



# Coding

The Future Is Code

Issue One March 2022 | 100% INDEPENDENT

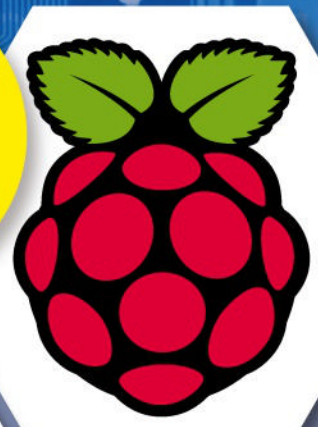
**USER**

*Discover  
the World of  
Programming*

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CODE  
Downloads**  
See inside for details



Everything you  
need to know  
about code



*Packed  
with OVER*  
**265**  
*Top tips and  
guides*

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Coding Potential**



Learn to code for you,  
and the future

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Coding Languages**



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# Coding **USER**

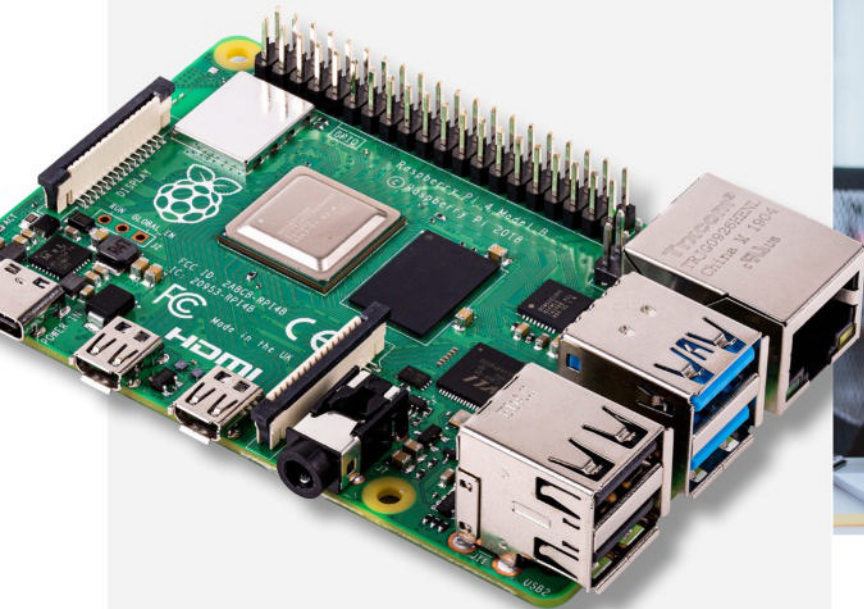
If you want to learn to code, this is the publication for you. With every issue our team of experts brings you the best tips, tricks and tutorials for creating code, regardless of your level of experience.

In this first issue we take a look at the various languages you can use to code. Which one is right for you? Our easy-to-follow tutorials show how to code on various platforms too, such as Linux, Windows and Raspberry Pi. If it's apps and gear you're looking for, our in-depth reviews help you find the very best your money can buy. We cover all the very best of tech across all major platforms, so you're bound to find something you like. It's all in this very first issue of Coding User.



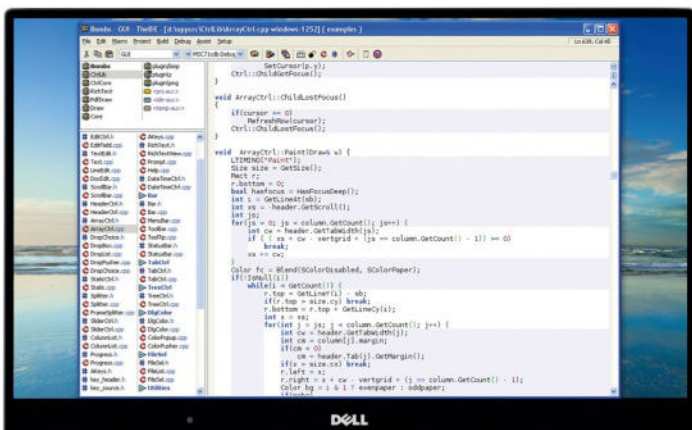


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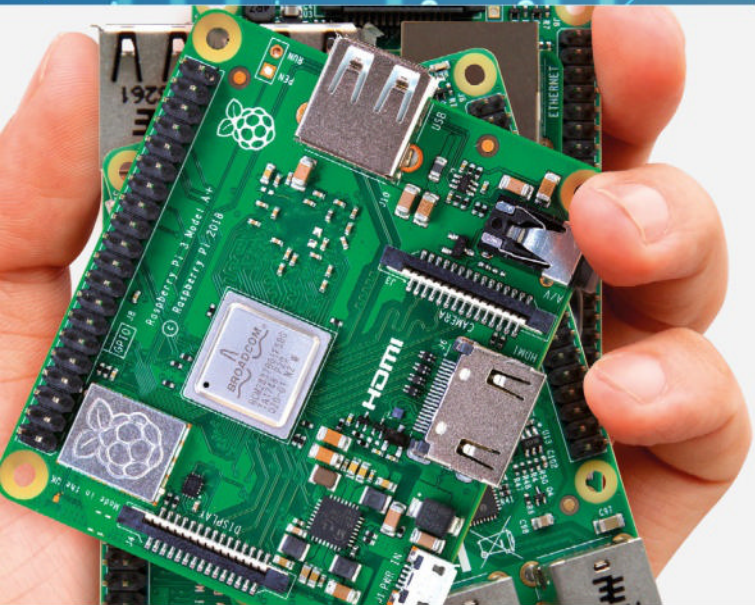


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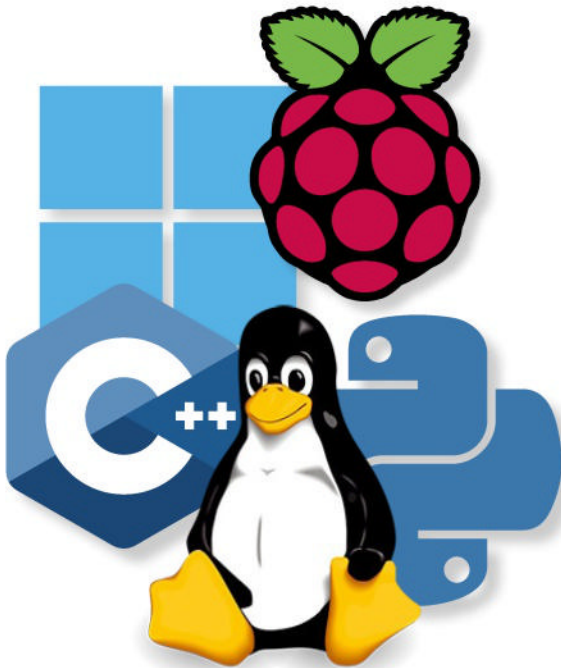




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Everything you do online, every time you power on your smart TV, whenever you use your in-car GPS, use your phone, play a game on a tablet, console or PC, it's all been coded by a group of people. All these ones and zeros are developed by those who have learned how to code, and with this book you too can learn how to get started on the road to becoming a programmer.

We cover C++, Python, Linux, Windows and the Raspberry Pi within these pages. But first, let's begin with a good foundation.

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Being a Programmer

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A Brief History of Coding

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Choosing a Programming Language

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Creating a Coding Platform





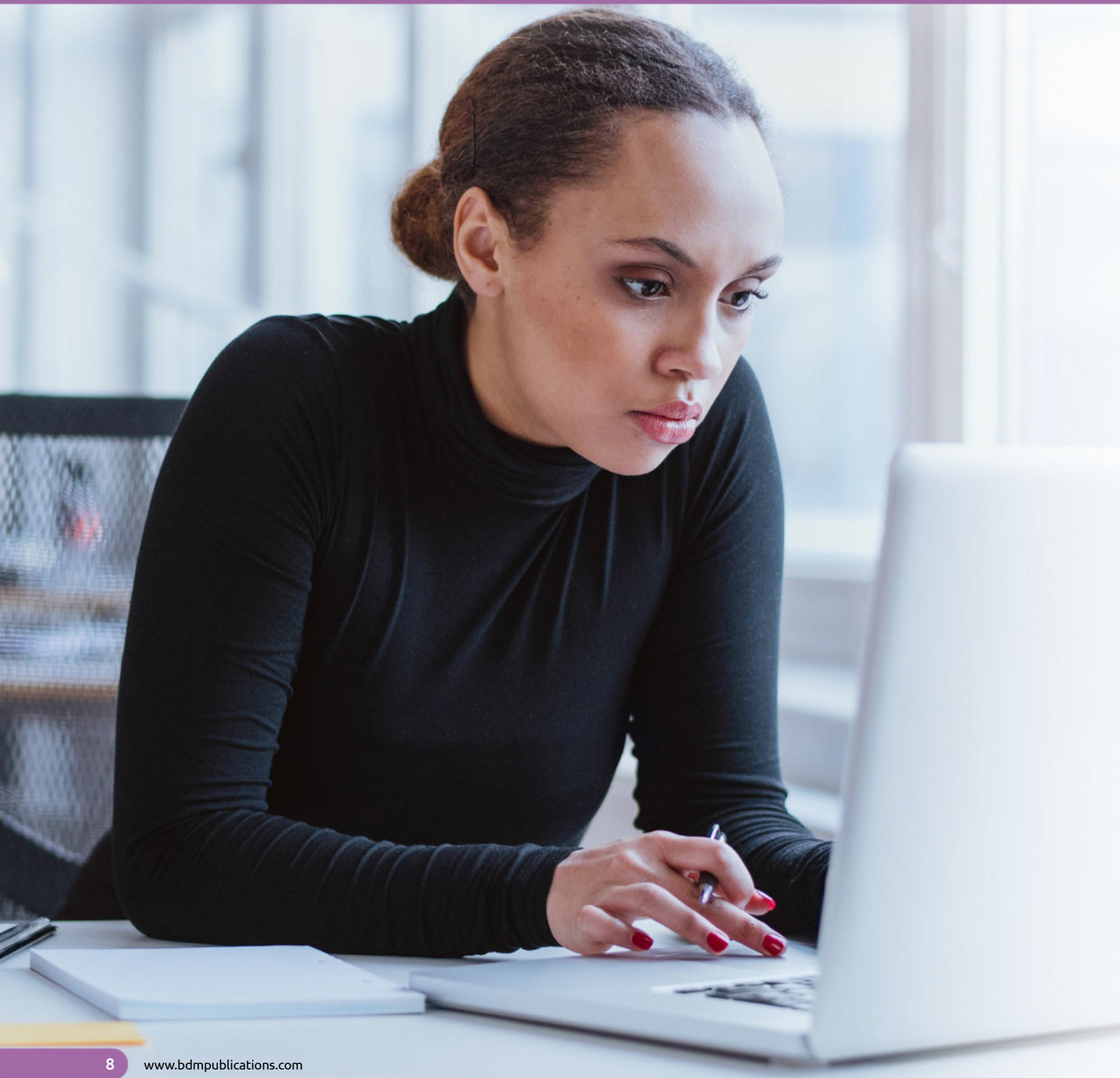
# Coding - Which Language is Right For You?





# Being a Programmer

Programmer, developer, coder, they're all titles for the same occupation, someone who creates code. What they're creating the code for can be anything from a video game to a critical element on board the International Space Station. How do you become a programmer though?







Times have changed since programming in the '80s, but the core values still remain.

“It’s up to you how far to take your coding adventure!”

```

1  #include<stdio.h>
2  #include<dos.h>
3  #include<stdlib.h>
4  #include<conio.h>
5  void setup()
6  {
7      textcolor(BLACK);
8      textbackground(15);
9      clrscr();
10     window(10,2,70,3);
11     printf("Press X to Exit, Press Space to Jump");
12     window(62,2,80,3);
13     printf("SCORE : ");
14     window(1,25,80,25);
15     for(int x=0;x<79;x++)
16     {
17         printf(" ");
18         textcolor(0);
19     }
20     int t,speed=40;
21     void ds(int jump=0)
22     {
23         static int a=1;
24
25         if(jump==0)
26             t=0;
27         else if(jump==2)
28             t--;
29         else t++;
30         window(2,15-t,18,25);
31         printf(" ");
32         printf(" ");
33         printf(" ");
34         printf(" ");
35         printf(" ");
36         printf(" ");
37         printf(" ");
38         printf(" ");
39         if(jump==1 || jump==2){
40             printf(" ");
41             printf(" ");
42         }else if(a==1)
43         {
44             printf(" ");
45             printf(" ");
46             a=2;
47         }
48         else if(a==2)
49         {
50             printf(" ");
51             printf(" ");
52             a=1;
53         }
54         printf(" ");
55         delay(speed);
56     }
57     void obj()
58     {

```

Being able to follow a logical pattern and see an end result is one of the most valued skills of a programmer.

## MORE THAN CODE

For those of you old enough to remember the '80s, the golden era of home computing, the world of computing was a very different scene to how it is today. 8-bit computers that you could purchase as a whole, as opposed to being in kit form and you having to solder the parts together, were the stuff of dreams; and getting your hands on one was sheer bliss contained within a large plastic box. However, it wasn't so much the new technology that computers then offered, moreover it was the fact that for the first time ever, you could control what was being viewed on the 'television'.

Instead of simply playing one of the thousands of games available at the time, many users decided they wanted to create their own content, their own games; or simply something that could help them with their homework or home finances. The simplicity of the 8-bit home computer meant that creating something from a few lines of BASIC code was achievable and so the first generation of home-bred programmer was born.

From that point on, programming expanded exponentially. It wasn't long before the bedroom coder was a thing of the past and huge teams of designers, coders, artists and musicians were involved in making a single game. This of course led to the programmer becoming more than simply someone who could fashion a sprite on the screen and make it move at the press of a key.

Naturally, time has moved on and with it the technology that we use. However, the fundamentals of programming remain the same; but what exactly does it take to be a programmer?

The single most common trait of any programmer, regardless of what they're doing, is the ability to see a logical pattern. By this we mean someone who can logically follow something from start to finish and envisage the intended outcome. While you may not feel you're such a person, it is possible to train your brain into this way of thinking. Yes, it takes time but once you start to think in this particular way you will be able to construct and follow code.

Second to logic is an understanding of mathematics. You don't have to be at a genius level but you do need to understand the rudiments of maths. Maths is all about being able to solve a problem and code mostly falls under the umbrella of mathematics.

Being able to see the big picture is certainly beneficial for the modern programmer. Undoubtedly, as a programmer, you will be part of a team of other programmers, and more than likely part of an even bigger team of designers, all of whom are creating a final product. While you may only be expected to create a small element of that final product, being able to understand what everyone else is doing will help you create something that's ultimately better than simply being locked in your own coding cubicle.

Finally, there's also a level of creativity needed to be a good programmer. Again though, you don't need to be a creative genius, just have the imagination to be able to see the end product and how the user will interact with it.

There is of course a lot more involved in being a programmer, including learning the actual code itself. However, with time, patience and the determination to learn, anyone can become a programmer. Whether you want to be part of a triple-A video game team or simply create an automated routine to make your computing life easier, it's up to you how far to take your coding adventure!



# A Brief History of Coding

It's easy to think that programming a machine to automate a process or calculate a value is a modern concept that's only really happened in the last fifty years or so. However, that assumption is quite wrong, coding has actually been around for quite some time.

01000011 01101111 01100100 01100101

Essentially all forms of coding are made up of ones and zeros, on or off states. This works for a modern computer and even the oldest known computational device.

~87 BC

It's difficult to pinpoint an exact start of when humans began to 'program' a device. However, it's widely accepted that the Antikythera Mechanism is possibly the first 'coded' artefact. It's dated to about 87 BC and is an ancient Greek analogue computer and orrery used to predict astronomical positions.



~850 AD

The Banū Mūsā brothers, three Persian scholars who worked in the House of Wisdom in Baghdad, published the Book of Ingenious Devices in around 850 AD. Among the inventions listed was a mechanical musical instrument, a hydro-powered organ that played interchangeable cylinders automatically.



1800

Joseph Marie Jacquard invents a programmable loom, which used cards with punched holes to create the textile design. However, it is thought that he based his design on a previous automated weaving process from 1725, by Basile Bouchon.



1842-1843



Ada Lovelace translated the memoirs of the Italian mathematician, Francis Maneciang, regarding Charles Babbage's Analytical Engine. She made copious notes within her writing, detailing a method of calculating Bernoulli Numbers using the engine. This is recognised as the first computer program. Not bad, considering there were no computers available at the time.

1930-1950



During the Second World War, there significant advances were made in programmable machines. Most notably, the cryptographic machines used to decipher military codes used by the Nazis. The Enigma was invented by the German engineer Arthur Scherbius but was made famous by Alan Turing at Bletchley Park's codebreaking centre.



From the 1970s, the development of the likes of C, SQL, C with Classes (C++), MATLAB, Common Lisp and more came to the fore. The '80s was undoubtedly the golden age of the home computer, a time when silicon processors were cheap enough for ordinary folk to buy. This led to a boom in home/bedroom coders with the rise of 8-bit machines.



## 1951-1958

## 1959

## 1960-1970

## 1970-1985

## 1990s-Present Day

```
MONITOR FOR 6802 1.4          9-14-80 TSC ASSEMBLER PAGE 2

C000  RE 00 70  START  ORG  ROM+00000 BEGIN MONITOR
C000  RE 00 70  START  LDS  #STACK

*****
* FUNCTION: INITA - Initialize ACIA
* INPUT: none
* OUTPUT: none
* CALLS: none
* DESTROYES: acc A

0013  HEXSTA EQU 400010011
0011  CTRREG EQU 400010001

C003  RE 13  INITA  LDA A  HEXSTA  HEXST ACIA
C005  RE 00 04  STA A  ACIA
C006  RE 11  LDA A  #CTRREG  SET 8 BITS AND 2 STOP
C00A  RE 00 04  STA A  ACIA
C00D  RE 00 01  JMP  SIGNON  GO TO START OF MONITOR

*****
* FUNCTION: INCH - Input character
* INPUT: none
* OUTPUT: char in acc A
* DESTROYES: acc A
* CALLS: none
* DESCRIPTION: Gets 1 character from terminal

C010  RE 00 04  INCH  LDA A  ACIA  GET STATUS
C013  RE 47  AND A  #0  SHIFTR RORF FLAG INTO CARRY
C014  RE 24  FA  ROR  INCH  ROTATE NOT READY
C016  RE 00 05  LDA A  ACIA+1  GET CHAR
C019  RE 04 7F  AND A  #17F  MASK PARITY
C01B  RE 00 79  JMP  OUTCH  RCH0 & RTS

*****
* FUNCTION: INHEX - INPUT HEX DIGIT
* INPUT: none
* OUTPUT: digit in acc A
* CALLS: INCH
* DESTROYES: acc A
* Returns to monitor if not HEX input

C01E  RE 00 00  INHEX  AND A  INCH  GET A CHAR
C020  RE 01 30  CMP A  #0  ZERO
C022  RE 28 11  BEQ  HEXERR  NOT HEX
C024  RE 01 39  CMP A  #9  NINE
C026  RE 2F 0A  BLE  HEXOKS  GOOD HEX
C028  RE 01 41  CMP A  #A  A
C02A  RE 28 09  BEQ  HEXERR  NOT HEX
C02C  RE 01 46  CMP A  #F  F
C02E  RE 28 05  BEQ  HEXERR  NOT HEX
C030  RE 00 07  SUB A  #1  FIX A-F
C032  RE 04 0F  HEXSTA AND A  #0F  CONVERT ASCII TO DIGIT
C034  RE 39  RTS

C035  RE 00 AF  HEXERR JMP  CTRL  RETURN TO CONTROL LOOP
```

The first true computer code was Assembly Language (ASM) or Regional Assembly Language. ASM was specific to the architecture of the machine it was being used on. In 1951 programming languages fell under the generic term Autocode. Soon languages such as IPL, FORTRAN and ALGOL 58 were developed.

Computer programming was mainly utilised by universities, the military and big corporations during the '60s and the '70s. A notable step toward a more user-friendly, or home user language, was the development of BASIC (Beginners All-purpose Symbolic Instruction Code) in the mid-sixties.

```
10 INPUT "What is your name: "; U$
20 PRINT "Hello "; U$
25 REM
30 INPUT "How many stars do you want: "; N
35 S$ = ""
40 FOR I = 1 TO N
50 S$ = S$ + "*"
55 NEXT I
60 PRINT S$
65 REM
70 INPUT "Do you want more stars? "; A$
80 IF LEN(A$) = 0 THEN GOTO 70
90 A$ = LEFT$(A$, 1)
100 IF (A$ = "Y") OR (A$ = "y") THEN GOTO 30
110 PRINT "Goodbye ";
120 FOR I = 1 TO 200
130 PRINT U$; " ";
140 NEXT I
150 PRINT
```



The Internet age brought a wealth of new programming languages and allowed people access to the tools and knowledge needed to learn coding in a better way. Not only could a user learn how to code but they could freely share their code and source other code to improve their own.

Admiral Grace Hopper was part of the team that developed the UNIVAC I computer and she eventually developed a compiler for it. In time, the compiler she developed became COBOL (Common Business-oriented Language), a computer language that's still in use today.







# Choosing a Programming Language

It would be impossible to properly explain every programming language in a single book of this size. New languages and ways in which to 'talk' to a computer or device and set its instructions are being invented almost daily; and with the onset of quantum computing, even more complex methods are being born. Here is a list of the more common languages along with their key features.





**SQL**

SQL stands for Structured Query Language. SQL is a standard language for accessing and manipulating databases. Although SQL is an ANSI (American National Standards Institute) standard, there are different versions of the SQL language. However, to be compliant, they all support at least the major commands such as Select, Update and Delete in a similar manner.

**JAVASCRIPT**

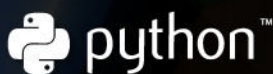
JavaScript (often shortened to JS) is a lightweight, interpreted, object-oriented language with first class functions. JavaScript runs on the client side of the web, that can be used to design or program how the web pages behave on the occurrence of an event. JavaScript is an easy to learn and also powerful scripting language, widely used for controlling web page behaviour.

**JAVA**

Java is the foundation for virtually every type of networked application and is the global standard for developing enterprise software, web-based content, games and mobile apps. The two main components of the Java platform are the Java Application Programming Interface (API) and the Java Virtual Machine (JVM) that translates Java code into machine language.

**C#**

C# is an elegant object-oriented language that enables developers to build a variety of secure and robust applications that run on the .NET Framework. You can use C# to create Windows client applications, XML Web services, client server applications, database applications and much more. The curly-brace syntax of C# will be instantly recognisable to anyone familiar with C, C++ or Java.

**PYTHON**

Python is a widely used high level programming language used for general purpose programming, created by Guido van Rossum and first released in 1991. An interpreted language, Python has a design philosophy that emphasises code readability and a syntax that allows programmers to express concepts in fewer lines of code. This can make it easier for new programmers to learn.

**C++**

C++ (pronounced cee plus plus) is a general purpose programming language. It has imperative, object-oriented and generic programming features. It was designed with a bias toward system programming and embedded, resource-constrained and large systems, with performance, efficiency and flexibility of use as its design highlights.

**RUBY**

Ruby is a language of careful balance. Its creator, Yukihiro "Matz" Matsumoto, blended parts of his favourite languages (Perl, Smalltalk, Eiffel, Ada and Lisp) to form a new language. From its release in 1995, Ruby has drawn devoted coders worldwide. Ruby is seen as a flexible language; essential parts of Ruby can be removed or redefined, at will. Existing parts can be added to.

**PERL**

Perl is a general purpose programming language, used for a wide range of tasks including system administration, web development, network programming, GUI development and more. Its major features are that it's easy to use, supports both procedural and object-oriented (OO) programming, has powerful built-in support for text processing and has one of the most impressive collections of third-party modules.

**SWIFT**

Swift is a powerful and intuitive programming language for macOS, iOS, watchOS and tvOS. Writing Swift code is interactive and fun; the syntax is concise yet expressive and Swift includes modern features that developers love. Swift code is safe by design, yet also produces software that runs lightning fast. A coding tutorial app, Swift Playgrounds, is available for the iPad.





# Creating a Coding Platform

The term 'Coding Platform' can signify: a type of hardware on which you can code, a particular operating system, or even a custom environment that's pre-built and designed for easy game creation. In truth it's quite a loose term, as a Coding Platform can be a mixture of all of these ingredients, it's simply down to which programming language you intend to code in and what your end goals are.

