

## Variables and constants

In this video we will look more closely at how programs store data while they are executing. They do this through the use of variables. We will look at how these are declared, how values are assigned and how that value can be changed during the course of the program's execution.

All of the programs that we have written so far involve one or more variable. When we declare a variable, we allocate memory space in RAM to store the data. In the program, the variable is referred to by its identifier. We could use an identifier such as `x` to represent a number but this isn't very helpful as it doesn't tell other programmers who may read your code what that variable represents in the program. It's a bit like calling somebody by shouting: "Hey, you there!" – it's too vague. It is much better to use an identifier that tells us what the variable does such as: 'age'.

If you need to use two words you should use an underscore between them as variable identifiers can't have spaces. Some languages are case sensitive with regards to variable identifiers but others are not.

Some values can't be changed within a program. These are called 'constants'. In many languages, they can be declared in the same way as variables. However, in Python, there is no specific constant declaration. An example of a constant is `pi` which we could use to calculate the area of a circle. So I have a small program that calculates the area of a circle. I have one variable to hold the radius, I have another variable to hold the calculated area and I've got a third one that's going to hold the `pi` constant that we are going to use in the program.

So on the 4<sup>th</sup> line down just here I have actually assigned a value to `pi`. Now that's not going to change during the program – although I can't declare it as a constant in Python I know that I am not going to change that value, I am just going to use it in the program. So the calculation part as we know is will calculate the area of the circle.


In some languages variables are not assigned a starting value so it is good practice to do this after we have declared them. This is called 'initialisation'. At any point during the program, we can change the value of a variable using an assignment statement, for example `age = 21`.

In Python, the `input()` function reads in values entered by the user and then assigns this to a variable. The `input` function accepts a string of characters so we might need to change this into a number so that we can use it in the program especially if we are performing mathematical calculations.

We can output variable values to the user in Python by using the `print()` function and we use the variable name as the parameter that we pass to this function.

In working programs, we will read data in, we will process it and then we will output the result. Operators perform mathematical processes such as addition or subtraction but programming often involves other types of operators such as `>` or `<` and logical operators `AND`, `OR` and `NOT`. You need to be able to use all of these within your programs.

One way of thinking about logical operators is in terms of a weather related analogy – so if it's sunny I might want to wear a hat and I might want to wear some sunglasses. I could of course just wear one of these – so sunglasses or a hat. If it's raining I'll need to take an umbrella, I might want to have a hat too – so umbrella and hat to protect me from the rain. If it is cold I'll want to wear a scarf, so I might want to wear a scarf and also a hat. So you can combine together the different operators to give you exactly the conditions that you need to use within your program.



A variable is defined as an identifier with associated memory location in RAM and a value within a program. A constant is an identifier with associated memory in RAM whose value is fixed and cannot be changed within a program. We have seen how variables and constants can be declared, initialised and used within programs and how data can be input and output from the program. If you want to learn more about how programs are stored in RAM you can watch the video titled 'The difference between RAM and ROM' in this series.

Thanks very much for watching.