming/c-if-else-statement).

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

}

[Run Code](https://www.programiz.com/c-programming/online-compiler)

**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 > 5) 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;

## Program to Print ASCII Value

#include <stdio.h>

int main() {

char c;

printf("Enter a character: ");

scanf("%c", &c);

// %d displays the integer value of a character

// %c displays the actual character

printf("ASCII value of %c = %d", c, c);

return 0;

}

[Run Code](https://www.programiz.com/c-programming/online-compiler)

**Output**

Enter a character: G

ASCII value of G = 71

## Program to Multiply Two Numbers

#include <stdio.h>

int main() {

double a, b, product;

printf("Enter two numbers: ");

scanf("%lf %lf", &a, &b);

// Calculating product

product = a \* b;

// %.2lf displays number up to 2 decimal point

printf("Product = %.2lf", product);

return 0;

}

[Run Code](https://www.programiz.com/c-programming/online-compiler)

**Output**

Enter two numbers: 2.4

1.12

Product = 2.69