Coding can be one of those experiences that sounds fantastic, but is often confusing to tackle. After all, there's a plethora of languages to choose from, countless apps that will enable you to code in a specific, or range, of languages and an equally huge amount of third-party software to consider. In addition, by accessing the Internet, you will discover that there are countless coding tutorials available for the language in which you've decided you want to program, alongside even more examples of code. It's all a little too much at first.

The trick is to slow down and, to begin with, not look too deeply into coding. Like all good projects, you need a solid foundation on which to build your skillset and to have all the necessary tools available to enable you to complete the basic steps. This is where creating a coding platform comes in, as it will be your learning foundation while you begin to take your first tentative steps into the wider world of coding.

```
5
6 from django.contrib.auth.decorators import login_required, permission_required
7 from django.contrib.admin.views.decorators import staff_member_required
8 from django.core.exceptions import ObjectDoesNotExist
9 from django.http import HttpResponseForbidden
10 from django.contrib.auth import authenticate, login, logout
11 from django.contrib.auth.models import User
12
13 from django.core.paginator import Paginator
14 from django.core.urlresolvers import reverse
15 from django.conf import settings
16 from django.db.models import Q, Sum, Min, Count
17
18 from django.contrib import messages
19 from datetime import date, timedelta
20 import re
21
22 from .models import *
23
24
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## OPERATING SYSTEMS

Windows 10 is the most widely used operating system in the world, so it's natural that the vast majority of coding tools are written for Microsoft's leading operating system. However, don't discount macOS and especially Linux.

macOS users enjoy an equal number of coding tools to their Windows counterparts. In fact, you will probably find that a lot of professional coders use a Mac over a PC, simply because of the fact that the Mac operating system is built on top of Unix (the command-line OS that powers much of the world's filesystems and servers). This Unix layer lets you test programs in almost any language without using a specialised IDE.

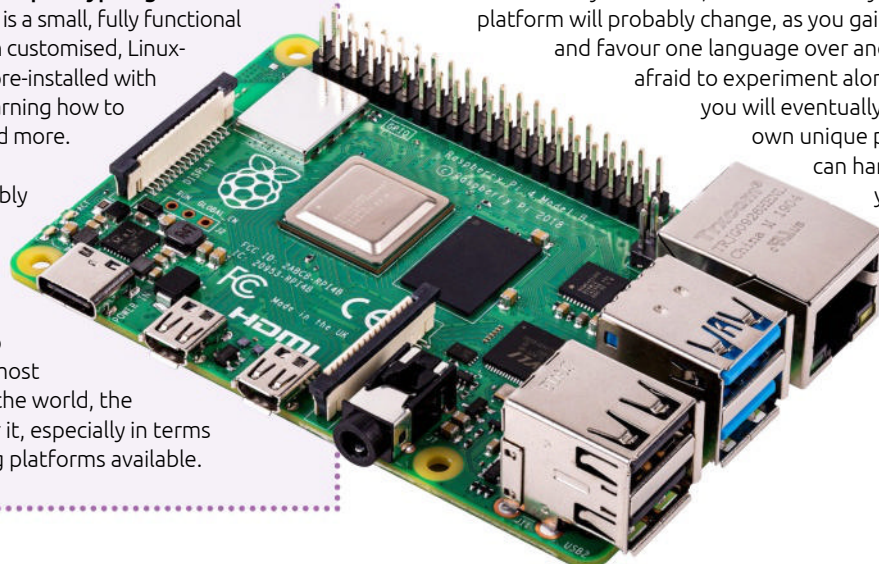


However, Linux is, by far and away, one of the most popular and important coding operating systems available. Not only does it have a Unix-like backbone, it's also free to download, install and use and comes with most of the tools necessary to start learning how to code. Linux powers most of the servers that make up the Internet. It's used on nearly all of the top supercomputers, as well as specifically in organisations such as NASA, CERN and the military, it also forms the base of Android-powered devices, smart TVs and in-car systems. Linux, as a coding platform, is an excellent idea and it can be installed inside a virtual machine without ever affecting the installation of Windows or macOS.

## THE RASPBERRY PI

If you haven't already heard of the Raspberry Pi, then we suggest you head over to [www.raspberrypi.org](http://www.raspberrypi.org) and check it out. In short, the Raspberry Pi is a small, fully functional computer. It comes with its own customised, Linux-based operating system that's pre-installed with everything you need to start learning how to code in Python, C++, Scratch and more.

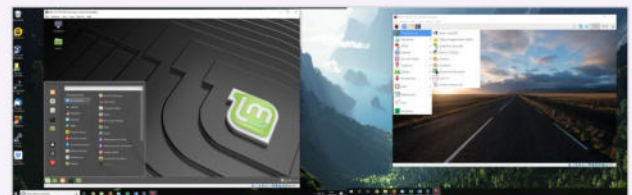
Costing around £35, it's incredibly cheap and allows you to utilise different hardware, in the form of robotics and electronics projects, as well as offering a complete desktop experience. Although not the most powerful computing device in the world, the Raspberry Pi has a lot going for it, especially in terms of being one of the best coding platforms available.



## VIRTUAL MACHINES

A virtual machine is a piece of software that allows you to install a fully working operating system within the confines of the software itself. The installed OS will allocate user-defined resources from the host computer, providing memory, hard drive space etc., as well as sharing the host computer's Internet connection.

The advantage of a virtual machine is that you can work with Linux, for example, without it affecting your currently installed host OS. This means that you can have Windows 10 running and launch your virtual machine client, boot into Linux and use all the functionality of Linux, while still being able to use Windows.



This, of course, makes it a fantastic coding platform, as you can have different installations of operating systems running from the host computer while using different coding languages. You can test your code without fear of breaking your host OS and it's easy to return to a previous configuration without the need to reinstall everything again.

Virtualisation is the key to most big companies now. You will probably find, rather than having a single server with an installation of Windows Server, for example, the IT team have instead opted for a virtualised environment whereby each Windows Server instance is a virtual machine running from several powerful machines. This cuts down on the number of physical machines, allows the team to better manage resources and enables them to deploy an entire server dedicated to a particular task in a fraction of the time.

## YOUR OWN CODING PLATFORM

Whichever method you choose, remember that your coding platform will probably change, as you gain experience and favour one language over another. Don't be afraid to experiment along the way, as you will eventually create your own unique platform that can handle all the code you enter into it.





C++ is an amazing programming language. Most of what you see in front of you when you power up your computer, regardless of whether you're using Windows, macOS or Linux, is created using C++. Being able to code in C++ will open a whole new world for you, in terms of desirable professional skills and the ability to code amazing apps and games.

C++ is an efficient and powerful language that's used to develop operating systems, applications, games and much more. It's used in science, engineering, banking, education, the space industry, and much more.

Why C++?

C++ Facts & Figures

Equipment You Will Need

Structure of C++ Code

Did You Know?





# Introducing C++





# Why C++?

C++ is one of the most popular programming languages available today. Originally called C with Classes, the language was renamed to C++ in 1983. It's an extension of the original C language, and is a general purpose object-oriented (OOP) environment.

## C EVERYTHING

Due to both the complexity of the language and its power and performance, C++ is often used to develop games, programs, device drivers, and even entire operating systems.

Dating back to 1979, the start of the golden era of home computing, C++, or rather C with Classes, was the brainchild of Danish computer scientist Bjarne Stroustrup, while working on his Ph.D. thesis. Stroustrup's plan was to further the original C language, which had been widely used since the early seventies.

C++ proved to be popular among the developers of the 80s, since it was a much easier environment with which to get to grips, and, more importantly, it was 99% compatible with the original C language. This meant that, beyond the mainstream computing labs, regular people who didn't have access to the mainframes and large computing data centres could use it.

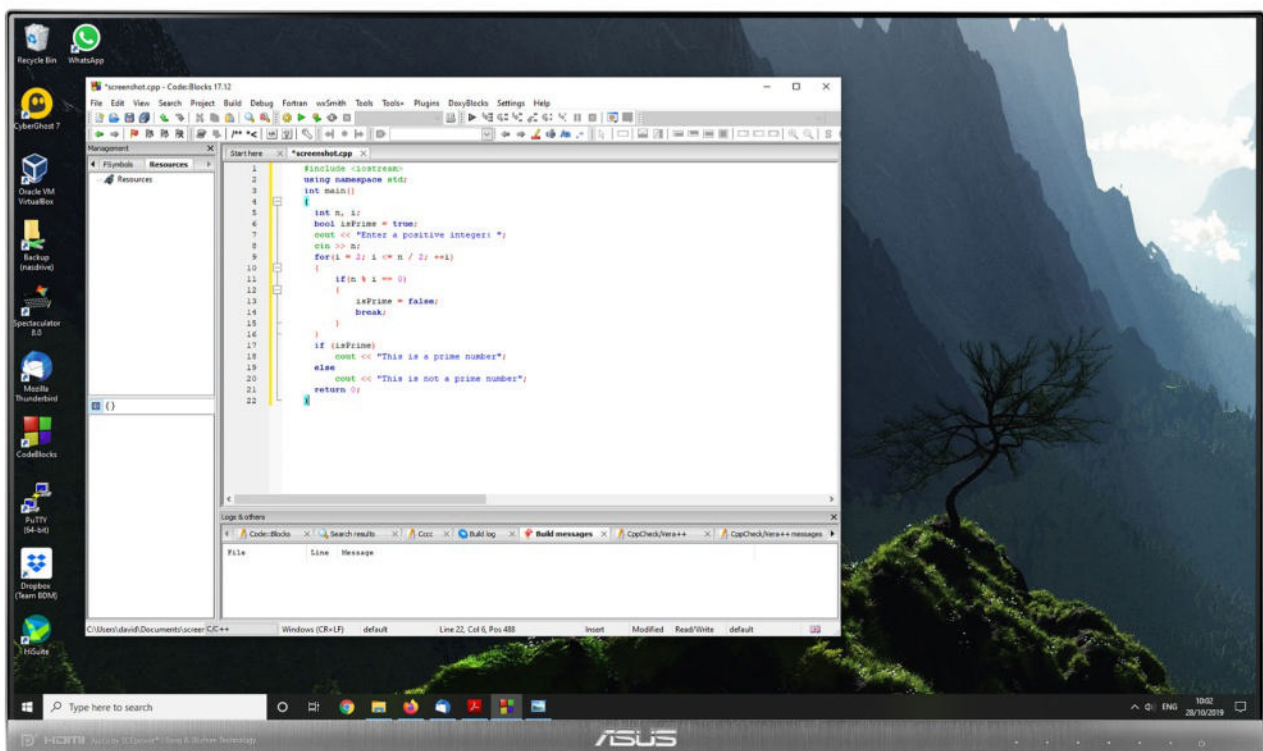
C++'s impact in the digital world is immense. Many of the programs, applications, games, and even operating systems are coded

using C++. For example, all of Adobe's major applications, such as Photoshop, InDesign and so on, are developed in C++. You will find that the browser you use to surf the Internet is written in C++, as well as Windows 10, Microsoft Office, and the backbone to Google's search engine. Apple's macOS is written largely in C++ (with some other languages mixed in depending on the function), and the likes of NASA, SpaceX, and even CERN use C++ for various applications, programs, controls, and umpteen other computing tasks.

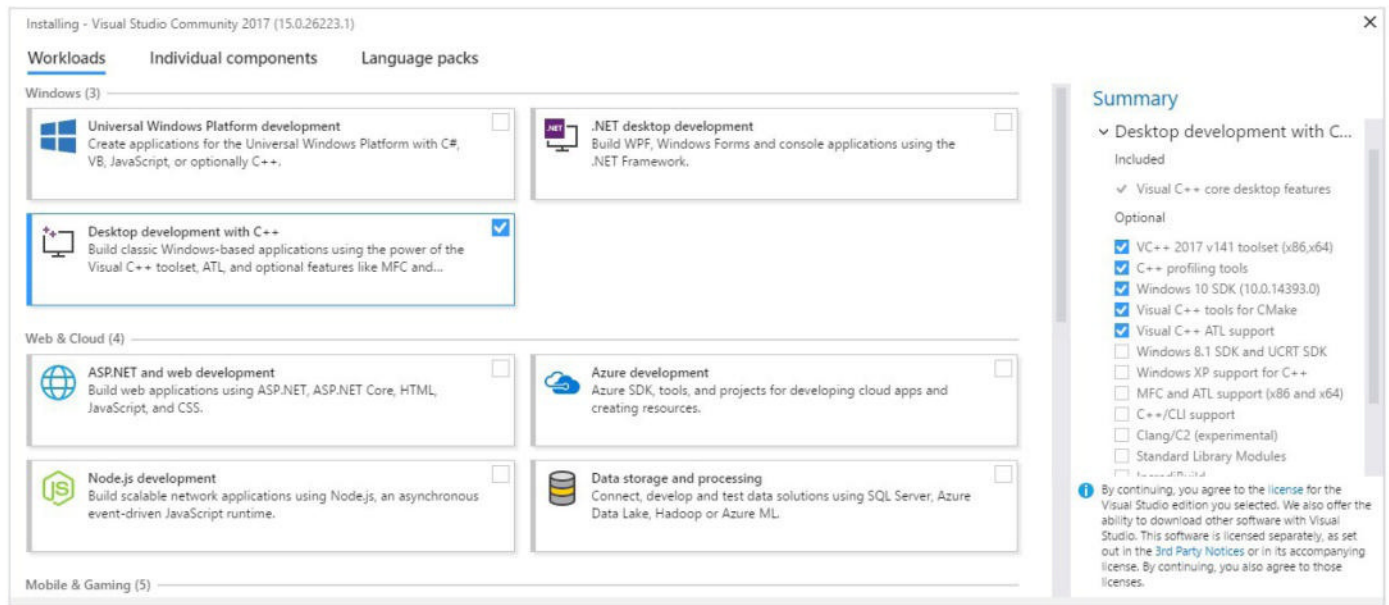
As well as being an easier addition to the core C language, C++ is also extremely efficient and performs well across the board. This higher level of performance over other languages, such as Python, BASIC and such, makes it an ideal development environment for modern computing; hence the aforementioned companies using it so widely.



**C++ code is much faster than other programming languages.**







**Microsoft's Visual Studio is a great, free environment in which to learn C++.**

C++ puts the developer in a much wider world of coding. By mastering C++, you will find yourself being able to develop code for the likes of Microsoft, Apple and so on. Generally, C++ developers enjoy a higher salary than programmers of some other languages, and, due to its versatility, the C++ programmer can move between jobs and companies without the need to re-learn anything specific.

You will discover, as you become a more advanced coder, that many of the developers in various coding jobs around the world tend to use pre-designed development engines. For example, when creating games, the likes of Bethesda, the team behind Oblivion and Skyrim, utilise a 3D game engine called The Creation Engine. This enables the team to quickly create animations, characters, items, terrains, rooms, and just about everything else you'd see in the game. The engine itself has been modified to make the most of the current graphics card hardware, and computer or console processing power. These engines are mostly written in C++, and when making

improvements to the engine, or when creating a new game, if the developers want to add something that the engine can't do, they will use C++ to create the new content or link between two different engines. The end result, of course, is a game that contains the latest graphical technology, while being seamlessly bound together with some pretty clever C++ coding.

Getting to use C++ is quite easy, all you need is the right set of tools in which to communicate with the computer in C++, and you can start your journey. A C++ IDE is free of charge, even the immensely powerful Visual Studio from Microsoft is freely available to download and use. You can get into C++ from any operating system, be it macOS, Linux, Windows, or even mobile platforms.

So, to answer the question of Why C++, the answer is because it's fast, efficient, and developed by most of the applications you regularly use. It's cutting edge, and a fantastic language to have mastered.



**Indeed, the operating system you're using is written in C++.**



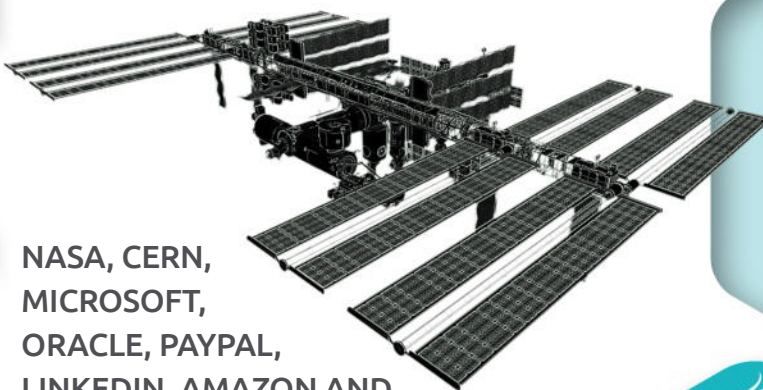




C++

# Facts & Figures

C++ is one of the top programming languages in the industry. It's quick, powerful, and used by nearly every major tech and gaming company in the world. Here's some interesting facts about the rather wonderful C++.



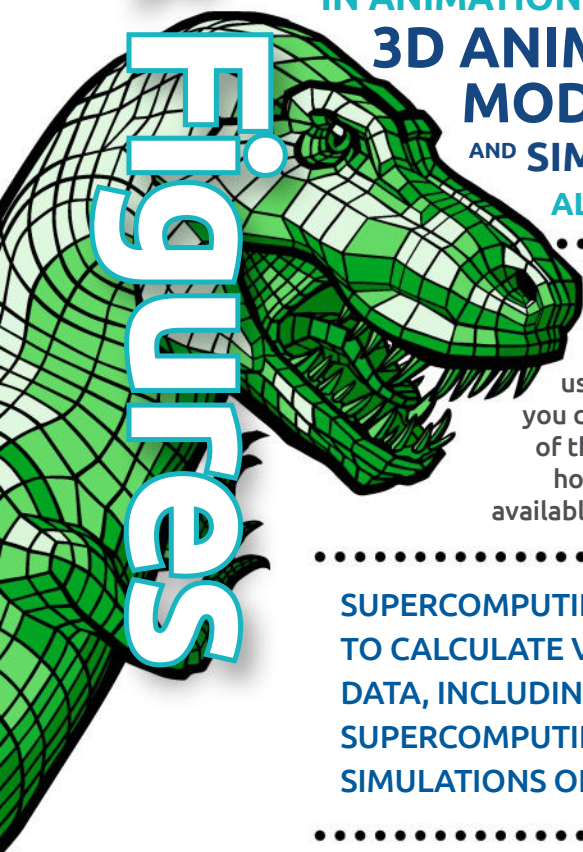
NASA, CERN, MICROSOFT, ORACLE, PAYPAL, LINKEDIN, AMAZON AND THE MILITARY USE C++.

C++ is one of the predominant programming languages for the development of all kinds of technical and commercial software.

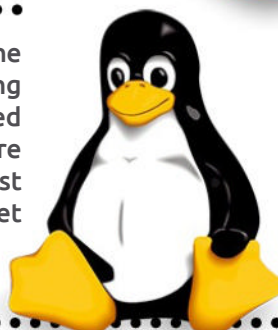
C++ IS USED FREQUENTLY IN ANIMATION PROCESSES.

**3D ANIMATION, MODELLING, AND SIMULATIONS**

ALL UTILISE C++.



A lot of the Linux operating system is coded using C++, therefore you could say that most of the world's Internet hosting servers are available thanks to C++.



**SUPERCOMPUTING USES C++ CODE TO CALCULATE VAST AMOUNTS OF DATA, INCLUDING THE NASA-BASED SUPERCOMPUTING FARM THAT RUNS SIMULATIONS OF THE UNIVERSE.**



C++ has influenced other programming languages, such as C# and Java.



70%

More than 70% of all trading is known as High Frequency Trading (HFT), and the software responsible is written in C++ to make use of its high speed.



Sources: ITJobsWatch,  
Google, Quora, Stack  
Exchange, eduCBA,  
StackOverflow,  
stackShare,  
AppDynamics

## C++ Facts & Figures



The Xbox  
operating system  
uses C++ as its  
backbone.



Many database applications  
are built using C++, such  
as MySQL, it's also used  
by Wikipedia, Yahoo and  
YouTube.



Gaming is one of the  
biggest users of C++.  
It handles the  
complexities of 3D games,  
supports multiplayer  
options, and enables  
intensive CPU and  
GPU hardware  
functions.



Google Chrome, Mozilla's  
Firefox, and even Microsoft's  
Edge web browsers are  
coded in C++.



Most of Adobe's  
stable of products  
are developed  
using C++.

THE  
**90<sup>th</sup>**

PERCENTILE SALARY  
FOR A UK-BASED C++  
DEVELOPER IS

**£120,000**

C++ is  
used in computer  
networking as the  
main code behind the  
Programmable Logic  
Controller, connecting  
servers, processors, other  
hardware, and  
even robotics.



Windows 95, 98, 2000,  
XP, 7, 8.1 and 10, as well as  
Microsoft Office, use C++  
as the backbone programming  
language of choice.



MRI scanning  
machines and  
Computer Aided Design  
all use C++ to help with  
the enhanced imagery  
produced by these  
systems.

**FORTNITE**

The Unreal 4 Engine,  
which is coded in C++,  
is used for hundreds  
of games, including  
Fortnite.

.....  
**RADAR  
PROCESSING  
TECHNOLOGIES  
USE C++, AS  
WELL AS  
ADVANCED  
MISSILE  
DETECTION  
SYSTEMS.**  
.....

.....  
**FLIGHT CONTROL SYSTEMS IN  
MODERN AIRCRAFT, INCLUDING  
MILITARY AIRCRAFT, USE C++.**  
.....





# Equipment You Will Need

You don't need to invest a huge amount of money in order to learn C++, and you don't need an entire computing lab at your disposal either. Providing you have a fairly modern computer, everything else is freely available.

## C++ SETUPS

As most, if not all, operating systems have C++ at their code, it stands to reason that you can learn to program in C++ no matter what OS you're currently using.



### ☐ COMPUTER

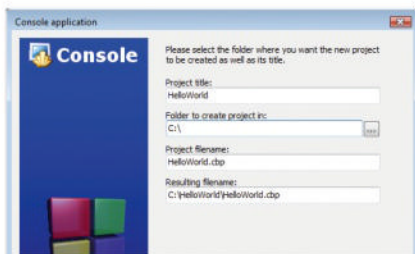
Unless you fancy writing out your C++ code by hand on a sheet of paper (which is something many older coders used to do), then a computer is an absolute must have component. PC users can have any recent Linux distro or Windows OS, Mac users the latest macOS.

### ☐ AN IDE

An IDE is used to enter and execute your C++ code. Many IDEs come with extensions and plugins that help make it work better, or add an extra level of functionality. Often, an IDE will provide enhancements depending on the core OS being used, such as enhancements for Windows 10.

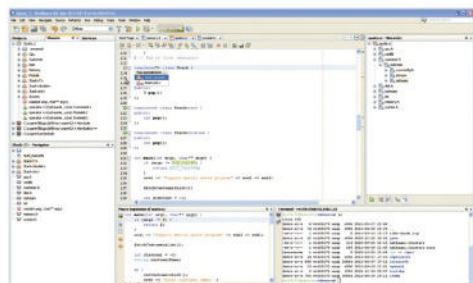
### ☐ COMPILER

A compiler is a program that converts the C++ language into binary that the computer can understand. While some IDEs come with a compiler built in, others don't. Code::Blocks is our favourite IDE that comes with a C++ compiler as part of the package. More on this later.



### ☐ TEXT EDITOR

Some programmers much prefer to use a text editor to assemble their C++ code before running it through a compiler. Essentially, you can use any text editor to write code, just save it with a .cpp extension. However, Notepad++ is one of the best code text editors available.

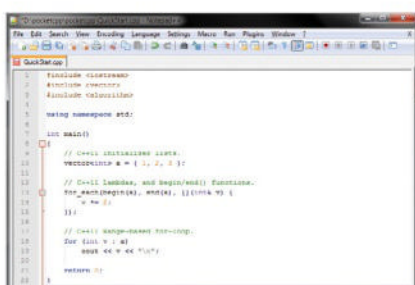


### ☐ INTERNET ACCESS

While it's entirely possible to learn how to code on a computer that's not attached to the Internet, it's extraordinarily difficult. You will need to install the relevant software, keep it up to date, install any extras or extensions, and look for help when coding. All of which require access to the Internet.

### ☐ TIME AND PATIENCE

You're going to need to set aside significant time to spend on learning how to code in C++. Sadly, unless you're a genius, it's not going to happen overnight, or even in a week. A good C++ coder has spent many years honing their craft, so be patient, start small and keep learning.



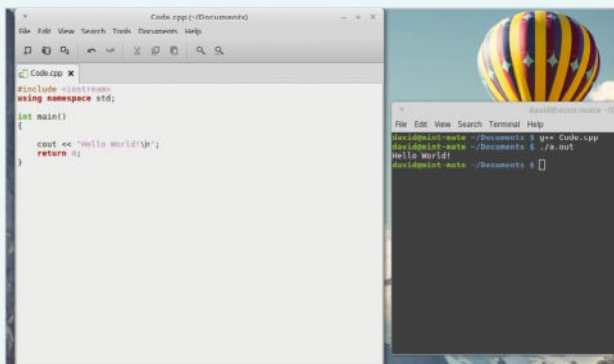


## OS SPECIFIC NEEDS

C++ will work in any operating system; however, getting all the necessary pieces together can be confusing to a newcomer. Here's some OS specifics for C++.

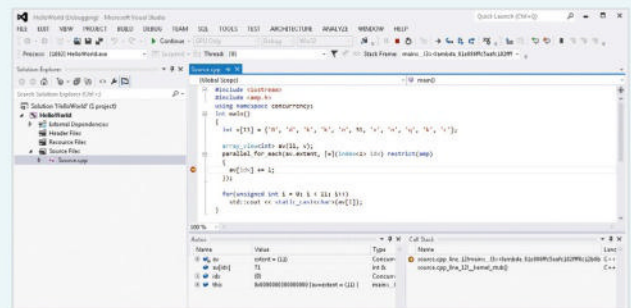
### LINUX

Linux users are lucky in that they already have a compiler and text editor built into their operating system. Any text editor will allow you to type out your C++ code, when it's saved with a .cpp extension, use g++ to compile it.



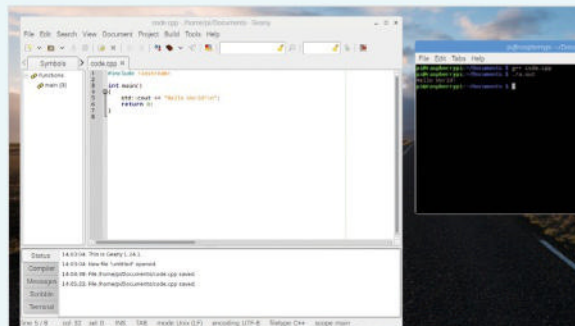
### WINDOWS

As we've mentioned previously, one good IDE is Microsoft's Visual Studio. However, a better IDE and compiler is Code::Blocks, which is kept regularly up to date with a new release twice yearly, or so. Otherwise, Windows users can enter their code in Notepad++ then compile it with MinGW – which Code::Blocks uses.



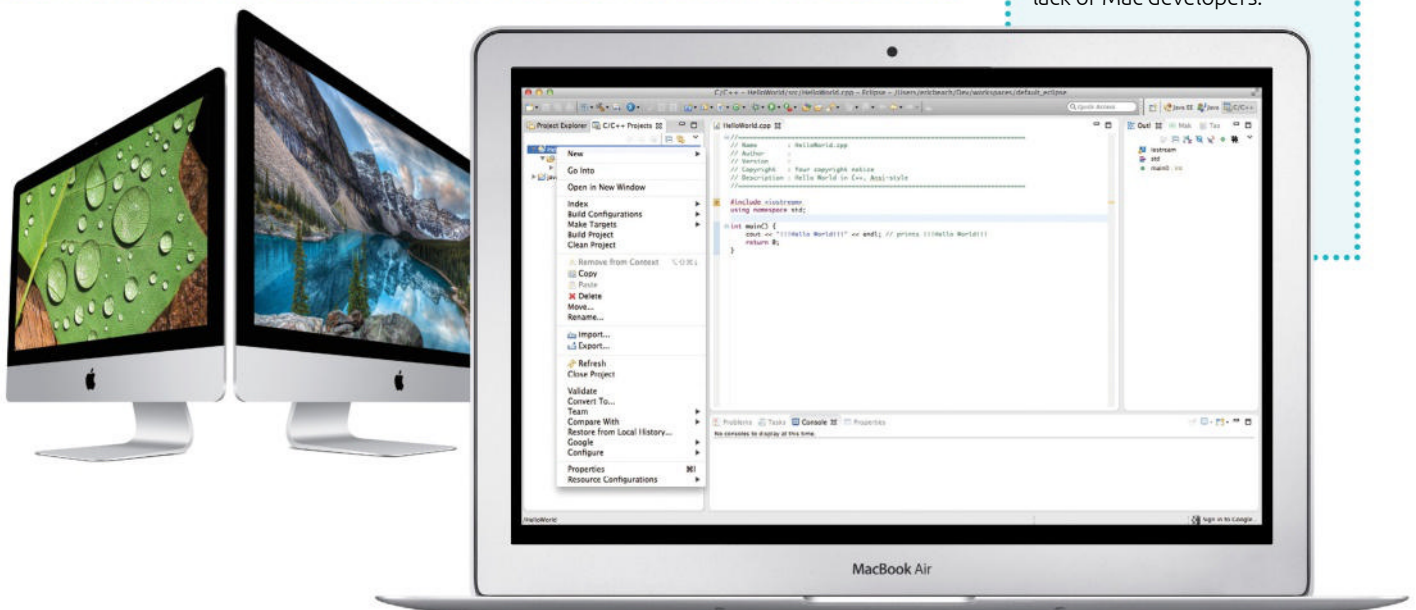
### RASPBERRY PI

The Raspberry Pi's operating system is Raspbian, which is Linux based. Therefore, you're able to write your code out using a text editor and then compile it with g++, as you would in any other Linux distro.



### MAC

Mac owners will need to download and install Xcode, in order to compile their C++ code natively. Other options for the macOS include Netbeans, Eclipse or Code::Blocks. Note: the latest Code::Blocks isn't available for Mac, due to a lack of Mac developers.







# Structure of C++ Code

C++ is an amazing programming language to learn. If your dream is to become a games designer, or work at the cutting edge of science or engineering technology, then being able to code in C++ is a must. Remember, you're never too old to learn how to code.

## #INCLUDE <C++ IS ACE!>

As you learn the basics of programming, you will begin to understand the structure of a program. The commands may be different, but you will start to see how the code works.

### C++

Danish student Bjarne Stroustrup invented C++ in 1979, as a part of his Ph.D. thesis. Initially C++ was called C with Classes, which added features to the already popular C programming language while making it a more user-friendly environment.

**Bjarne Stroustrup, inventor of C++.**



### #INCLUDE

The structure of a C++ program can look complex, but once you get familiar with it you'll begin to see how it flows. Every C++ code begins with a directive, #include <>. The directive instructs the pre-processor to include a section of the standard C++ code. For example: #include <iostream> includes the iostream header to support input/output operations.

