

1 What is programming?

1.1 Input, process, and output

Computers, no matter how they are programmed, work with inputs, processes, and outputs.

1.1.1 Input

All computers accept inputs. An input is data that is entered into or received by a computer. This could include a user pressing a key on a keyboard, clicking a mouse to select something on screen, or tapping a touch pad. Some inputs indicate to the computer what we want it to do, while others provide data for the computer to process. Inputs don't always have to be initiated by human beings. For example, a temperature sensor could gather and input data into a computer or a message could be received by a computer from another device.

1.1.2 Process

The process determines what the computer does with the input. The same input can be processed in different ways. For example, in word processing software, when you press the letter A on a keyboard, the computer may process the input and display it as a letter A on the screen. In gaming software, pressing the letter A may be a directional control, moving a character in the game to a different place on screen. A program contains the set of instructions that define the process.

1.1.3 Output

The output is how the computer presents the results of the process. Outputs can be returned to the user in many ways such as text on a screen, printed materials, or as sound from a speaker.

Exercise

Think about your day. How many times have you used a computer, mobile phone, or other electronic device? For two of the interactions you have had today, write down the inputs, processes, and outputs for those interactions.

INPUTS

PROCESSES

OUTPUTS

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1.2 Instructions and programs

A program is a set of instructions that a computer can run. Programs are clear, ordered, and in a language that computers can follow.

1.2.1 Giving instructions in order

When programming, you must make sure that you give the instructions in the correct order, as the computer will go through them in that order. Unlike a person, the computer would not be able to realise an instruction was missing if you left it out.

If you were instructing a person to put up a tent, you might tell them “Take the tent out of the bag”. They would know to open the bag first, however a computer would not realise you had missed an instruction and may present an error.

1.2.2 Understandable instructions

Just like people, computers need instructions to be in a format that they understand. While a person may be able to infer what you mean — look at a diagram, ask for clarification, or ask questions — this is not possible for a computer. Computers only understand certain instructions or commands in the language that the user is programming them in, so instructions need to be written clearly and accurately.

If you decided to write the instructions down for a person, they would be able to see past any spelling and grammatical errors or ask for clarification if handwriting is illegible. Errors in words you type, when using text-based languages, may mean the computer is unable to interpret the instruction and the program will stop or behave in an unexpected way.

1.2.3 Clear instructions

When a person has finished following instructions, they will be able to look at the result and evaluate if they have been successful. Computers do not have the capacity to evaluate whether a program of instructions has been carried out correctly. They will follow the instructions regardless of whether they are successful in producing the output expected by the programmer or not. This once again shows the importance of designing and writing programs that are clear and concise.

Exercise

*Think about a time that a computer or electronic device has behaved in a way that you didn't expect. How did you resolve the situation? Write down what you did to change the **order**, **format**, or **clarity** of your instructions so the device better understood your intentions.*

Circle the type of change you made:

ORDER

FORMAT

CLARITY

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1.3 What does programming allow us to do?

Programming allows us to be creators rather than just consumers of technology. Instead of using technology, such as writing a letter on a word-processing package or using a paint package to draw a picture, we can develop programs to solve new problems or develop new ideas.

1.3.1 Programs can personalise your experiences and benefit society

I See You - <https://online.coollestprojects.org/projects/216>

To reduce the number of car accidents that are caused by fatigue when drivers fall asleep behind the steering wheel, this program recognises when a driver's eyes move off the road for more than two seconds. Using a web camera, an Arduino board, and a laptop, the system alerts the driver with an alarm if they lose concentration at the wheel or fall asleep. This type of technology can be used to personalise cars of the future.

1.3.2 Programs can help you express yourself and encourage creativity

Ukelectric - <https://online.coollestprojects.org/projects/169>

This project showcases a home-made ukulele which is programmed using micro:bit MakeCode. By creating his own instrument, this child can express himself by making his own music. The pitch of the instrument can be altered by tilting the ukulele and is played either by using foil pads or by pressing the buttons on the micro:bit.

1.3.3 Programs are already part of our everyday lives

It may surprise you to learn that you are already a programmer. You have probably already performed a programming task without recognising it. Programming doesn't always take the shape of writing code on a computer.

Perhaps you have configured a device to record broadcast television, this may have required using an unfamiliar system where you had to select the channel and start and end times. When you set a device to do something in the future this is a type of programming.

Have you created a regular automatic payment, this is a type of program the bank allows you to write and run against their banking system for your convenience.

What about writing a formula for a spreadsheet? Even a formula as simple as calculating the total for a column of data requires you to write a short program for the software to execute.

Exercise

Write down two programs you feel have had a significant impact on our society in recent years.

If you could create your own program — what would you make and why?