

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	False	False	
True	False	False	True	False	True	True	False	
False	True	False	False	True	True	False	True	
False	False	False	False	False	False	True	False	

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