```
*newcode.cpp (~/.D)
File Edit View Search Tools Documents Help
#include <iostream>
```

### INT MAIN()

int main() initiates the declaration of a function, which is a group of code statements under the name 'main'. All C++ code begins at the main function, regardless of where it lies within the main body of the code.

```
*newcode.cpp (~/.D)
File Edit View Search Tools Documents Help
#include <iostream>
int main()
```

## BRACES

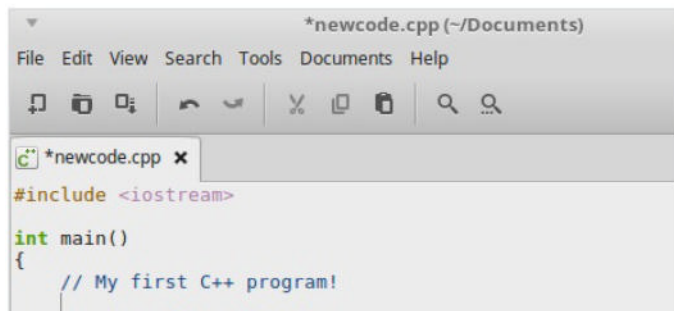
The open brace is something that you may not have come across before, especially if you're used to other coding languages. The open brace indicates the beginning of the main function, and contains all the code belonging to that function.

```
*newcode.cpp (~/.Documents)
File Edit View Search Tools Documents Help
#include <iostream>
int main()
{
```



## COMMENTS

Lines that begin with a double slash are comments. This means they won't be executed in the code and are ignored by the compiler. Why are they there? Comments are designed to help you, or another programmer looking at your code, explain what's going on. There are two types of comment: `/*` covers multiple line comments, `//` a single line.



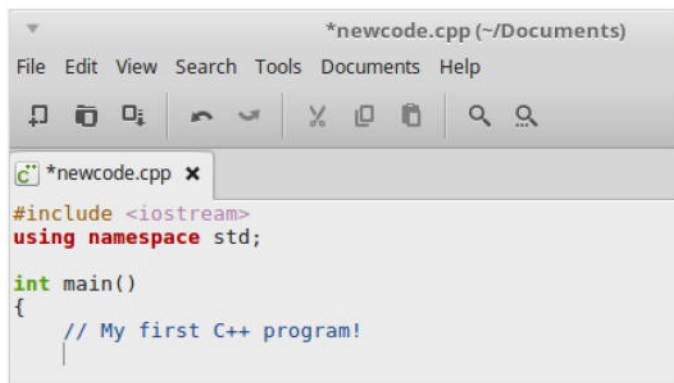
```
*newcode.cpp (~/Documents)
File Edit View Search Tools Documents Help

#include <iostream>

int main()
{
    // My first C++ program!
}
```

## STD

In C++, STD means Standard. It's a part of the Standard Namespace in C++, which covers a number of different statements and commands. You can leave the `std` part out of a code, but it must be declared at the start with: `using namespace std;`



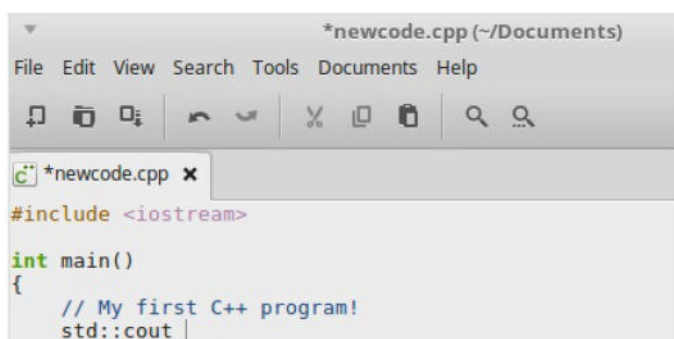
```
*newcode.cpp (~/Documents)
File Edit View Search Tools Documents Help

#include <iostream>
using namespace std;

int main()
{
    // My first C++ program!
}
```

## COUT

In this example we're using `cout`, which is a part of the Standard Namespace – hence why it's there, as you're asking C++ to use it from that particular namespace. `Cout` means Character OUTput, which displays, or prints, something to the screen. If we leave `std::` out we have to declare it at the start of the code; as mentioned previously.



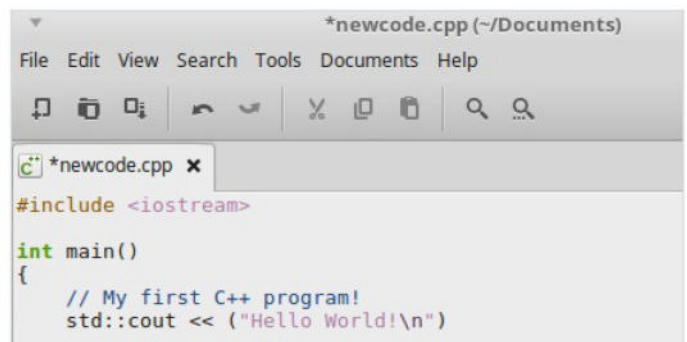
```
*newcode.cpp (~/Documents)
File Edit View Search Tools Documents Help

#include <iostream>

int main()
{
    // My first C++ program!
    std::cout |
}
```

## <<

The two chevrons used here are insertion operators. This means that, whatever follows, the chevrons are to be inserted into the `std::cout` statement. In this case, they are the words 'Hello World', which are to be displayed on the screen when you compile and execute the code.



```
*newcode.cpp (~/Documents)
File Edit View Search Tools Documents Help

#include <iostream>

int main()
{
    // My first C++ program!
    std::cout << ("Hello World!\n")
}
```

## OUTPUTS

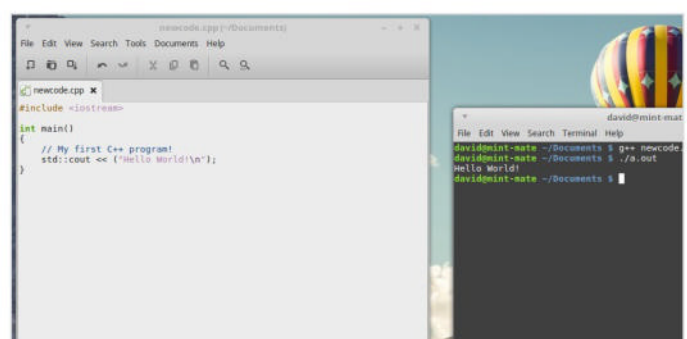
Leading on, ("Hello World!") is the part that we want to appear on the screen when the code is executed. You can enter whatever you like, as long as it's inside the quotation marks. The brackets aren't needed, but some compilers insist on them. The `\n` part indicates a new line is to be inserted.



```
// My first C++ program!
std::cout << ("Hello World!\n")|
```

## ; AND }

Finally you will notice that lines within a function code block (except comments) end with a semicolon. This marks the end of the statement, and all statements in C++ must have one at the end or the compiler will fail to build the code. The very last line has the closing brace to indicate the end of the main function.



```
*newcode.cpp (~/Documents)
File Edit View Search Tools Documents Help

#include <iostream>

int main()
{
    // My first C++ program!
    std::cout << ("Hello World!\n");
}

david@mint-mat: ~/Documents $ g++ newcode.cpp
david@mint-mat: ~/Documents $ ./a.out
Hello World!
```



# DID YOU KNOW?

## Apollo 11

July 20th 1969 is remembered as a turning point in human history, when mankind first stepped on the moon. The software that helped the crew make that pivotal voyage didn't even exist at the time and had to be developed from scratch. Using a new method of storing programs called Rope Memory, the engineers at MIT Instrumentation Laboratory populated the memory with a special version of assembly.

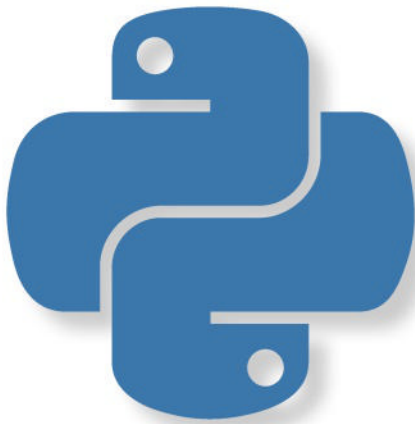
Incredibly, that code is freely available to view on GitHub. Uploaded by a researcher in 2003, you can view the code by visiting [www.github.com/chrislgarry/Apollo-11/](https://www.github.com/chrislgarry/Apollo-11/). Look out for code snippets, such as `Burn_Baby_Burn`, in particular line 925 with the comment "Goodbye. Come again soon."

Have a look through, and see what else you can find.









Python is one of the most respected and used programming languages in the world. It's designed to help beginners get into code, but also has some amazingly powerful features that are utilised by data scientists and engineers around the world.

You don't need to look too far to Python at work. It's used throughout the Internet, and helps drive some of the biggest projects and companies in a multitude of industries.

In this section, we will look at what you will need to get started with Python. The first steps into a new learning experience are always the hardest, but we're here to help.

Why Python?

What Can You Do with Python?

Python in Numbers

Equipment You Will Need

Getting to Know Python





# Introducing Python





# Why Python?

There are many different programming languages available for the modern computer, and some still available for older 8 and 16-bit computers too. Some of these languages are designed for scientific work, others for mobile platforms and such. So why choose Python out of all the rest?

## PYTHON POWER

Ever since the earliest home computers were available, enthusiasts, users and professionals have toiled away until the wee hours, slaving over an overheating heap of circuitry to create something akin to magic.

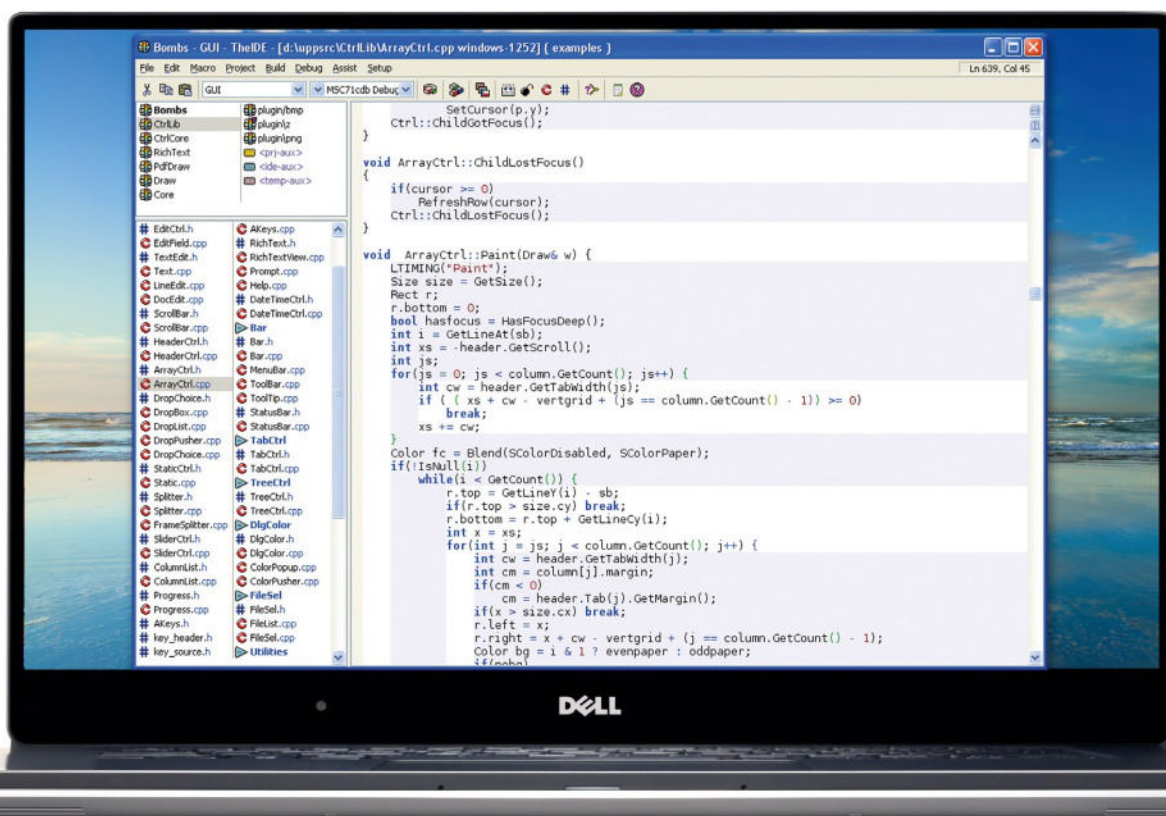
These pioneers of programming carved their way into a new frontier, forging small routines that enabled the letter 'A' to scroll across the screen. It may not sound terribly exciting to a generation that's used to ultra high-definition graphics and open world, multi-player online gaming. However, forty-something years ago it was blindingly brilliant.

Naturally these bedroom coders helped form the foundations for every piece of digital technology we use today. Some went on to become chief developers for top software companies, whereas others pushed the available hardware to its limits and founded the billion pound gaming empire that continually amazes us.

Regardless of whether you use an Android device, iOS device, PC, Mac, Linux, Smart TV, games console, MP3 player, GPS device built-in to a car, set-top box or a thousand other connected and 'smart' appliances, behind them all is programming.

All those aforementioned digital devices need instructions to tell them what to do, and allow them to be interacted with. These instructions form the programming core of the device and that core can be built using a variety of programming languages.

The languages in use today differ depending on the situation, the platform, the device's use and how the device will interact with its







environment or users. Operating systems, such as Windows, macOS and such are usually a combination of C++, C#, assembly and some form of visual-based language. Games generally use C++ whilst web pages can use a plethora of available languages such as HTML, Java, Python and so on.

More general-purpose programming is used to create programs, apps, software or whatever else you want to call them. They're widely used across all hardware platforms and suit virtually every conceivable application. Some operate faster than others and some are easier to learn and use than others. Python is one such general-purpose language.

Python is what's known as a High-Level Language, in that it 'talks' to the hardware and operating system using a variety of arrays, variables, objects, arithmetic, subroutines, loops and countless more interactions. Whilst it's not as streamlined as a Low-Level Language, which can deal directly with memory addresses, call stacks and registers, its benefit is that it's universally accessible and easy to learn.

```
1 //file: Invoke.java
2 import java.lang.reflect.*;
3
4 class Invoke {
5     public static void main( String [] args ) {
6         try {
7             Class c = Class.forName( args[0] );
8             Method m = c.getMethod( args[1], new Class
9                 [] { } );
10            Object ret = m.invoke( null, null );
11            System.out.println(
12                "Invoked static method: " + args[1]
13                + " of class: " + args[0]
14                + " with no args\nResults: " + ret );
15        } catch ( ClassNotFoundException e ) {
16            // Class.forName( ) can't find the class
17        } catch ( NoSuchMethodException e2 ) {
18            // that method doesn't exist
19        } catch ( IllegalAccessException e3 ) {
20            // we don't have permission to invoke that
21            // method
22        } catch ( InvocationTargetException e4 ) {
23            // an exception occurred while invoking that
24            // method
25            System.out.println(
26                "Method threw an: " + e4.
27                getTargetException( ) );
28        }
29    }
30 }
```



Java is a powerful language that's used in web pages, set-top boxes, TVs and even cars.

Python was created over twenty six years ago and has evolved to become an ideal beginner's language for learning how to program a computer. It's perfect for the hobbyist, enthusiast, student, teacher and those who simply need to create their own unique interaction between either themselves or a piece of external hardware and the computer itself.

Python is free to download, install and use and is available for Linux, Windows, macOS, MS-DOS, OS/2, BeOS, IBM i-series machines, and even RISC OS. It has been voted one of the top five programming languages in the world and is continually evolving ahead of the hardware and Internet development curve.

So to answer the question: why Python? Simply put, it's free, easy to learn, exceptionally powerful, universally accepted, effective and a superb learning and educational tool.

