

Learn C#: Logic

Boolean Type

The `bool` data type can be either `true` or `false` and is based on the concept that the validity of all logical statements must be either true or false. A *boolean expression* is any expression that evaluates to, or returns, a boolean value.

Booleans encode the science of logic into computers, allowing for logical reasoning in programs. In a broad sense, the computer can encode the truthfulness or falseness of certain statements, and based on that information, completely alter the behavior of the program.

```
bool skyIsBlue = true;
bool penguinsCanFly = false;
Console.WriteLine($"True or false, is the
sky blue? {skyIsBlue}.");
// This simple program illustrates how
booleans are declared. However, the real
power of booleans requires additional
programming constructs such as
conditionals.
```

Logical Operators

Logical operators receive boolean expressions as input and return a boolean value.

The `&&` operator takes two boolean expressions and returns `true` only if they both evaluate to `true`.

The `||` operator takes two boolean expressions and returns `true` if either one evaluates to `true`.

The `!` operator takes one boolean expression and returns the opposite value.

```
// These variables equal true.
bool a = true && true;
bool b = false || true;
bool c = !false;

// These variables equal false.
bool d = true && false;
bool e = false || false;
bool f = !true;
```

Truth Tables

A *truth table* is a way to visualize boolean logic. Since booleans only have two possible values, that means that we can compactly list out in a table all the possible input and output pairs for unary and binary boolean operators.

The image below gives the *truth tables* for the *AND*, *OR*, and *NOT* operators. For each row, the last column represents the output given that the other columns were fed as input to the corresponding operator.

Boolean Operators								
AND			OR			NOT		
A	B	A AND B	A	B	A OR B	A	NOT A	
True	True	True	True	True	True	True	False	
True	False	False	True	False	True	False	True	
False	True	False	False	True	True			
False	False	False	False	False	False			

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