```
40 LET PY=15
70 FOR W=1 TO 10
71 CLS
75 LET BY=INT (RND*28)
80 LET BX=0
90 FOR D=1 TO 20
100 PRINT AT PX,PY;" U "
110 PRINT AT BX,BY;" O "
120 IF INKEY$="P" THEN LET PY=PY+1
130 IF INKEY$="O" THEN LET PY=PY-1
140 IF PY<2 THEN LET PY=2
150 IF PY>27 THEN LET PY=27
160 LET BX=BX+1
170 PRINT AT BX-1,BY;" "
180 NEXT D
190 NEXT W
200 IF (BY-1)=PY THEN LET S=S+1
210 PRINT AT 10,10;"score=";S
220 FOR V=1 TO 1000: NEXT V
300 NEXT W

0 OK, 0:1
```



BASIC was once the starter language that early 8-bit home computer users learned.

```
print(HANGMAN[0])
attempts = len(HANGMAN) - 1

while (attempts != 0 and "-" in word_guessed):
    print("\nYou have {} attempts remaining".format(attempts))
    joined_word = "".join(word_guessed)
    print(joined_word)

    try:
        player_guess = str(input("\nPlease select a letter between A-Z + "\n> ")).
    except: # check valid input
        print("That is not valid input. Please try again.")
        continue

    else:
        if not player_guess.isalpha(): # check the input is a letter. Also checks a
            print("That is not a letter. Please try again.")
            continue
        elif len(player_guess) > 1: # check the input is only one letter
            print("That is more than one letter. Please try again.")
            continue
        elif player_guess in guessed_letters: # check if letter hasn't been guessed
            print("You have already guessed that letter. Please try again.")
            continue
        else:
            pass

        guessed_letters.append(player_guess)

    for letter in range(len(chosen_word)):
        if player_guess == chosen_word[letter]:
            word_guessed[letter] = player_guess # replace all letters in the chosen
            if player_guess not in chosen_word:
```



Python is a more modern take on BASIC, it's easy to learn and makes for an ideal beginner's programming language.





# What Can You Do with Python?

Python is an open-source, object-oriented programming language that's simple to understand and write with, yet also powerful and extremely malleable. It's these characteristics that help make it such an important language to learn.

Python's ability to create highly readable code, within a small set of instructions, has a considerable impact on our modern digital world. From being an ideal first programmers' choice through to being able to create interactive stories and games; from scientific applications through to artificial Intelligence and web-based applications, the only limit to Python is the imagination of the person coding in it.

It's Python's malleable design that makes it an ideal language for many different situations and roles. Even certain aspects of the coding world that require more efficient code still use Python. For example, NASA utilises Python both as a stand-alone language and as a bridge between other programming languages. This way, NASA scientists and engineers are able to get to the data they need without having to cross multiple language barriers; Python fills the gaps and provides the means to get the job done.

You'll find lots of examples of this, where Python is acting behind the scenes. This is why it's such an important language to learn.



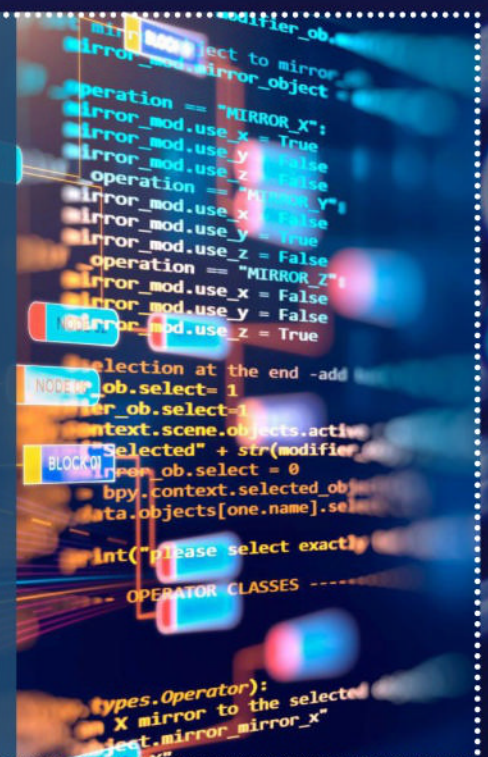
Beautiful is better than ugly.  
Explicit is better than implicit.  
Simple is better than complex.  
Complex is better than complicated.  
Flat is better than nested.  
Sparse is better than dense.  
Readability counts.  
Special cases aren't special enough to break the rules.  
Although practicality beats purity.  
Errors should never pass silently.  
Unless explicitly silenced.  
In the face of ambiguity, refuse the temptation to guess.  
There should be one-- and preferably only one --obvious way to do it.  
Although that way may not be obvious at first unless you're Dutch.  
Now is better than never.  
Although never is often better than \*right\* now.  
If the implementation is hard to explain, it's a bad idea.  
If the implementation is easy to explain, it may be a good idea.  
Namespaces are one honking great idea -- let's do more of those!

## BIG DATA

Big data is a buzzword you're likely to have come across in the last couple of years. Basically, it means extremely large data sets that are available for analysis to reveal patterns, trends and interactions between humans, society and technology. Of course, it's not just limited to those areas, big data is currently being used in a variety of industries, from social media to health and welfare, engineering to space exploration and beyond.

Python plays a substantial role in the world of big data. It's extensively used to analyse huge chunks of the available big data and extract specific information based on what the user/company requires from the wealth of numbers present. Thanks to an impressive set of data processing libraries, Python makes the act of getting to the data, in amongst the numbers, that counts and presenting it in a fashion that's readable and useable for humans.

There are countless libraries and freely available modules that enable fast, secure and more importantly, accurate processing of data from the likes of supercomputing clusters. For example, CERN uses a custom Python module to help analyse the 600 million collisions per second that the Large Hadron Collider (LHC) produces. A different language handles the raw data, but Python is present to help sift through the data so scientists can get to the content they want without the need to learn a far more complex programming language.





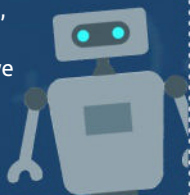
## ARTIFICIAL INTELLIGENCE

Artificial Intelligence and Machine Learning are two of the most groundbreaking aspects of modern computing. AI is the umbrella term used for any computing process wherein the machine is doing something intelligent, working and reacting in similar ways to humans. Machine Learning is a subset of AI and provides the overall AI system with the ability to learn from its experiences.

However, AI isn't simply the creation of autonomous robots intent on wiping out human civilisation. Indeed, AI can be found in a variety of day-to-day computing applications where the 'machine', or more accurately the code, needs to learn from the actions of some form of input and anticipate what the input is likely to require, or do, next.

This model can be applied to Facebook, Google, Twitter, Instagram and so on. Have you ever looked up a celebrity on Instagram and then discovered that your searches within other social media platforms are now specifically targeted toward similar celebrities? This is a prime example of using AI in targeted advertising and behind the code and algorithms that predict what you're looking for, is Python.

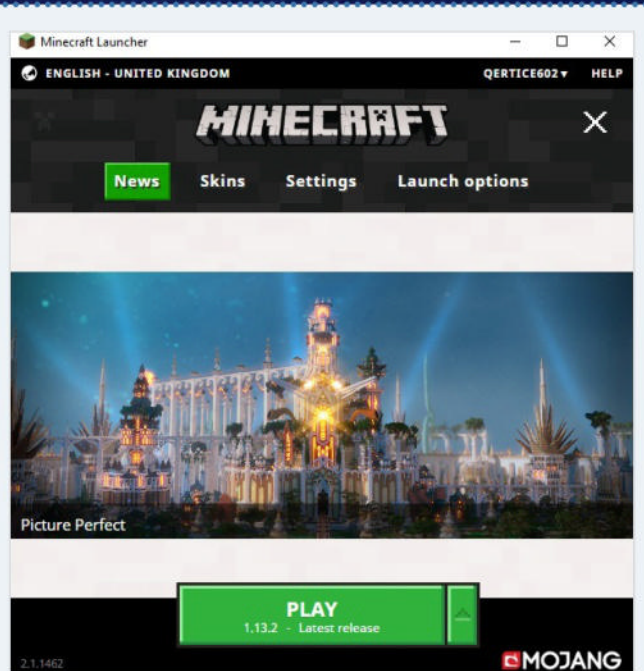
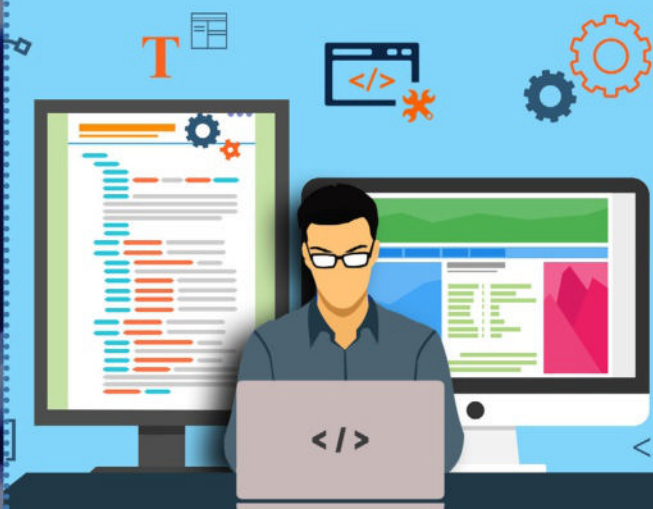
Spotify, for example, uses Python based code, among other things, to analyse your musical habits and offer playlists based on what you've listened to in the past. It's all clever stuff and moving forward, Python is at the forefront of the way the Internet will work in the future.



## WEB DEVELOPMENT

Web development has moved on considerably since the early days of HTML scripting in a limited text editor. The many frameworks and web management services available now means that building a page has become increasingly complex.

With Python, the web developer has the ability to create dynamic and highly secure web apps, enabling interaction with other web services and apps such as Instagram and Pinterest. Python also allows the collection of data from other websites and even apps built within other websites.



## GAMING

Although you won't find too many triple-A rated games coded using Python, you may be surprised to learn that Python is used as an extra on many of the high-ranking modern games.

The main use of Python in gaming comes in the form of scripting, where a Python script can add customisations to the core game engine. Many map editors are Python compatible and you will also come across it if you build any mods for games, such as The Sims.

A lot of the online, MMORPG (Massively Multiplayer Online Role-Playing Game) games available utilise Python as a companion language for the server-side elements. These include: code to search for potential cheating, load balancing across the game's servers, player skill matchmaking and to check whether the player's client-side game matches the server's versions. There's also a Python module that can be included in a Minecraft server, enabling the server admin to add blocks, send messages and automate a lot of the background complexities of the game.

## PYTHON EVERYWHERE

As you can see, Python is quite a versatile programming language. By learning Python, you are creating a well-rounded skillset that's able to take you into the next generation of computing, either professionally or simply as a hobbyist.

Whatever route you decide to take on your coding journey, you will do well to have Python in your corner.







# PYTHON IN NUMBERS

There's a lot to like about Python, but don't just take our word for it. Here are some amazing facts and figures surrounding one of the most popular programming languages of recent years.

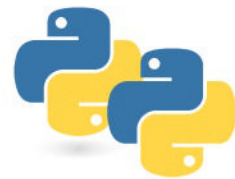
Python creator Guido Van Rossum named Python after reading scripts from Monty Python's Flying Circus.



Alexa, Amazon's Virtual Personal Assistant, uses Python to help with speech recognition.



.....  
**PYTHON AND  
LINUX SKILLS  
ARE THE THIRD  
MOST POPULAR  
I.T. SKILLS IN  
THE UK.**



Data analysis and Machine Learning are the two most used Python examples.



As of the end of 2018, Python was the most discussed language on the Internet.



Disney Pixar uses Python in its Renderman software to operate between other graphics packages.

75%

OVER 75% OF RECOMMENDED CONTENT FROM NETFLIX IS GENERATED FROM MACHINE LEARNING – CODED BY PYTHON.

90%

90% OF ALL FACEBOOK POSTS ARE FILTERED THROUGH PYTHON-CODED MACHINE LEARNING.

75%

IT'S ESTIMATED THAT OVER 75% OF NASA'S WORKFLOW AUTOMATION SYSTEMS ON BOARD THE I.S.S. USE PYTHON.



# 16,000



There are over 16,000 Python jobs posted every six months in the UK.

PYTHON SKILL-BASED POSITIONS ARE THE

# 16<sup>th</sup>

MOST SOUGHT-AFTER JOBS IN THE UK.



Python Data Science is thought to become the most sought-after job in the coming years.



Google is the top company for hiring Python developers, closely followed by Microsoft.



Data Science, Blockchain and Machine Learning are the fastest growing Python coding skills.



New York and San Francisco are the top Python developer cities in the world.



Python developers enjoy an average salary of

# £60,000

## 95%

95% OF ALL BEGINNER CODERS START WITH AND STILL USE, PYTHON AS THEIR PRIMARY OR SECONDARY LANGUAGE.

## 75%

75% OF ALL PYTHON DEVELOPERS USE PYTHON 3, WHEREAS 25% STILL USE THE OUTDATED PYTHON 2 VERSION.

## 79%

79% OF ALL PROGRAMMERS USE PYTHON REGULARLY, 21% USE IT AS A SECONDARY LANGUAGE.

## 49%

49% OF WINDOWS 10 DEVELOPERS USE PYTHON 3 AS THEIR MAIN PROGRAMMING LANGUAGE.



# Equipment You Will Need

You can learn Python with very little hardware or initial financial investment. You don't need an incredibly powerful computer and any software that's required is freely available.

## WHAT WE'RE USING

Thankfully, Python is a multi-platform programming language available for Windows, macOS, Linux, Raspberry Pi and more. If you have one of those systems, then you can easily start using Python.



### ☐ COMPUTER

Obviously you're going to need a computer in order to learn how to program in Python and to test your code. You can use Windows (from XP onward) on either a 32 or 64-bit processor, an Apple Mac or Linux installed PC.

### ☐ AN IDE

An IDE (Integrated Developer Environment) is used to enter and execute Python code. It enables you to inspect your program code and the values within the code, as well as offering advanced features. There are many different IDEs available, so find the one that works for you and gives the best results.

### ☐ PYTHON SOFTWARE

macOS and Linux already come with Python preinstalled as part of the operating system, as does the Raspberry Pi. However, you need to ensure that you're running the latest version of Python. Windows users need to download and install Python, which we'll cover shortly.

### ☐ TEXT EDITOR

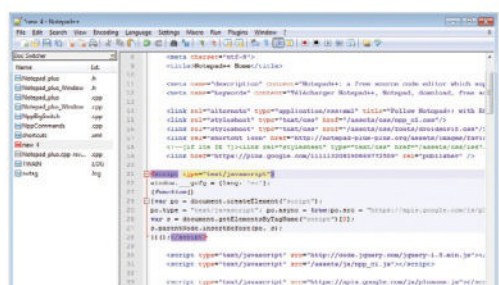
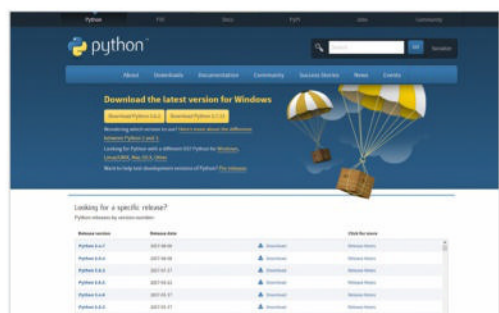
Whilst a text editor is an ideal environment to enter code into, it's not an absolute necessity. You can enter and execute code directly from the IDLE but a text editor, such as Sublime Text or Notepad++, offers more advanced features and colour coding when entering code.

### ☐ INTERNET ACCESS

Python is an ever evolving environment and as such new versions often introduce new concepts or change existing commands and code structure to make it a more efficient language. Having access to the Internet will keep you up-to-date, help you out when you get stuck and give access to Python's immense number of modules.

### ☐ TIME AND PATIENCE

Despite what other books may lead you to believe, you won't become a programmer in 24-hours. Learning to code in Python takes time, and patience. You may become stuck at times and other times the code will flow like water. Understand you're learning something entirely new, and you will get there.



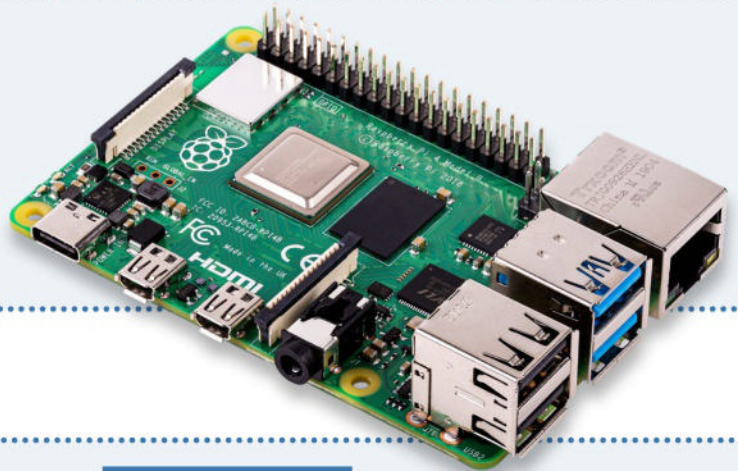


## THE RASPBERRY PI

Why use a Raspberry Pi? The Raspberry Pi is a tiny computer that's very cheap to purchase, but offers the user a fantastic learning platform. Its main operating system, Raspbian, comes preinstalled with the latest Python along with many modules and extras.

### RASPBERRY PI

The Raspberry Pi 4 Model B is the latest version, incorporating a more powerful CPU, a choice of 1GB, 2GB or 4GB memory versions and Wi-Fi and Bluetooth support. You can pick up a Pi from around £34, increasing up to £54 for the 4GB memory version, or as a part of kit for £50+, depending on the kit you're interested in.



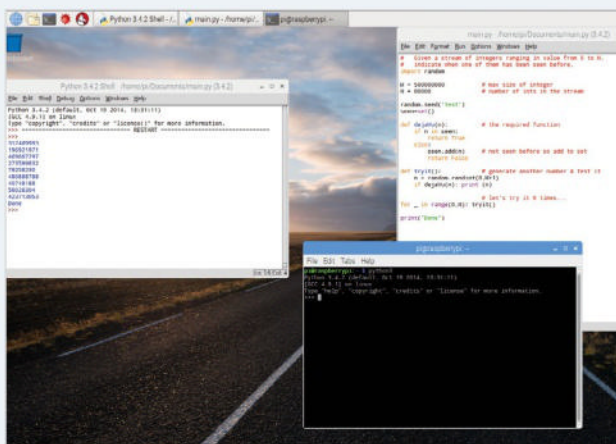
### FUZE PROJECT

The FUZE is a learning environment built on the latest model of the Raspberry Pi. You can purchase the workstations that come with an electronics kit and even a robot arm for you to build and program. You can find more information on the FUZE at [www.fuze.co.uk](http://www.fuze.co.uk).



### RASPBIAN

The Raspberry Pi's main operating system is a Debian-based Linux distribution that comes with everything you need in a simple to use package. It's streamlined for the Pi and is an ideal platform for hardware and software projects, Python programming and even as a desktop computer.



### BOOKS

We have several great Raspberry Pi titles available via [www.bdmpublications.com](http://www.bdmpublications.com). Our Pi books cover how to buy your first Raspberry Pi, set it up and use it; there are some great step-by-step project examples and guides to get the most from the Raspberry Pi too.





# Getting to Know Python

Python is one of the most used and popular programming languages. It's a great language on which to learn how to code, but it's also powerful enough to be used by companies when trawling through petabytes of raw data.

## PYTHON POWER

Python is a high-level, general-purpose programming language that was designed by Guido van Rossum in the late '80s, as a successor to the ABC Programming Language, and became available to use in 1990.



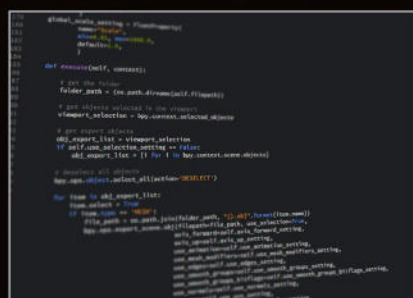
Guido van Rossum, the designer of Python.

The Python Software Foundation, a non-profit organisation devoted to both furthering and improving Python, currently develops the language. The foundation's purpose is to "promote, protect, and advance the Python programming language, and to support and facilitate the growth of a diverse and international community of Python programmers."

The structure of Python code has been designed to flow easily, allowing those who are just beginning to code to follow it without too much difficulty. Yet, despite its ease of use, Python is regularly used throughout a number of industries in real-world scenarios.

Big Data and AI are the two fastest growing Python-backed technologies at the moment. Big Data is simply a modern term

used to describe huge amounts of data, such as sequences of numbers collated during a day's worth of trading on the Stock Exchange. Python code is used to dig into the voluminous collection of numbers, and then feed back with reports on the highs and lows, what's trending, and so on.



Python code is both elegant and easy to read (when you know how).



Made up from over 5 Petabytes of data, spread across a ton of hard drives, Python helped science to unveil the first image of a black hole.

As a side note, it's not just the likes of the Stock Exchange that use Python to study large quantities of data; in April 2019 the first image of a black hole was released, the supermassive black hole in the galaxy called M87, located roughly 55 million light years away. Thanks to the collaboration of over 200 scientists, using an array of telescopes spanning the world (called the Event Horizon Telescope Project), the combined power of the telescopes formed an impressive five petabytes of data, spread across tens of hard drives weighing in at nearly one ton. Five petabytes, by the way, equates to around 5,000 years' worth of MP3 files. Once all those hard drives were gathered together and shipped to a central supercomputer cluster, the team then used Python to painstakingly stitch together all the fragments of data from the five petabytes to finally form the most talked about astronomic event of the decade.

AI, if you're not familiar with the term, stands for Artificial Intelligence. Although we're still a long way off from the visionary stories of Arthur C. Clarke, AI is fast becoming one of the most influential technologies of our modern age. Rather than controlling robots, the AI that Python drives is designed to create autonomous ways of interacting with people online. For example, when you search for something on the Amazon website you will usually notice that similar products start to appear, whether within Amazon itself,



## PYTHON 3 VS PYTHON 2

In a typical computing scenario, Python is complicated somewhat by the existence of two active versions of the language: Python 2 and Python 3.



**Python 3 is the best option to download, or update to.**

Python 3 is the newest release of the programming language. However, if you dig a little deeper into the Python site and investigate Python code online, you will undoubtedly come across Python 2. Crucially, although you can run Python 3 and Python 2 alongside each other, it's not recommended. Always opt for the latest stable release, as posted by the Python website. You will find, when using macOS or Linux, that Python 2 is already installed. This is because both these operating systems utilise elements of code necessary to the core functionality of the OS. Linux users tend to be better off, as most distributions package the latest version of Python 3 out-of-the-box, whereas macOS often has Python 3, it's usually an older version. Microsoft doesn't use any Python code for its core Windows systems, which is why you won't find Python inherent to Windows and therefore need to install it from scratch.

You need to be careful when you look up Python code online, although there are countless websites that offer quick tutorials, code snippets and support – and 99% of these sites are a great help to those starting out with Python – a lot of the sites haven't been updated for some time, and as such use Python 2. If you enter Python 2 code into the Python 3 IDLE, the chances are it won't work due to incompatibilities between the older version and the newer. Python 2 is good, but Python 3 is better. You can obviously spend time converting the Python 2 code into version 3, but, to begin with, it's best to make sure that the code you're looking at is for the Python 3 libraries. Don't worry, though, all the code in this book is designed for Python 3, and that includes all the sub versions from Python 3.1 to the latest 3.x.

Python 3's growing popularity has meant that it's now prudent to start learning to develop with the new features and begin to phase out the previous version. Many development companies, such as SpaceX and NASA, use Python 3 for snippets of important code.

However, support for Python 2 is set to end on January 1st 2020, but this doesn't mean it'll be the last you see of it. Many Linux distros use Python 2 libraries, as does macOS, and to be fair, for the developers to transfer the existing Python 2 content to Python 3 may take more time than they have available, i.e. before the start of 2020. It's likely then, that we will still be seeing Python 2 long after it has had the final nail hammered into its coffin – in fact, expect to see that cut-off date extend further into the future.

or from a search engine, or even Facebook. The code behind these targeted snippets is Python, and it's using a form of AI to help determine what it is you would likely search for.

Despite the fact that many people find the targeting of advertising intrusive, or even an invasion of privacy, you have to admit that the code technology behind it all is rather impressive. With some very clever techniques, a Python developer is able to create a machine thinking script that not only displays items, news stories, books, other websites and ideas relating to what you've searched for, but it can also predict what you may be interested in looking for in the future. Another element to consider, with regards to AI, is that Python code can be used to help a computer learn how to do something more efficiently. In the case of neural networks in AI, the Python code is designed to return a result, then, as the code is run over and over again, the AI portion will begin to learn how to obtain a more accurate result, or do the maths behind the code quicker. It all depends on what the developer wants from their AI Python code.

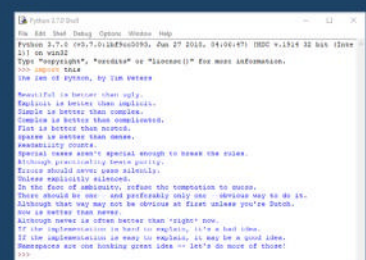


**An example of Python AI code, using a feedforward neural network.**

```
import random
import numpy as np
class Network(object):
    def __init__(self, sizes):
        self.num_layers = len(sizes)
        self.sizes = sizes
        self.biases = [np.random.randn(y, 1) for y in sizes[1:]]
        self.weights = [np.random.randn(y, x)
                        for x, y in zip(sizes[:-1], sizes[1:])]
    def feedforward(self, a):
        for b, w in zip(self.biases, self.weights):
            a = sigmoid(np.dot(w, a)+b)
        return a
    def SGD(self, training_data, epochs, mini_batch_size, eta,
            test_data=None):
```

## ZEN OF PYTHON

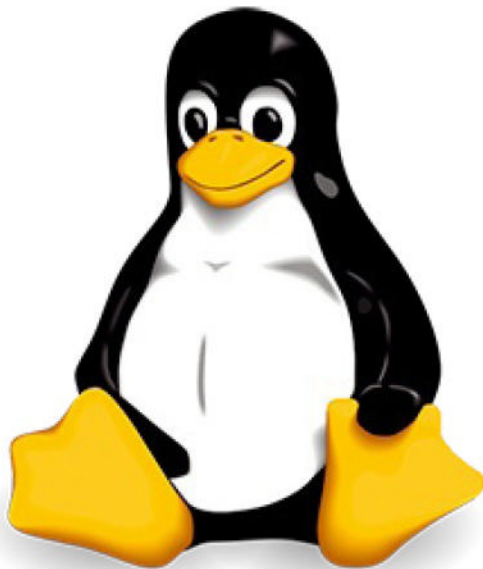
Python lets you access all the power of a computer in a language that humans can understand. Behind all this is an ethos called "The Zen of Python". This is a collection of 20 software principles that influences the design of the language. Principles include "Beautiful is better than ugly" and "Simple is better than complex." Type: `import this` into Python and it will display all the principles.



**The Zen of Python, as seen when entering: `import this`, into the Python IDLE.**

As you will discover over the coming pages, Python is a fantastic language to learn. Get to grips with the basics, and before long, you'll be creating your own Python code for games, tools, and maybe even something in AI. The only limit with Python is your own imagination.





Linux is such a versatile operating system that's both malleable and powerful, while offering the programmer a perfect foundation on which to build their skills. While all the popular and mainstream programming languages are available on Linux, as they are on Windows and macOS, Linux also utilises its own coding language, called scripting.

In this section we'll cover the basics, from which distribution to go with, to installing Linux on your computer.

Why Linux?

The Best Linux Distributions

Equipment You Will Need

Creating a Linux Installer on Windows

Installing Linux on a PC





# Coding on Linux







# Why Linux?

For many of its users, Linux means freedom. Freedom from the walled-gardened approach of other operating systems, freedom to change and use the OS as you please and freedom from any form of licensing or payment. There's a lot more to Linux than you may think.

## FREE AND OPEN

Linux is a fantastic fit for those who want something different; the efficiency of the system, the availability of applications and its stability, are just a few reasons why.

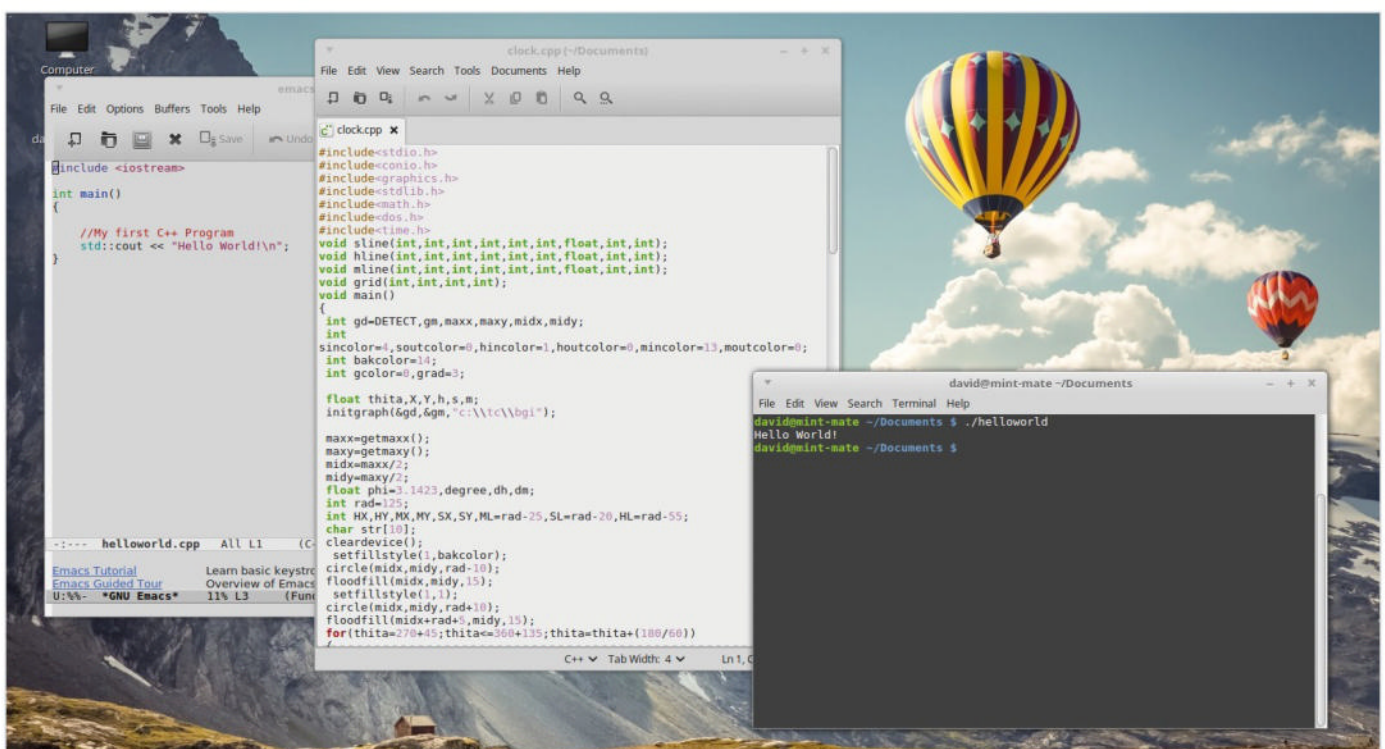
The first thing we need to address is that there is no basic operating system called Linux. Fundamentally, Linux is the operating system kernel, the core component of an OS. When talking about Linux we are, in fact, referring to one of the many distributions, or distros, that use the Linux kernel. No doubt you've heard of at least one of the current popular distros: Ubuntu, Linux Mint, Fedora, openSUSE, Debian, Raspbian... the list goes on. Each one of these distros offers the user something a little different. While each has the Linux kernel at its core, they offer a different looking desktop environment, different pre-loaded applications, different ways in which to update the system and get more apps installed and a slightly different look and feel throughout the entire system. However, at the centre lies Linux, which is why we say, Linux.

Linux works very differently to Windows or macOS. For a start, it's free to download, free to install on as many computers as you like, free to use for an unlimited amount of time and free to upgrade and extend with equally free programs and applications. This free to use element is one of the biggest draws for the developer. While a Windows license can cost up to £100 and a Mac considerably more, a user, be they a developer, gamer, or someone who wants to put an older computer to use, can quickly download a distro and get to work in a matter of minutes.

Alongside the free to use aspect comes a level of freedom to customise and mould the system to your own uses. Each of the distros available on the Internet have a certain 'spin', some offer increased security, a fancy-



**Linux is a great operating system in which to start coding.**

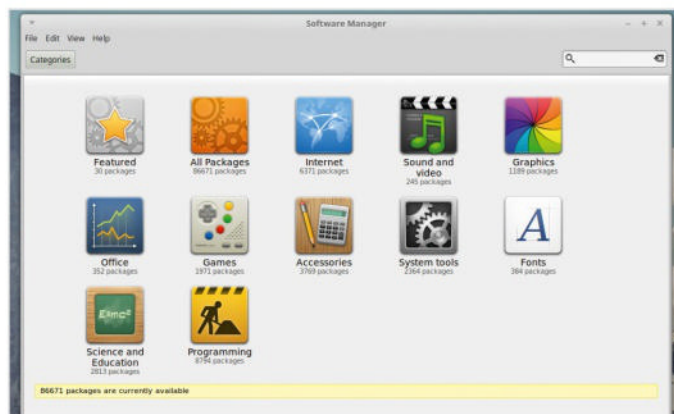




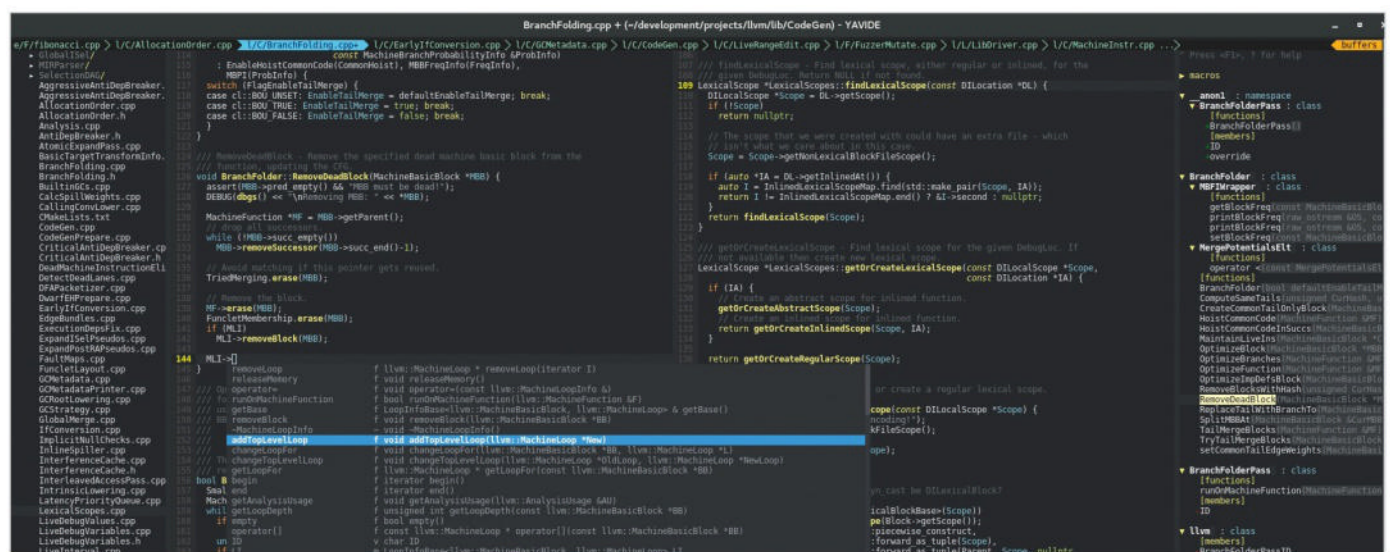
looking desktop, a gaming specific spin, or something directed toward students. This extensibility makes Linux a more desirable platform to use, as you can quickly mould the system into a development base, including many different kinds of IDEs for use with Python, web development, C++, Java and so on, or even a base for online anonymity, perhaps as a Minecraft server, media centre and much more.

Another remarkable advantage for those looking to learn how to code is that Linux comes with most of the popular coding environments built-in. Both Python and C++ are pre-installed in a high percentage of Linux distros, which means you can start to program almost as soon as you install the system and boot it up for the first time.

Generally speaking, Linux doesn't take up as many system resources as Windows or macOS, (by system resources, we mean memory, hard drive space and CPU load), as the Linux code has been streamlined and is free from third-party 'bloatware', which hogs those systems resources. A more efficient system, means more available resources for the coding and testing environment and the programs you will eventually create. Less resource use also means you can use Linux on older hardware that would normally struggle, or even refuse to run, the latest versions of Windows or macOS.



**There are thousands of free packages available for programmers under Linux.**



**A Linux programming environment can be as simple or as complex as you need it to be.**



**Each distro offers something unique to the user but all have Linux at the core.**

So rather than throwing away an old computer, it can be reused with a Linux distro.

However, it's not all about C++, Python, or any of the other more popular programming languages. Using the command line of Linux (also called the Terminal), you're able to create Shell scripts, which are programs made up of scripting languages and designed to run from the command line. They are used mainly to automate tasks, or offer the user some form of input and output for a certain operation.

There are many more advantages we could list, for example, there are thousands and thousands of free programs and apps available that cover practically every aspect of computing. Known as packages, there are (at the time of writing) over 8,700 specific programming applications on Linux Mint alone and an incredible 62,000+ overall packages, catering from Amateur Radio to WWW tools.

In conclusion, Linux is a great resource and environment in which to program. It's perfectly suited for developers, while continually improving and evolving. If you're serious about getting into coding, or you just want to explore something new, then give Linux a try and see how it works for you.



# The Best Linux Distributions

There are numerous versions of Linux available, known as “Distributions”. Each has a different ethos and approach. Here are five great distributions to try and where you can get them.

## LINUX MINT – LINUXMINT.COM

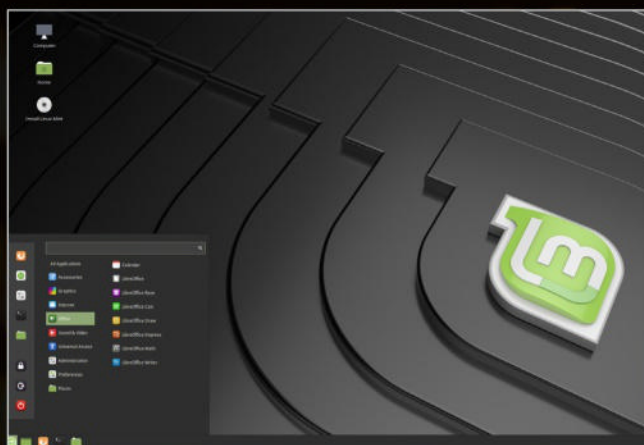
By far the most popular Linux distro (distribution) is Linux Mint. Mint began life back in 2006, as an alternative to the then, most popular distro, Ubuntu. Although based on Ubuntu’s Long Term Support build, Linux Mint took a different direction to offer the user a better overall experience.

Linux Mint has three main desktop versions available with each new version of the core OS it releases. This may sound confusing at first, but it’s quite simple. Currently, Linux Mint uses the Cinnamon Desktop Environment as its flagship model, although MATE and Xfce models are also available.

Cinnamon is a graphically rich desktop environment, while MATE uses less fancy graphics but is more stable on a wider variety of desktop systems and finally Xfce is an extremely streamlined desktop environment that is built for speed and ultimate stability.

Throughout this title, we’ll be using the Cinnamon version, however, you can try out any of the other desktop environments.

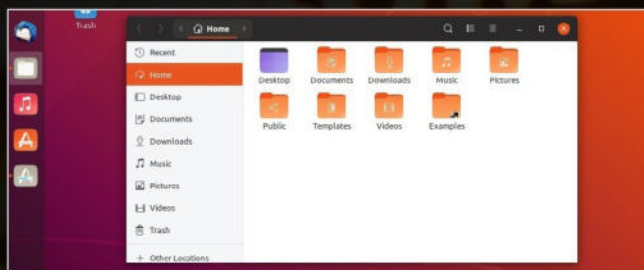
In fact, it’s recommended that you spend at least some time trying different environments and even different distros, to see which suits you and your computer best.



## UBUNTU – UBUNTU.COM

The second most popular distro available is Ubuntu: an ancient African word meaning ‘humanity to others’. Ubuntu’s popularity has fluctuated over its fourteen-year life. At one time, it was easily the most used, Linux-based operating system in the world, sadly, some wrong choices along the way with regards to its presentation, along with some unfavourable and controversial elements involving privacy, saw it topple from the number one spot.

That said; Ubuntu has since made amends and is slowing crawling its way back up the Linux leader board. The latest versions of the OS use the GNOME 3 desktop environment, it’s impressive although it can be a little confusing for former Windows users



and it’s a little heavy on system resources (especially if you plan to install it on an older computer).

Ubuntu, for all its faults, is a good Linux distro to start experimenting with. It’s a clean interface, easy to use and install and offers the user the complete Linux experience.



## ARCH – ARCHLINUX.ORG

Arch is one of the longest running Linux distributions and forms the basis of many other versions of Linux. So why install Mint, or Ubuntu when you can install Arch? Many users do exactly that, but it's not ideal for beginners. Ubuntu and Mint both offer an easier installation path and come with software packages that will help you get started.

Arch, on the other hand, is a more 'bare bones' affair. It is committed to free software and its repositories contain over 50,000 apps to install. You can also install multiple Desktop environments and use them as you would with any other distro.

Arch is a distro for when you're more experienced with Linux. You start with nothing more than the command line and from there: you manually partition your hard drive, set where the installation files will go, create a user, set the OS locale and install a desktop environment, along with the apps you want.

The advantage, for all this hard work, is a distro that you've created. This means your Arch distro won't come with all the unnecessary files and apps that other distros have pre-installed; it's custom made for you, by you.



## OPENSUSE – OPENSUSE.ORG

Most Linux distributions fall into two camps: those with the latest features and technology like Ubuntu and Mint and those with fewer new features, but rock-solid reliability, like Debian.

Meanwhile, openSUSE attempts to cover both bases. OpenSUSE Leap is a rock-solid system. It's developed openly by a community, along with SUSE employees. They develop an enterprise-level operating system: SUSE, which powers the London Stock Exchange, amongst other things. It is designed for mission critical environments where 'there is no scope for instability'. If you find all that too sensible, openSUSE Tumbleweed is a rolling release with all the latest features and the occasional crash.

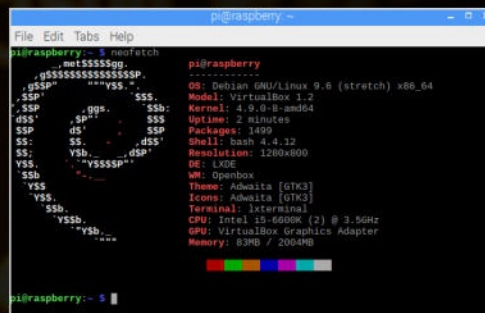
openSUSE is a highly respected Linux distribution and many of its core contributors work on the Linux Kernel, LibreOffice, Gnome and other key Linux areas. In short: openSUSE is where you'll find the pros hanging out.



## RASPBERRY PI DESKTOP – RASPBERRYPI.ORG/DOWNLOADS/RASPBERRY-PI-DESKTOP

No doubt you've heard of the Raspberry Pi? It's hard not to have, as this remarkable, tiny computer has taken the technology world by storm since it was introduced six years ago.

There are several aspects to the Raspberry Pi that make it such a sought-after piece of the computing world. For one, it's cheap, costing around £25 for, what is essentially, a fully working computer. It's small, measuring not much bigger than a credit card. You can employ it to build electronics, using a fully programmable interface and it comes with Raspbian, its own custom-made, Debian-based operating system that includes an office suite alongside many



different programming languages and educational resources.

Originally, Raspbian was exclusive to the Pi hardware, as the Raspberry Pi uses an ARM processor to power it. However, the Raspberry Pi Foundation has since released a PC version of Raspbian: Raspberry Pi Desktop.

As with the Pi version, Raspberry Pi Desktop comes with all the coding, educational and other apps you will ever need. It's quick, stable and works superbly. If you're interested in stretching your Linux experience, then this is definitely one of the top distros to consider.





# Equipment You Will Need

The system requirements for successfully installing Linux Mint on to a PC are surprisingly low, so even a computer that's several years old will happily run this distro. However, it's worth checking you have everything in place before proceeding.

## MINTY INGREDIENTS

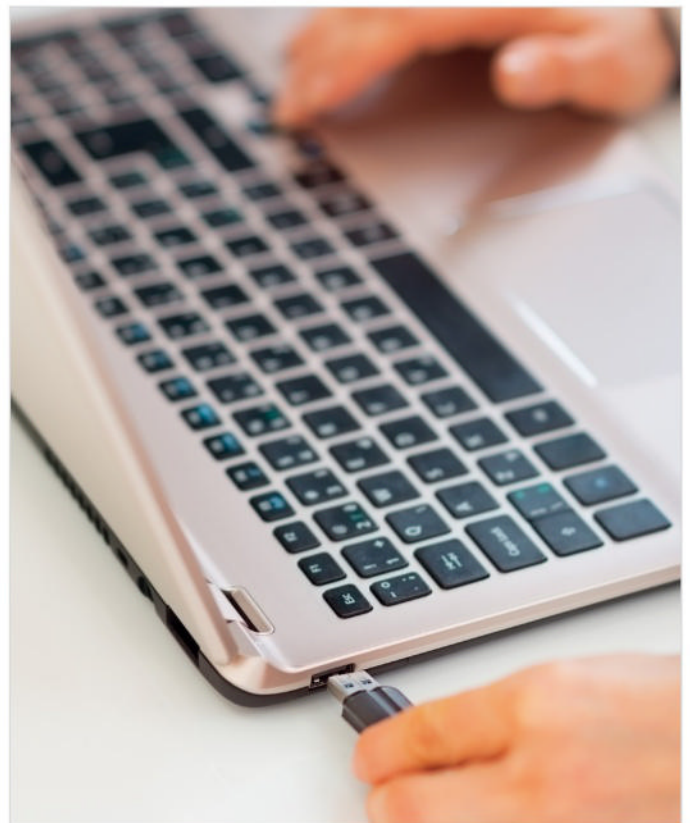
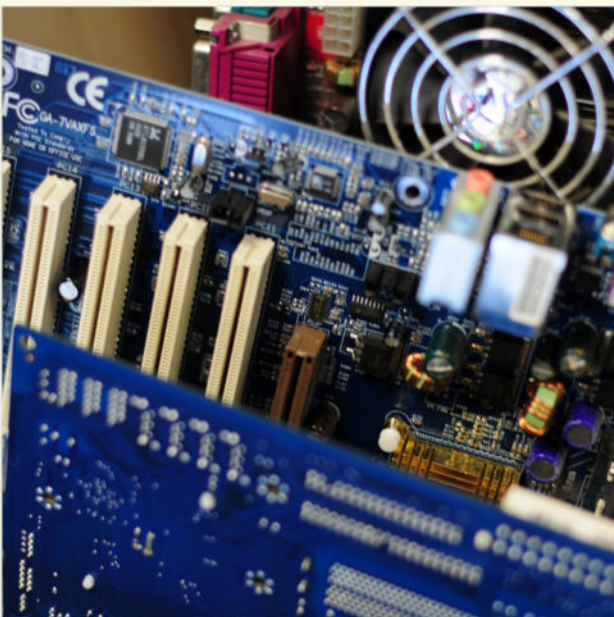
Here's what you'll need to install and run Linux Mint as we work through this book. You have several choices available, so take your time and see which works best for you.

### SYSTEM REQUIREMENTS

The minimum system requirements for Linux Mint are as follows:

<b>CPU</b>	700MHz
<b>RAM</b>	512MB
<b>Hard Drive Space</b>	9GB (20GB recommended)
<b>Monitor</b>	1024 x 768 resolution

Obviously the better the system you have, the better and quicker the experience will be.



### USB INSTALLATION

You can install Linux Mint onto your computer via USB or DVD. We'll look into each a little later on, but if you're already familiar with the process (or you're thinking of USB and just gathering the hardware you'll need), then you're going to need a minimum 4GB USB flash drive/stick to contain the Linux Mint ISO.



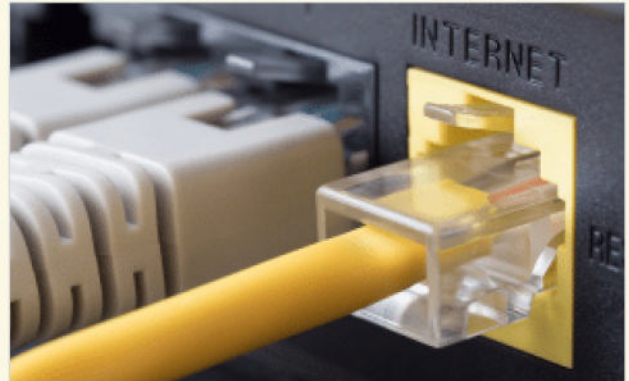
## DVD INSTALLATION

DVD installation of Linux Mint simply requires a blank DVD-R disc. Of course, you'll also need an optical drive (a DVD Writer drive) before you're able to transfer, or burn, the ISO image to the disc.



## INTERNET CONNECTION

It goes without saying, that an Internet connection is vital for making sure that Linux Mint is resourced with the latest updates and patches, as well as the installation of further software. Although you don't need an Internet connection to use Linux Mint, you'll miss out on a world of free software available for the distro.



## MAC HARDWARE

Although Linux Mint can be installed onto a Mac, there's a school of thought that recommends Mac owners use a virtual environment, such as VirtualBox or Parallels; and why not, macOS is already a splendid operating system. If you're looking to breathe new life into an older Mac, make sure it's an Intel CPU model and not the Power-PC models. However, be aware, it's not as pain-free as installing on to a PC.



## VIRTUAL ENVIRONMENT

Installation to a virtual environment is a favourite method of testing and using Linux distros. Linux Mint works exceedingly well when used in a virtual environment, more on that later. There are many different virtual environment apps available, however VirtualBox, from Oracle, is one of the easiest. You can get the latest version from [www.virtualbox.org](http://www.virtualbox.org).



# VirtualBox





# Creating a Linux Installer on Windows

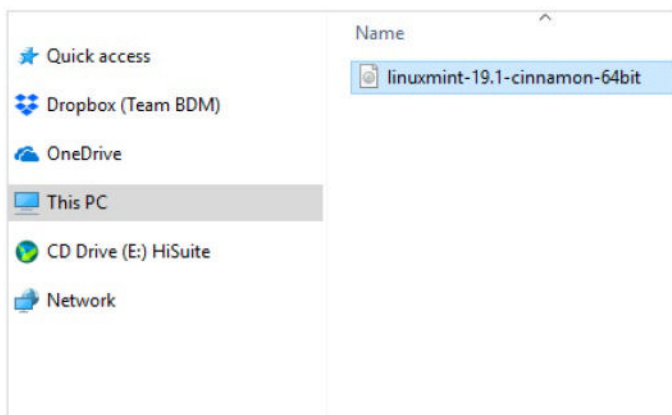
You need to transfer the downloaded Linux ISO to either a DVD or a USB key before you can install it to a computer. This will be a live environment, which will allow you to test the OS prior to installation, but first you need to create the bootable media.

## DVD BOOTABLE MEDIA

We're using a Windows 10 PC here to transfer the ISO to a DVD. As long as you're using a version of Windows from 7 onward, the process is extremely easy.

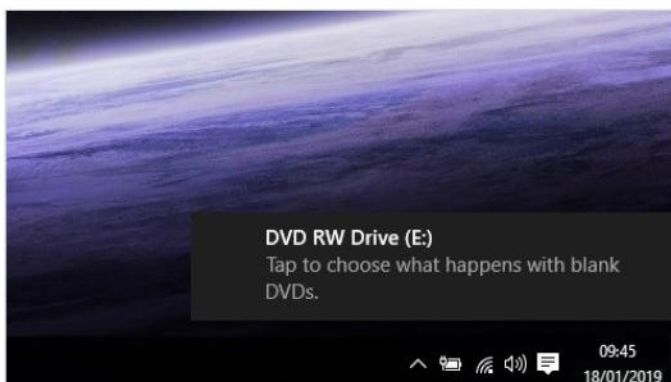
### STEP 1

First locate the ISO image of Linux you've already downloaded. In Windows 7, 8.1 and 10 computers, you'll usually find this in the Downloads folder unless, when saving it, you've specified a different location.



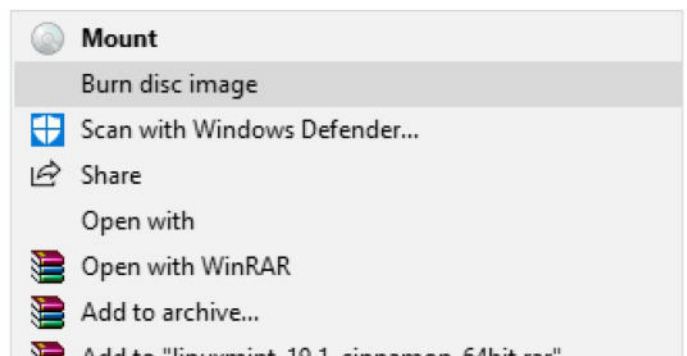
### STEP 2

Next, insert a recordable DVD disc into your computer's optical drive. After a few seconds, while the disc is read, Windows will display a pop-up message asking you what to do with the newly inserted disc, ignore this as we're going to use the built-in image burning function.



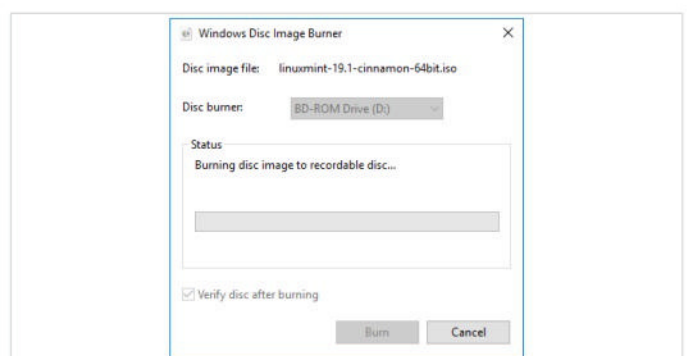
### STEP 3

Right-click the Linux ISO and from the menu select Burn Disc Image. Depending on the speed of the PC, it may take a few seconds before anything happens. Don't worry too much, unless it takes more than a minute, in which case it might be worth restarting your PC and trying again. With luck, the Windows Disc Image Burner should launch.



### STEP 4

With the Windows Disc Image Burner dialogue box open, click on the 'Verify disc after burning' tick box, followed by the **Burn** button. The process should take a few minutes, depending on the speed of your PC's optical drive. Once it's complete, it will run through the verification stage and when done, the optical drive should auto-eject the disc for you.



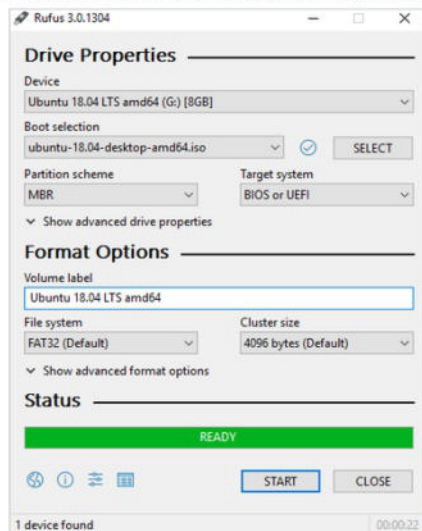


## USB BOOTABLE MEDIA

USB media is faster than a DVD and it's often more convenient as most modern PCs don't have an optical drive installed. The process of transferring the image is easy, but you'll need a third-party app first and a USB flash drive of 4GB or more.

### STEP 1

First, open up a web browser and go to <https://rufus.akeo.ie/>. Scroll down the page a little and you'll come to a Download heading, under which you'll see the latest version of Rufus. Left-click on the link to start the download.



### STEP 4

When you're ready, click on the Start button at the bottom of the Rufus app. This may open up another dialogue box asking you to download and use a new version of SysLinux. SysLinux is a selection of boot loaders used to allow a modern PC to access and boot from a USB flash drive. It is necessary, so if asked, click on 'Yes' to continue.



This image uses Syslinux 6.03/20151222 but this application only includes the installation files for Syslinux 6.03/2014-10-06.

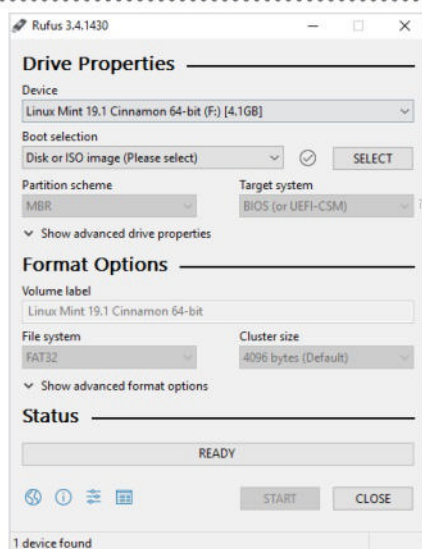
As new versions of Syslinux are not compatible with one another, and it wouldn't be possible for Rufus to include them all, two additional files must be downloaded from the Internet ('ldlinux.sys' and 'ldlinux.bss'):

- Select 'Yes' to connect to the Internet and download these files
- Select 'No' to cancel the operation

Note: The files will be downloaded in the current application directory and will be reused automatically if present.

### STEP 2

Double-click the downloaded Rufus executable; you can click 'Yes' to the Windows security question and 'Yes' to checking for updates. With Rufus launched, it should have already identified your inserted USB flash drive (if not, just remove and reinsert).



### STEP 5

The next step asks in which image mode do you want the Linux ISO to be written to the USB flash drive. Both methods work for different situations, but generally, the recommended ISO Image Mode is the more popular. Make sure this mode is pre-selected and click 'OK' to continue, followed by 'OK' again to confirm the action.



ISOHybrid image detected

The image you have selected is an 'ISOHybrid' image. This means it can be written either in ISO Image (file copy) mode or DD Image (disk image) mode. Rufus recommends using ISO Image mode, so that you always have full access to the drive after writing it. However, if you encounter issues during boot, you can try writing this image again in DD Image mode.

Please select the mode that you want to use to write this image:

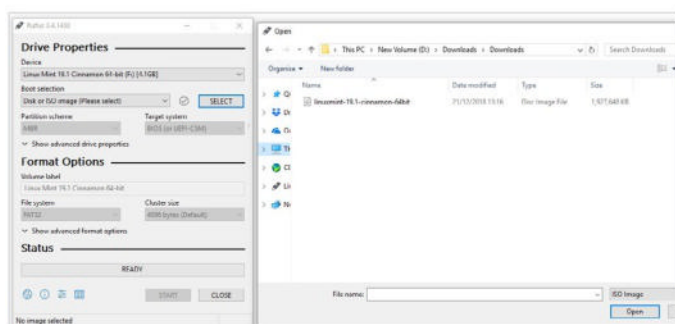
- ☒ Write in ISO Image mode (Recommended)
- ☐ Write in DD Image mode

OK

Cancel

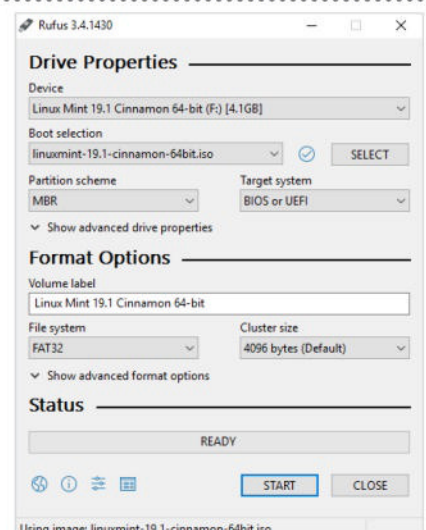
### STEP 3

At first glance the Rufus interface can look a little confusing, don't worry though, it's really quite simple. To begin with, click on the SELECT button next to the 'Disk or ISO image (Please select)' pull-down menu. This will launch a Windows Explorer window from where you can locate and select the Linux ISO.



### STEP 6

The Linux ISO is now being transferred to the USB flash drive. The process shouldn't take too long, depending on the speed of the USB device and the PC. During the process, you may find Rufus will auto-open the USB drive in Windows Explorer, don't worry you can minimise or close it if you want. Click on the Close button once the process is complete.







# Installing Linux on a PC

Most Linux distros come as a Live Environment. This means you can boot into an actual, fully working distro straight from the DVD or USB you've just created. Let's see how that works and how you go about installing Linux from there.

## UEFI BIOS

The Unified Extensible Firmware Interface (UEFI) is used to identify hardware and protect a PC during its boot-up process. It replaces the traditional BIOS, but can cause issues when installing Linux.

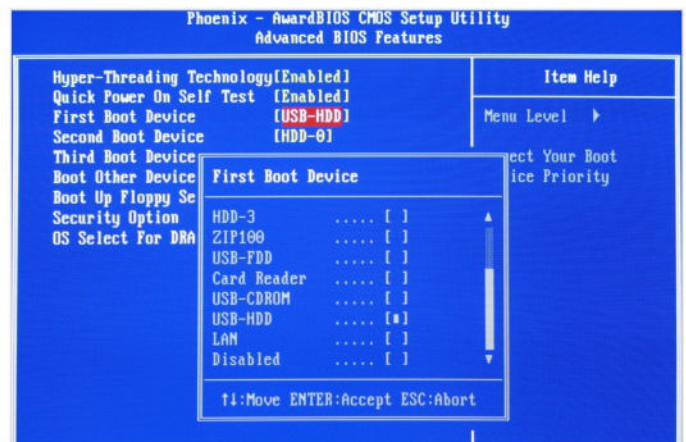
### STEP 1

Insert your DVD or USB flash drive into your PC and, if you haven't already, shutdown Windows. In this instance, we're using the USB boot media but the process is virtually identical. Start the PC and when prompted press the appropriate keys to enter the BIOS or SETUP; these could be, for example, **F2**, **Del** or even **F12**.



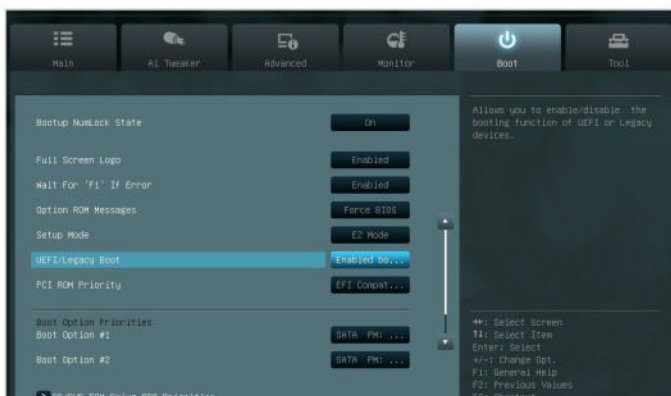
### STEP 3

With UEFI turned to Legacy mode, there are now two ways of booting into the Live Environment. The first is via the BIOS you're already in. Locate the **Boot Sequence** and change the first boot device from its original setting, usually Internal HDD or similar, to: **USB Storage Device** for the USB media option; or **DVD Drive**, for the DVD media option.



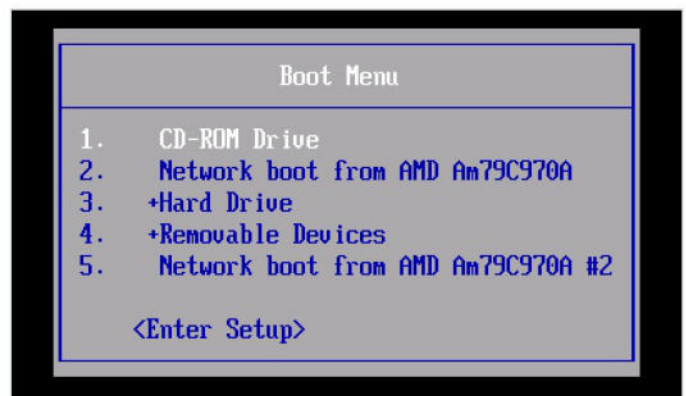
### STEP 2

There are different versions of a UEFI BIOS, so covering them all would be impossible. What you're looking for is a section that details the **Boot Sequence** or **Boot Mode**. Here you'll have the option to turn off UEFI and choose **Legacy**, or disable **Secure Booting**. Most distros work with UEFI but it can be a tricky process to enable it to boot.



### STEP 4

Alternatively use the Boot Option Menu. With this option, you can press **F12** (or something similar) to display a list of boot media options; from there, you can choose the appropriate boot media. Either way, you can now Save and Exit the BIOS by navigating to the Save & Exit option and choosing **Save Changes and Exit**.

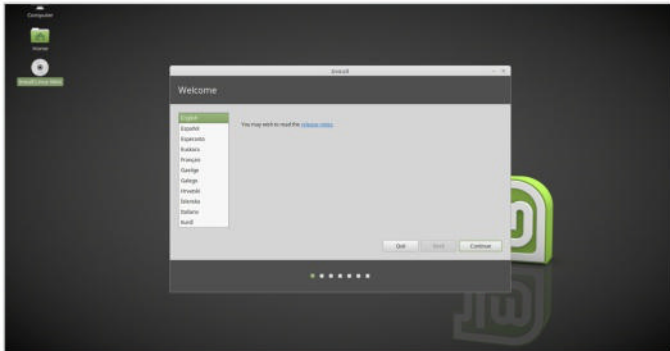


## INSTALLING LINUX

Once the Live Environment has booted, you will see the option to install the distro to your computer. Have a look around and when you're ready, look for the Install option on the desktop.

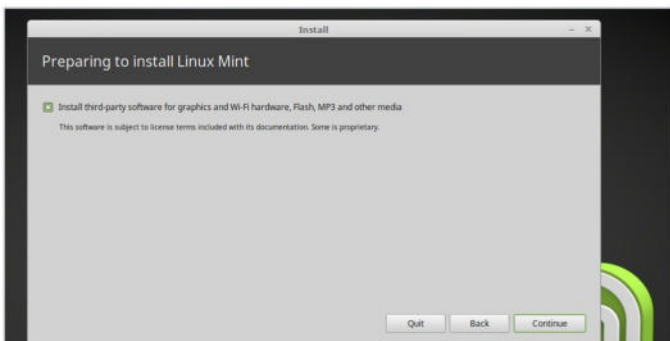
### STEP 1

Providing you're connected to the Internet (if not, then do so now) and you're in the Live Environment, start the installation process by double-clicking on the **Install Linux Mint** icon on the desktop. Other distros will display their own name, of course, but the process is the same. Click **Continue** when you're ready.



### STEP 2

While the installation process is very similar across most Linux distros, some offer different questions during the installation. Generally, the questions aren't too difficult, or technical, but some such as 'Installing third-party software...' can be confusing. In this case, you can click **Continue**, but if you're unsure, have an Internet-connected device available to ask any questions.



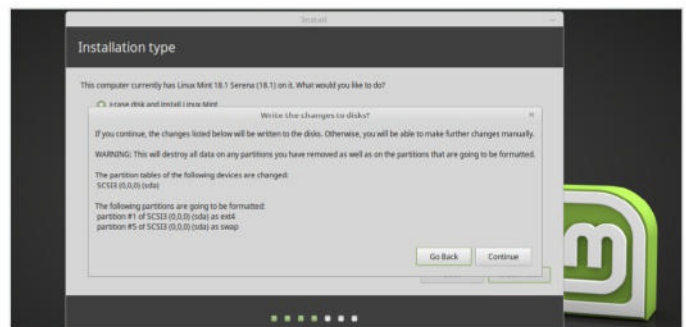
### STEP 3

When installing a new operating system it's recommended that you wipe the old OS, replacing it with the new. When you reach this stage of the installation process, ensure the 'Erase disk and install Linux...' option is selected. **NOTE: This will completely wipe Windows 10 from your computer; make sure you have backups of all your personal files and data.**



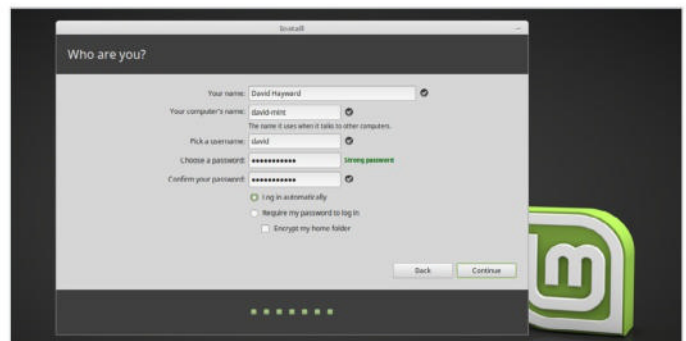
### STEP 4

Before the installation process begins, you're asked if the choice you made regarding the erasure of the hard drive is correct. This is your last chance to back out. If you're certain you don't mind wiping everything and starting again with Linux Mint, click **Continue**. If you need to back up your files remove the Linux disc/USB, reboot, back up and start again.



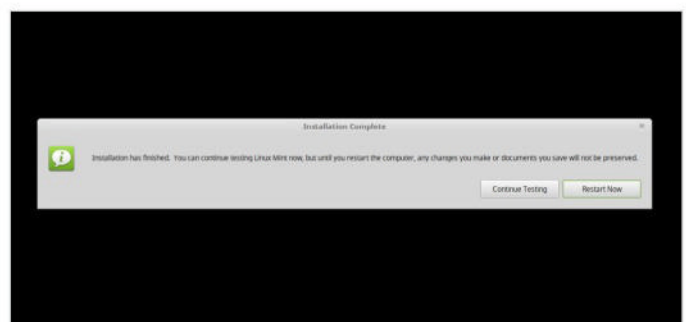
### STEP 5

Eventually you will be asked to set up your Linux username and password. Enter your Name to begin with, then **Computer Name** – which is the name used to identify it on the network. Next, choose a **Username**, followed by a good Password. You can tick the **Login Automatically** option, but leave the **Encrypt Home Folder** option for now.

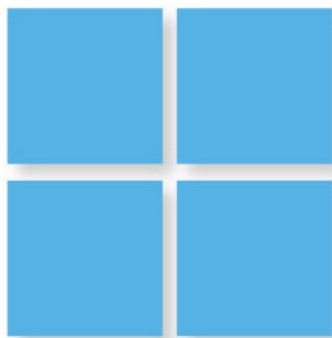


### STEP 6

The installation process can be quick and there may be more questions to answer, or it may simply start installing Linux based on your previous answers. Either way, you will end up being asked to Continue Testing the Live Environment, or Restarting to use the newly installed OS. If you're ready to use Linux, then click **Restart Now**.







Did you know that Windows has its own built-in scripting language? Batch files have been around since the early days of Windows, and while they are overshadowed by the might of Windows' modern graphical user interface, they are still there and still just as capable as they were thirty years ago.

Batch file programming is a skill that system administrators still use, so it's worth spending a bit of time learning how they work, and what you can do with them. This section introduces batch files, and covers user interactions, variables and loops.

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What is a Batch File?

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Getting Started with Batch Files

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Getting an Output

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Did You Know?

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Playing with Variables

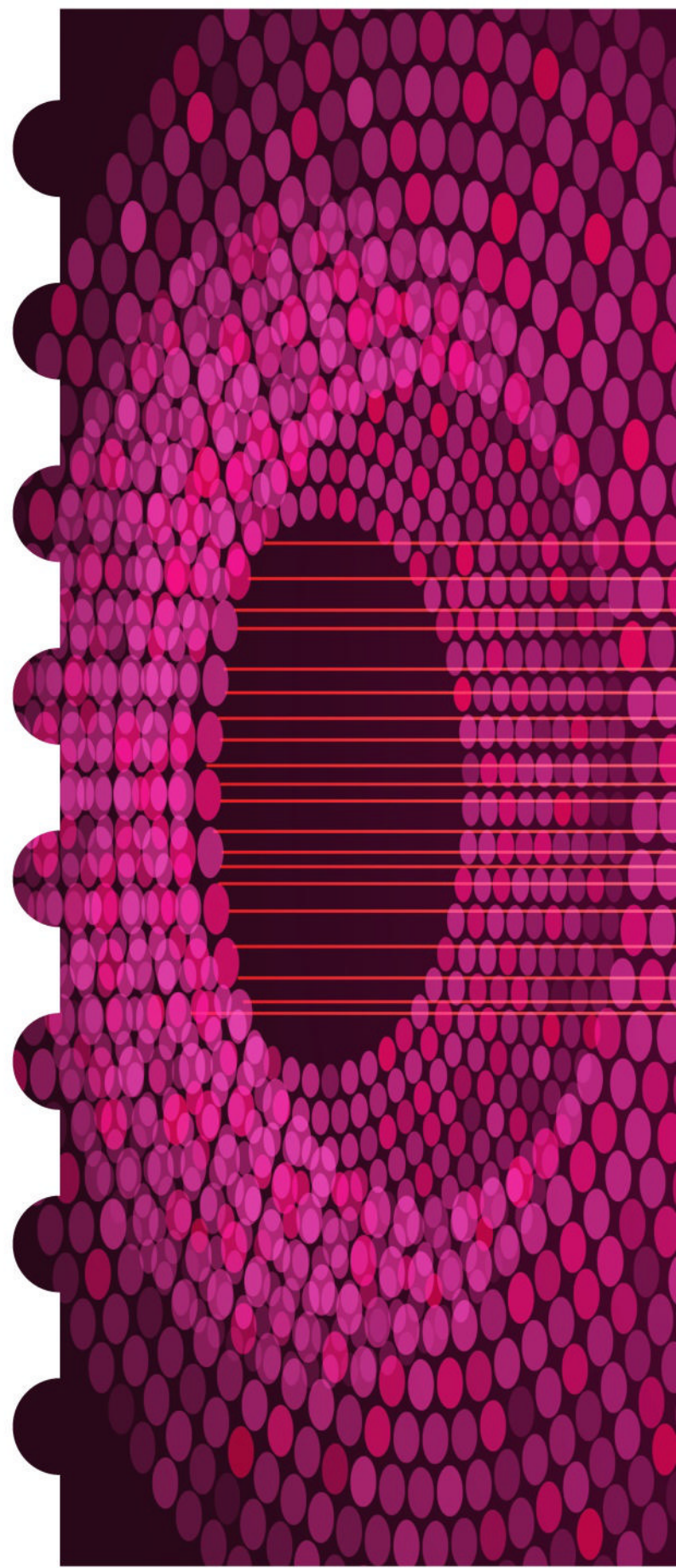
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Batch File Programming

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Loops and Repetition

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# Coding with Windows Batch Files





# What is a Batch File?

The Windows batch file has been around since the early days of DOS, and was once a critical element of actually being able to boot into a working system. There's a lot you can do with a batch file but let's just take a moment to see what one is.

## .BAT MAN

A Windows batch file is simply a script file that runs a series of commands, one line at a time, much in the same fashion as a Linux script. The series of commands are executed by the command line interpreter and stored in a plain text file with the .BAT extension; this signifies to Windows that it's an executable file, in this case, a script.

Batch files have been around since the earliest versions of Microsoft DOS. Although not exclusively a Microsoft scripting file, batch files are mainly associated with Microsoft's operating systems. In the early days, when a PC booted into a version of DOS (which produced a simple command prompt when powered up), the batch file was used in the form of a system file called Autoexec.bat. Autoexec.bat was a script that automatically executed (hence Autoexec) commands once the operating system had finished dealing with the Config.sys file.

When a user powered up their DOS-based computer, and once the BIOS had finished checking the system memory and so on, DOS would look to the Config.sys file to load any specific display requirements and hardware drivers, allocate them a slot in the available memory, assign any memory managers and tell the system where the Command.com file, which is the command line interpreter for DOS, was. Once it had done that, then the Autoexec.bat file took over and ran through each

line in turn, loading programs that would activate the mouse or optical drive into the memory areas assigned by the Config.sys file.

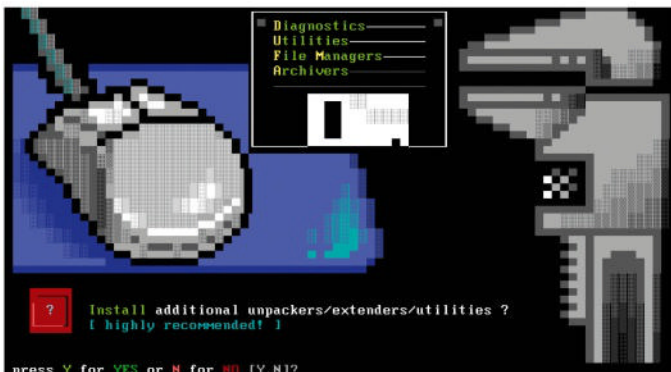
The DOS user of the day could opt to create different Autoexec.bat files depending on what they wanted to do. For example, if they wanted to play a game and have as much memory available as possible, they'd create a Config.sys and Autoexec.bat set of files that loaded the bare minimum of drivers and so on. If they needed access to the network, an Autoexec.bat file could be created to



The Autoexec.bat file was a PC user's first experience with a batch file.



Batch files are plain text and often created using Notepad.



Batch files were often used as utility programs, to help users with complex tasks.

load the network card driver and automatically gain access to the network. Each of these unique setups would be loaded on to a floppy disk and booted as and when required by the user.

The Autoexec.bat was the first such file many users came across in their PC-based computing lives; since many had come from a 16-bit or even 8-bit background; remember, this was the late eighties and early nineties. The batch file was the user's primary tool for automating tasks, creating shortcuts and adventure games and translating complex processes into something far simpler.

Nowadays however, a batch file isn't just for loading in drivers and such when the PC boots. You can use a batch file in the same way as any other scripting language file, in that you can program it to ask for user input and display the results on the screen; or save to a file and even send it to a locally or network attached printer. You can create scripts to back up your files to various locations, compare date stamps and only back up the most recently changed content as well as program the script to do all this automatically. Batch files are remarkably powerful and despite them not being as commonly used as they were during the older days of DOS, they are still there and can be utilised even in the latest version of Windows 10; and can be as complex or simple as you want them to be.

So what do you need to start batch file programming in Windows? Well, as long as you have Windows 10, or any older version of Windows for that matter, you can start batch file programming immediately. All you need is to be able to open Notepad and get to the command prompt of Windows. We show you how it all works, so read on.

## BATCH FILE POWER

Just like any other programming interface that can directly interrogate and manipulate the system, batch files require a certain amount of care when programming. It's hard to damage your system with a batch file, as the more important elements of the modern Windows system are protected by the User Account Control (UAC) security; UAC works by only allowing elevated privileges access to important system files. Therefore if you create a batch file that somehow deletes a system file, the UAC activates and stop the process.

However, if you're working in the command prompt with elevated privileges to begin with, as the Administrator, then the UAC won't question the batch file and continue regardless of what files are being deleted.

That said, you're not likely to create a batch file that intentionally wipes out your operating system. There are system controls in place to help prevent that; but it's worth mentioning as there are batch files available on the Internet that contain malicious code designed to create problems. Much like a virus, a rogue batch file (when executed with Administrator privileges) can cause much mayhem and system damage. In short, don't randomly execute any batch file downloaded from the Internet as an Administrator, without first reviewing what it does.

You can learn more about batch files in the coming pages, so don't worry too much about destroying your system with one. All this just demonstrates how powerful the humble batch file can be.



You can create complex batch files or simple ones that display ASCII images on screen.





# Getting Started with Batch Files

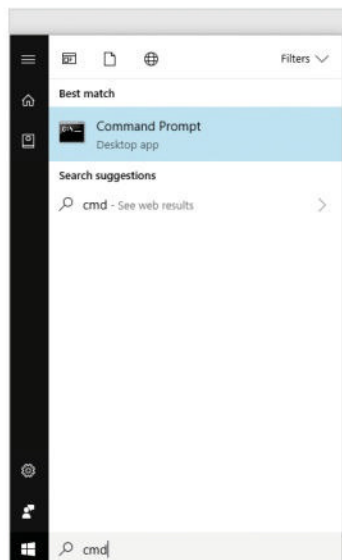
Before you begin to program with batch files, there are a few things you need to know. A batch file can only be executed once it has the .bat extension and editing one with Notepad isn't always straightforward.

## A NEW BATCH

Throughout this section on batch files we're going to be working with Notepad, the command prompt and within a folder called 'Batch Files'. To begin with, let's see how you get to the Windows command prompt.

### STEP 1

The Windows command prompt may look a little daunting to the newcomer but it's simply another interface (or Shell) used to access the filesystem. You can go anywhere you like in the command prompt, as you would with the graphical interface. To begin, click on the Windows Start button and enter CMD into the search box.

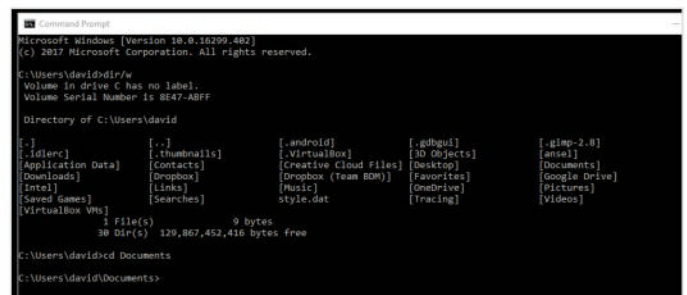


### STEP 3

While at the command prompt window, enter: `dir /w`. This lists all the files and directories from where you are at the moment in the system. In this case, that's your Home directory that Windows assigns every user that logs in. You can navigate by using the CD command (Change Directory). Try:

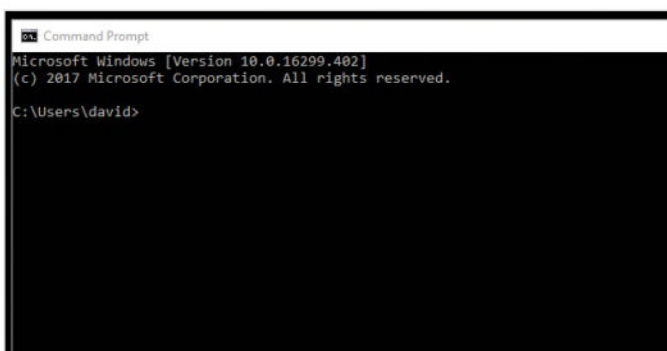
`cd Documents`

Then press Return.



### STEP 2

Click on the search result labelled Command Prompt (Desktop App) and a new window pops up. The Command Prompt window isn't much to look at to begin with but you can see the Microsoft Windows version number and copyright information followed by the prompt itself. The prompt details the current directory or folder you're in, together with your username.



### STEP 4

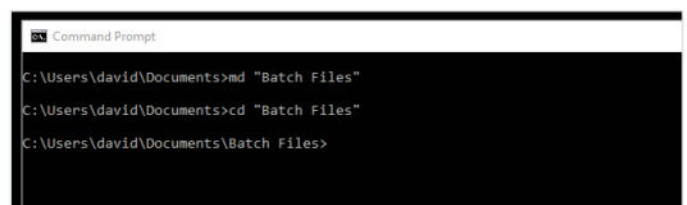
The prompt should change and display `\Documents>`; this means you're in the Documents directory. Now, create a new directory call Batch Files. Enter:

`md "Batch Files"`

You need the quotations because without them, Windows creates two directories: Batch and Files. Now change directory into the newly created Batch Files.

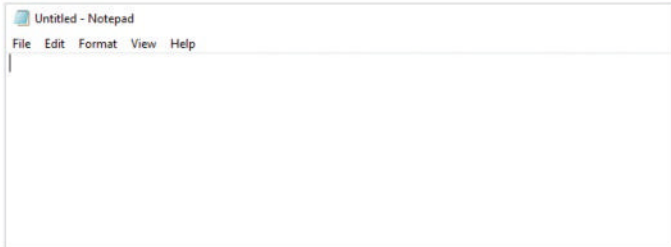
`cd Batch Files`

You won't need the quotes to change directories.



**STEP 5**

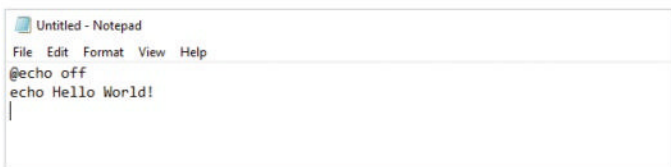
Now that you have the directory set up, where you store your batch files, here is how you can create one. Leave the command prompt window open and click on the Windows Start button again. This time enter Notepad and click on the search result to open the Notepad program. Notepad is a simple text editor but ideal for creating batch scripts with.

**STEP 6**

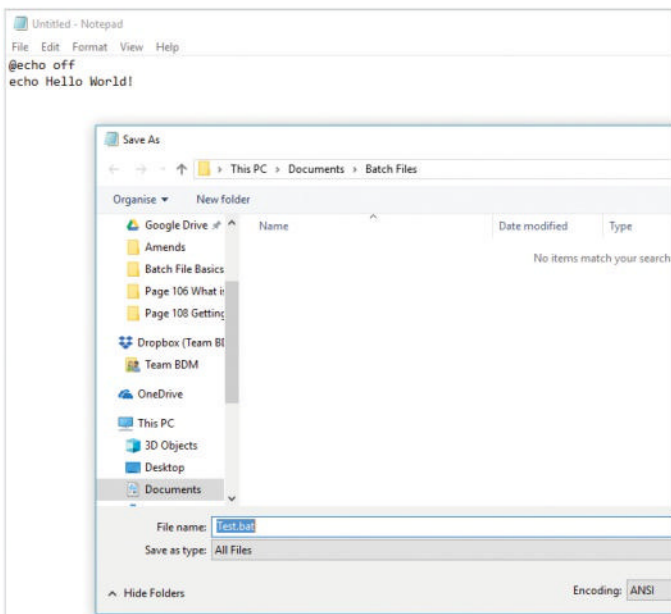
To create your first batch file, enter the following into Notepad:

```
@echo off
echo Hello World!
```

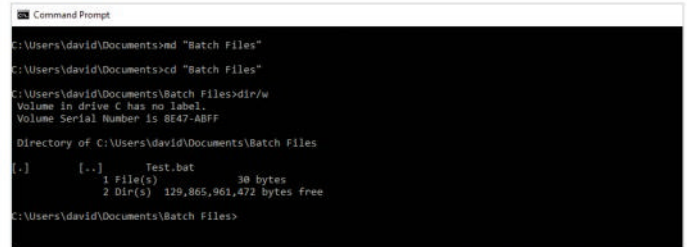
By default, a batch file displays all the commands that it runs through, line by line. What the @echo off command does is turn that feature off for the whole script; with the '@' (at) sign to apply that command to itself.

**STEP 7**

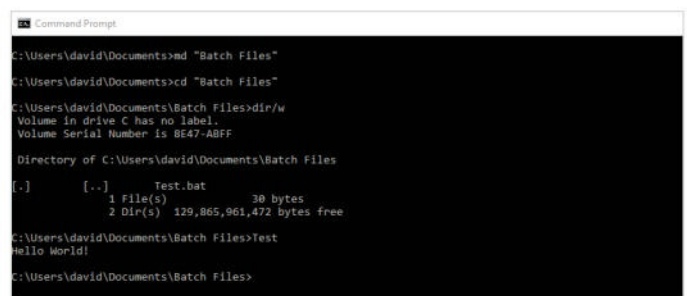
When saving anything in Notepad the default extension is .txt, to denote a text file. However, you want the extension to be .bat. Click on File > Save As and navigate to the newly created Batch Files directory in Documents. Click the drop-down menu Save as Type, and select All Files from the menu. In File Name, call the file **Test.bat**.

**STEP 8**

Back at the command prompt window, enter: `dir /w` again to list the newly created Test.bat file. By the way, the /w part of dir/w means the files are listed across the screen as opposed to straight down. Enter `dir` if you want (although you need more files to view) but it's considered easier to read with the /w flag.

**STEP 9**

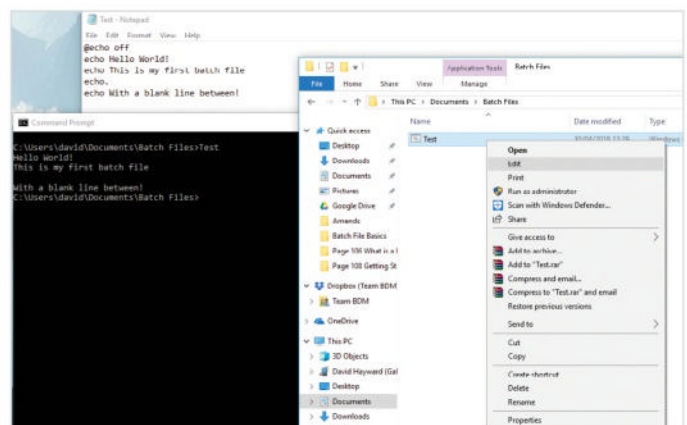
To execute the batch file you've just created, simply enter its name, Test, in the command prompt window. You don't need to add the .bat part, as Windows recognises it as an executable file, and the only one with that particular name in the current directory. Press return and see how you're greeted with Hello World! in the command prompt.

**STEP 10**

The echo command displays whatever is after it to the screen. Right-click the Test.bat file from Windows Explorer and select Edit to add more echo commands if you like. Try this:

```
@echo off
echo Hello World!
echo This is my first batch file
echo.
echo With a blank line between!
```

Remember to save each new change to the batch file.





# Getting an Output

While it's great having the command prompt window display what you're putting after the echo command in the batch file, it's not very useful at the moment, or interactive for that matter. Let's change up a gear and get some output.

## INPUT, OUTPUT

Batch files are capable of taking a normal Windows command and executing it, while also adding extra options and flags in to the equation.

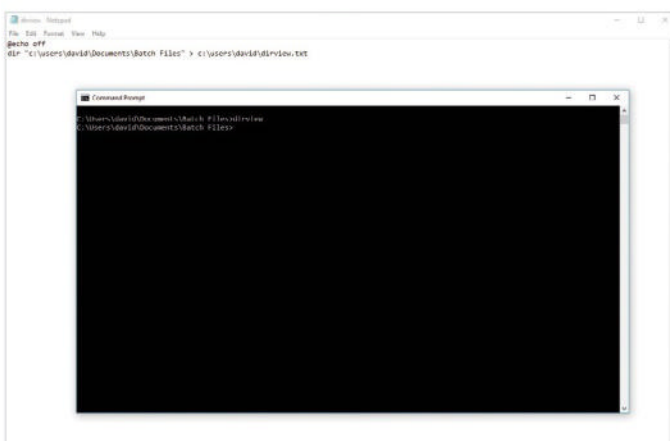
**STEP 1** Let's keep things simple to begin with. Create a new batch file called 'dirview.bat', short for Directory View. Start with the @echo off command and under that add:

```
dir "c:\users\YOURNAME\Documents\Batch Files" >
c:\users\YOURNAME\dirview.txt
```

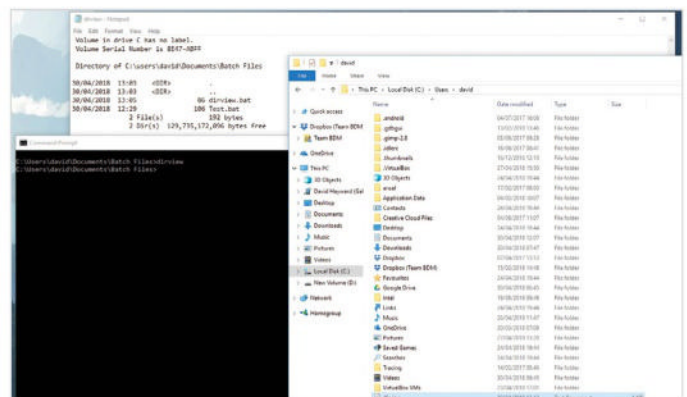
Substitute YOURNAME with your Windows username.



**STEP 2** The new line uses the dir command to list the contents of the directory Batch Files, in your Home directory, dumping the output to a text file called dirview.txt in the root of your Home directory. This is done, so that the Windows UAC doesn't require elevated permissions, as everything is in your own Home area. Save and run the batch file.



**STEP 3** You have no doubt noticed that there is no indication that the batch file worked as there's no meaningful output on the screen. However, if you now open Explorer and browse to c:\Users\YOURNAME, remembering to substitute YOURNAME with your Windows username, and double-click the dirview.txt file, you can see the batch file's output.



**STEP 4** If you want to automate the task of opening the text file that contains the output, add the following line to the batch file:

```
notepad.exe c:\users\YOURNAME\dirview.txt
```

Save the file and once again run from the command prompt. This time, it creates the output and automatically opens Notepad with the output contents.



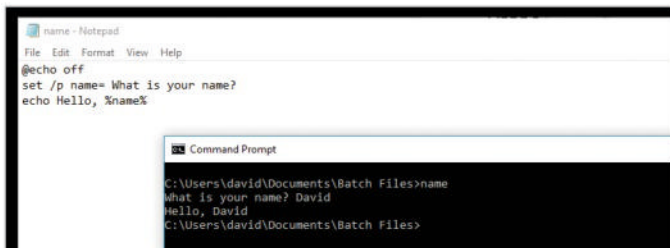
## OUTPUT WITH VARIABLES

Variables offer a more interesting way of outputting something to the screen and create a higher level of interaction between the user and the batch file. Try this example below.

**STEP 1** Create a new batch file and call it **name.bat**. Start with the `@echo off` command, then add the following lines:

```
set /p name= What is your name?
echo Hello, %name%
```

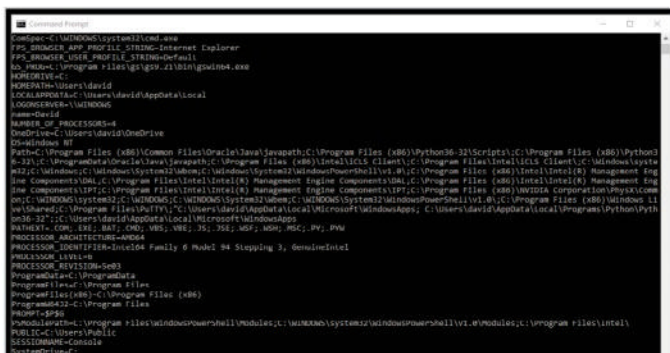
Note: there's a space after the question mark. This is to make it look neater on the screen. Save it and run the batch file.



**STEP 2** The set `/p` name creates a variable called name, with the `/p` part indicating that an **'=prompt string'** is to follow. The Set command displays, sets or removes system and environmental variables. For example, while in the command prompt window enter:

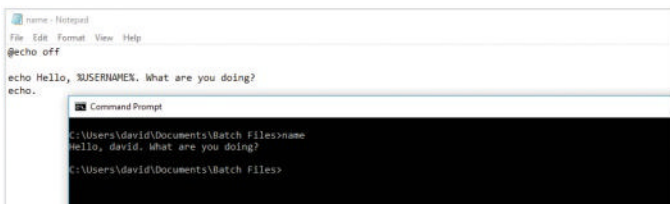
```
set
```

To view the current system variables. Note the name= variable we just created.



**STEP 3** Variables stored with Set can be called with the **%VARIABLENAME%** syntax. In the batch file, we used the newly created `%name%` syntax to call upon the contents of the variable called name. Your username, for example, is stored as a variable. Try this in a batch file:

```
echo Hello, %USERNAME%. What are you doing?
```



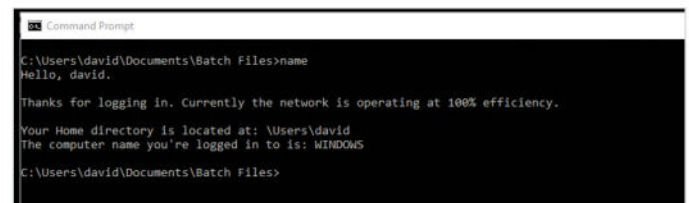
**STEP 4** This is extremely useful if you want to create a unique, personal batch file that automatically runs when a user logs into Windows. Using the default system variables that Windows itself creates, you can make a batch file that greets each user:

```
@echo off

echo Hello, %USERNAME%.
echo.
echo Thanks for logging in. Currently the network
is operating at 100%% efficiency.
echo.
echo Your Home directory is located at: %HOMEPATH%
echo The computer name you're logged in to is:
%COMPUTERNAME%
echo.
```



**STEP 5** Save and execute the batch file changes; you can overwrite and still use name.bat if you want. The batch file takes the current system variables and reports them accordingly, depending on the user's login name and the name of the computer. Note: the double percent symbol means the percent sign will be displayed, and is not a variable.



**STEP 6** Alternatively, you can run the batch file and display it on the user's desktop as a text file:

```
@echo off

echo Hello, %USERNAME%. > c:%HOMEPATH%\user.txt
echo. >> c:%HOMEPATH%\user.txt
echo Thanks for logging in. Currently the network
is operating at 100%% efficiency. >> c:%HOMEPATH%\
user.txt
echo. >> c:%HOMEPATH%\user.txt
echo Your Home directory is located at: %HOMEPATH%
>> c:%HOMEPATH%\user.txt
echo The computer name you're logged in to is:
%COMPUTERNAME% >> c:%HOMEPATH%\user.txt
echo. >> c:%HOMEPATH%\user.txt

notepad c:%HOMEPATH%\user.txt
```

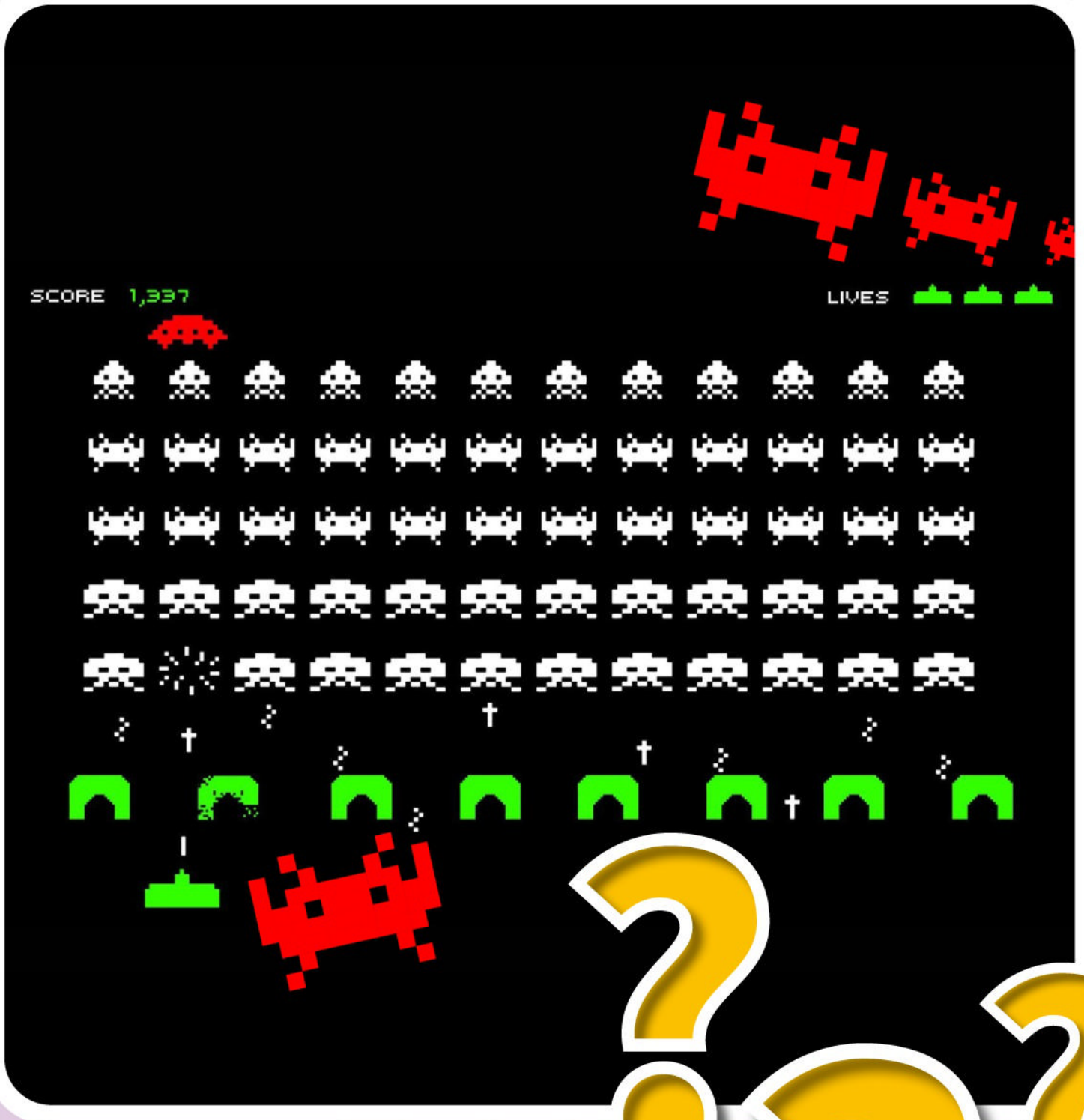
The `>` outputs to a new file called user.txt, while the `>>` adds the lines within the file.



# DID YOU KNOW?

## Space Invaders

When Space Invaders creator, Tomohiro Nishikado, was coding Space Invaders, he had to create his own hardware and development tools to write the game. Furthermore, he then discovered that as a result of the coding and the custom hardware, the fewer Invaders on-screen the faster the processor was able to render them. Thus, as you kill more Invaders, the faster they become. So rather than design the game to compensate for the speed increase, he decided to keep it as a challenging gameplay mechanism.







# Playing with Variables

There's a lot you can accomplish with both the system and environmental variables, alongside your own. Mixing the two can make for a powerful and extremely useful batch file and when combined with other commands, the effect is really impressive.

## USING MORE VARIABLES

Here's a good example of mixing system and environmental variables with some of your own creation, along with a number of external Windows commands.

**STEP 1** Create a new batch file called list.bat and start it off with the `@echo off` command. Begin by clearing the command prompt screen and displaying a list of the current directories on the computer:

```
cls
dir "c:\" > list.txt
type list.txt
echo.
```

```
list - Notepad
File Edit Format View Help
@echo off

cls
dir "c:\" > list.txt
type list.txt
echo.
```

**STEP 2** Save and execute the batch file. Within the command prompt you can see the contents of all the files and directories from the root of the C:\ drive; and as any user under Windows has permission to see this, there's no UAC elevated privileges required.

```
Command Prompt
Volume in drive C has no label.
Volume Serial Number is 8E47-ABFF

Directory of c:\

26/06/2017  10:37    <DIR>          activity
13/07/2017  09:57    <DIR>          monitoring
07/12/2017  18:32    <DIR>          PerfLogs
25/04/2018  11:51    <DIR>          Program Files
27/04/2018  10:52    <DIR>          Program Files (x86)
25/08/2017  10:10    <DIR>          Python27
26/03/2018  15:38    <DIR>          Speccy
27/04/2018  10:52    <DIR>          Temp
04/07/2017  16:08    <DIR>          Unified_Android_Toolkit
25/10/2017  11:02    <DIR>          Users
29/04/2018  11:39    <DIR>          Windows
               0 File(s)      0 bytes
               11 Dir(s)  129,728,413,696 bytes free

C:\Users\David\Documents\Batch Files>
```

**STEP 3** Now, create a batch file that displays the contents of any directory and post it as a text file to the user's screen. Add the following to the list.bat batch file:

```
echo Hello, %USERNAME%.
echo From the list, which folder would you like to
view?
set /p view= (enter as c:\folder)
dir "%view%" > view.txt
notepad.exe view.txt
```

```
list - Notepad
File Edit Format View Help
@echo off

cls
dir "c:\" > list.txt
type list.txt
echo.
echo Hello, %USERNAME%.
echo From the list, which folder would you like to view?
set /p view= (enter as c:\directory)
dir "%view%" > view.txt
notepad.exe view.txt
```

**STEP 4** What's happening here is the batch file asks the user to enter any of the directories displayed in the list it generated, in the form of '`c:\directory`'. Providing the user enters a valid directory, its contents are displayed as a text file. We created the view variable here along with `%HOMEPATH%`, to store the input and the text file.

```
Command Prompt
Volume in drive C has no label.
Volume Serial Number is 8E47-ABFF

Directory of c:\

26/06/2017  10:37    <DIR>          activity
13/07/2017  09:57    <DIR>          monitoring
07/12/2017  18:32    <DIR>          PerfLogs
25/04/2018  11:51    <DIR>          Program Files
27/04/2018  10:52    <DIR>          Program Files (x86)
25/08/2017  10:10    <DIR>          Python27
26/03/2018  15:38    <DIR>          Speccy
27/04/2018  10:52    <DIR>          Temp
04/07/2017  16:08    <DIR>          Unified_Android_Toolkit
25/10/2017  11:02    <DIR>          Users
29/04/2018  11:39    <DIR>          Windows
               0 File(s)      0 bytes
               11 Dir(s)  129,728,413,696 bytes free

Hello, David.
From the list, which directory would you like to view?
(enter as c:\directory) > C:\Users>

view - Notepad
File Edit Format View Help
@echo off

cls
dir "c:\" > list.txt
type list.txt
echo.
echo Hello, %USERNAME%.
echo From the list, which folder would you like to view?
set /p view= (enter as c:\directory)
dir "%view%" > view.txt
notepad.exe view.txt

Volume in drive C has no label.
Volume Serial Number is 8E47-ABFF

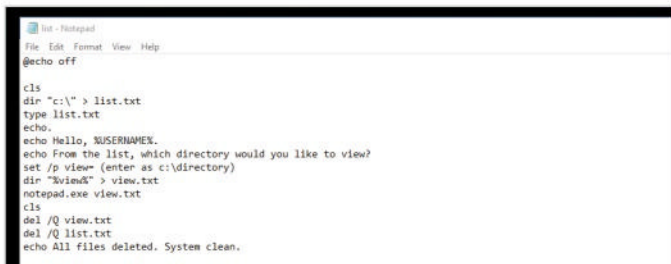
Directory of c:\Speccy

26/03/2018  11:08    <DIR>          .
26/03/2018  15:18    <DIR>          ..
               6,912 DPMs.scr
               3,341 RPM_login.png
205,296 BMP2SCR_EXP_2.11a.exe
224,485 BMP2SCR_EXP_2.11a.zip
0,912 Corsi.scr
187,908 crash-log
658,888 Crash.png
0,912 Crash.scr
4,109 Crash.exe
216,758 C:\Users\David - Copy.jpg
216,758 C:\Users\David - Copy.jpg
32,000,207 DE.mpl
26/04/2018  15:16    <DIR>          .
04/06/2018  24:49    <DIR>          ..
17/05/2018  00:32    <DIR>          Dns Loading Screens
314,134 Dns Test.PDN
6,912 Dns.scr
17/05/2018  00:32    <DIR>          Dns Test.jpg
286,492 Escape.jpg
6,912 Escape.scr
```

**STEP 5**

It's always a good idea, when creating text files for the user to temporarily view, to clean up after yourself. There's nothing worse than having countless, random text files cluttering up the file system. That being the case, let's clear up with:

```
cls
del /Q view.txt
del /Q list.txt
echo All files deleted. System clean.
```

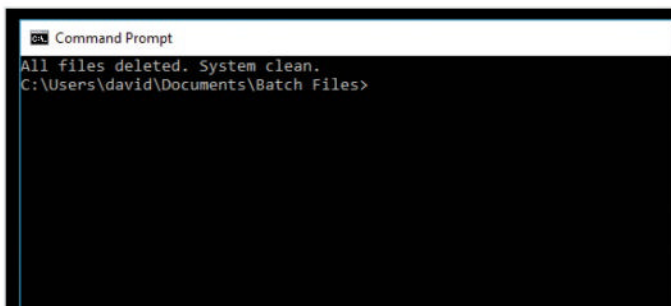


```
File Edit Format View Help
@echo off

cls
dir "c:\\" > list.txt
type list.txt
echo.
echo Hello, %USERNAME%.
echo From the list, which directory would you like to view?
set /p view= (enter as c:\directory)
dir "%view%" > view.txt
notepad.exe view.txt
cls
del /Q view.txt
del /Q list.txt
echo All files deleted. System clean.
```

**STEP 6**

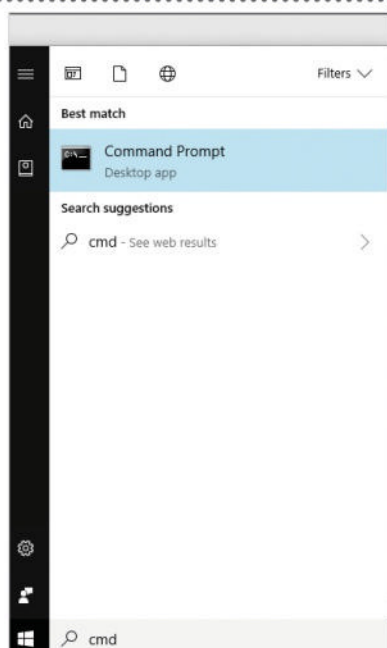
The additions to the batch file simply clear the command prompt window (using the `cls` command) and delete both the `view.txt` and `list.txt` files that were created by the batch file. The `/Q` flag in the `del` command means it deletes the files without any user input or notification. The final message informs the user that the files are removed.



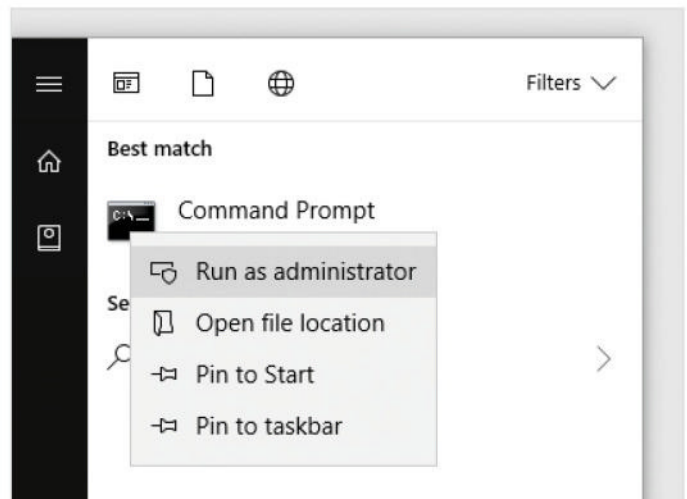
```
Command Prompt
All files deleted. System clean.
C:\Users\david\Documents\Batch Files>
```

**STEP 7**

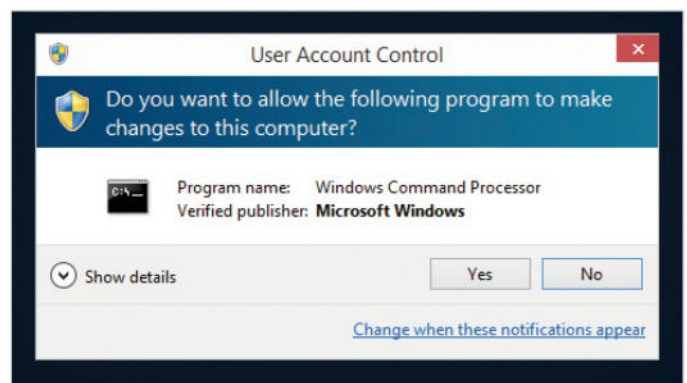
Depending on how your system is configured, you may not get any directory information at all or a message stating Access Denied. This is because the UAC is blocking access to protected areas of the system, like `c:\Windows` or `C:\Program Files`. Therefore, you need to run the batch file as an Administrator. Click the Windows Start button and enter **CMD** again.

**STEP 8**

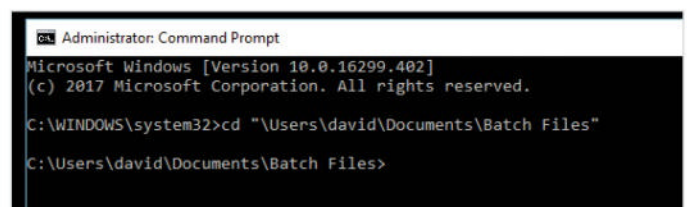
Instead of left clicking on the Command Prompt result, as you did the first time you opened it, right-click it and from the menu choose **Run as Administrator**. There is a risk that you could damage system files as the Administrator but as long as you're careful and don't do anything beyond viewing directories, you will be okay.

**STEP 9**

This action triggers the UAC warning message, asking you if you're sure you want to run the Windows command prompt with the elevated Administrator privileges. Most of the time we wouldn't recommend this course of action: the UAC is there to protect your system. In this case, however, click **Yes**.

**STEP 10**

With the UAC active, the command prompt looks a little different. For starters, it's now defaulting to the `C:\WINDOWS\system32` folder and the top of the windows is labelled **Administrator**. To run the batch file, you need to navigate to the Batch Files directory with: `cd \Users\USERNAME\Documents\Batch Files`. To help, press the Tab key to auto-complete the directory names.







# Batch File Programming

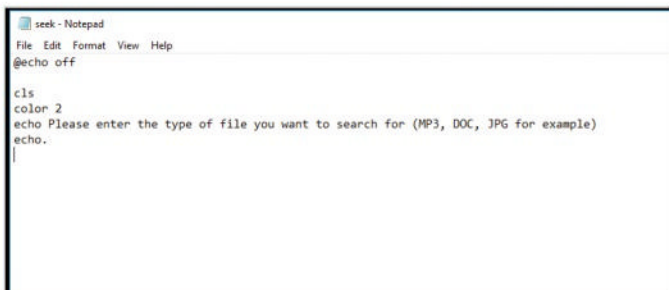
It's the little additions we can make to a batch file that help it stand out and ultimately become more useful. While the Windows graphical interface is still king, the command line can do just as much, and this is where batch files come into their own.

## SEARCHING FOR FILES

Here's an interesting little batch file that you can easily extend for your own use. It asks the user for a file type to search for and displays the results.

**STEP 1** We are introducing a couple of new commands into the mix here but we think they're really useful. Create a new batch file called seek.bat and in it put:

```
@echo off
cls
color 2
echo Please enter the type of file you want to
search for (MP3, DOC, JPG for example)
echo.
```



**STEP 2** The new command in this instance is color (Americanised spelling). Color, as you already assume, changes the colour of the command prompt display. The color attributes are specified by two hex digits, the first corresponds to the background colour of the Command console and the second to the foreground, and can be any of the following values:

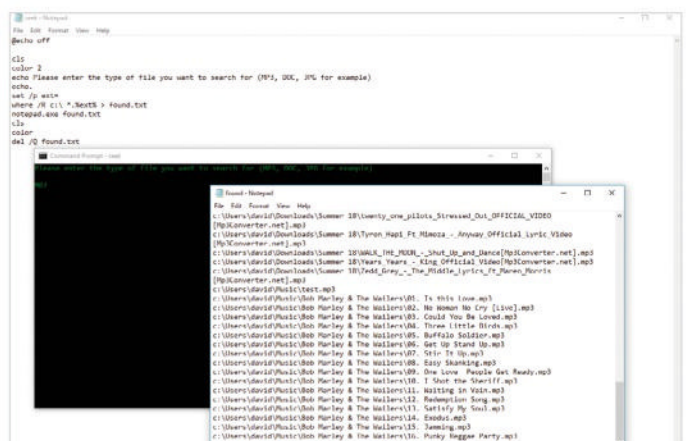
0 = Black	8 = Grey
1 = Blue	9 = Light Blue
2 = Green	A = Light Green
3 = Aqua	B = Light Aqua
4 = Red	C = Light Red
5 = Purple	D = Light Purple
6 = Yellow	E = Light Yellow
7 = White	F = Bright White

**STEP 3** Now let's extend the seek.bat batch file:

```
@echo off
cls
color 2
echo Please enter the type of file you want to
search for (MP3, DOC, JPG for example)
echo.
set /p ext=
where /R c:\ *.%ext% > found.txt
notepad.exe found.txt
cls
color
del /Q found.txt
```



**STEP 4** Another new command, Where, looks for a specific file or directory based on the user's requirements. In this case, we have created a blank variable called ext that the user can enter the file type in, which then searches using Where and dumps the results in a text file called found.txt. Save and run the batch file.



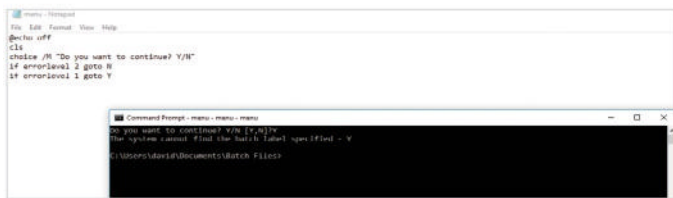
## CHOICE MENUS

Creating a menu of choices is a classic batch file use and a good example to help expand your batch file programming skills. Here's some code to help you understand how it all works.

### STEP 1

Rather than using a variable to process a user's response, batch files can instead use the Choice command in conjunction with an ErrorLevel parameter to make a menu. Create a new file called menu.bat and enter the following:

```
@echo off
cls
choice /M "Do you want to continue? Y/N"
if errorlevel 2 goto N
if errorlevel 1 goto Y
goto End:
```



### STEP 2

Running the code produces an error as we've called a Goto command without any reference to it in the file. Goto does exactly that, goes to a specific line in the batch file. Finish the file with the following and run it again:

```
:N
echo.
echo You chose No. Goodbye.
goto End

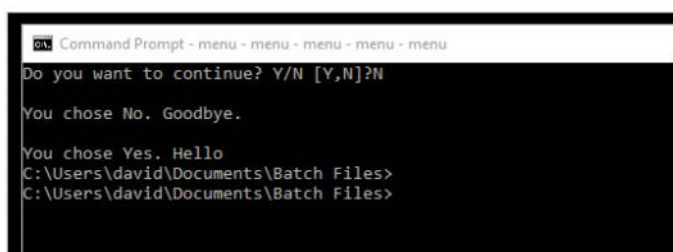
:Y
echo.
echo You chose Yes. Hello

:End
```



### STEP 3

The output from your choice is different depending on whether you pick Y or N. The :End part simply signifies the end of the file (also known as EOF). Without it the batch file runs through each line and display the Y response even if you enter N; so it's important to remember to follow your Goto commands.



### STEP 4

ErrorLevels are essentially variables and the /M switch of Choice allows a descriptive message string to be displayed. Extend this menu with something new:

```
@echo off
cls
echo.
echo -----
echo Please choose a directory.
echo.
echo Press 1 for c:\Music
echo.
echo Press 2 for c:\Documents
echo.
echo Press 3 for c:\Pictures
echo.
echo Press 4 for c:\Videos
echo.
echo -----
choice /C 1234
if errorlevel 4 goto Videos
if errorlevel 3 goto Pictures
if errorlevel 2 goto Documents
if errorlevel 1 goto Music
```

### STEP 5

Now add the Goto sections:

```
:Videos
cls
CD %HOMEPATH%\Videos
echo You are now in the Videos directory.
goto End

:Pictures
cls
CD %HOMEPATH%\Pictures
echo You are now in the Pictures directory.
goto End

:Documents
cls
CD %HOMEPATH%\Documents
echo You are now in the Documents directory.
goto End

:Music
cls
CD %HOMEPATH%\Music
echo you are now in the Music directory.
goto End

:End
```

### STEP 6

When executed, the batch file displays a menu and with each choice the code changes directory to the one the user entered. The %HOMEPATH% system variable will enter the currently logged in user's Music, Pictures and so directories, and not anyone else's.





# Loops and Repetition

Looping and repeating commands are the staple diet of every programming language, including batch file programming. For example, you can create a simple countdown or even make numbered files or directories in the system.

## COUNTERS

Creating code that counts in increasing or decreasing number sets is great for demonstrating loops. With that in mind, let's look at the If statement a little more, alongside more variables, and introduce the Else, Timeout and eof (End of File) commands.

### STEP 1

Start by creating a new batch file called count.bat. Enter the following, save it and run:

```
@echo off
cls
set /a counter=0

:numbers
set /a counter=%counter%+1
if %counter% ==100 (goto :eof) else (echo
%counter%)
timeout /T 1 /nobreak > nul
goto :numbers
```

```
count - Notepad
File Edit Format View Help
@echo off
cls
set /a counter=0

:numbers
set /a counter=%counter%+1
if %counter% ==100 (goto :eof) else (echo %counter%)
timeout /T 1 /nobreak > nul
goto :numbers
```

### STEP 2

The count.bat code starts at number one and counts, scrolling down the screen, until it reaches 100. The Timeout command leaves a one second gap between numbers and the Else statement continues until the counter variable equals 100 before going to the eof (End Of File), thus closing the loop.

```
Command Prompt - count
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
```

### STEP 3

The count.bat is a rough way of demonstrating a loop; a better approach would be to use a for loop. Try this example instead:

```
@echo off
for /L %%n in (1,1,99) do echo %%n
```

```
count - Notepad
File Edit Format View Help
@echo off
for /L %%n in (1,1,99) do echo %%n
```

```
Command Prompt
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
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31
32
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70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
```

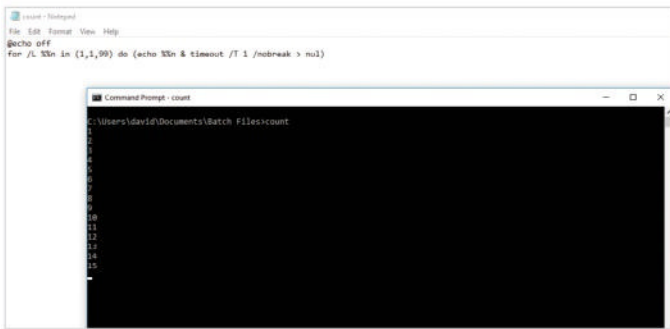
### STEP 4

Breaking it down, there's For, then the /L switch, which handles a range of numbers. Then the parameter labelled as %%n to denote a number. Then the in (1,1,99) part, which tells the statement how to count, as in 1 (start number), 1 (steps to take), 99 (the end number). The next part is do, meaning DO whatever command is after.

```
Command Prompt
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
C:\Users\david\Documents\Batch Fil
```

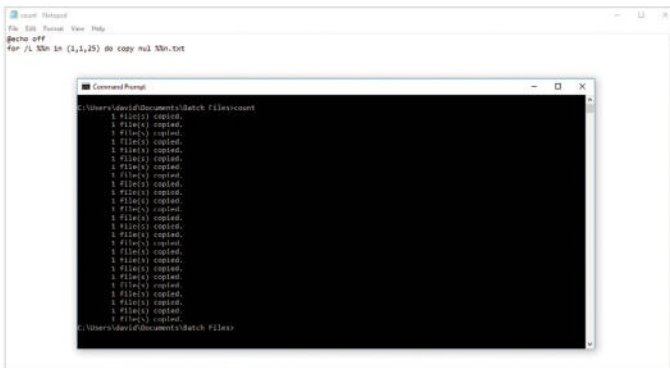
**STEP 5** You can include the pause between the numbers easily enough within the far simpler For loop by adding multiple commands after the Do For loop. The brackets and ampersand (&) separate the different commands. Try this:

```
@echo off
for /L %N in (1,1,99) do (echo %N & timeout /T 1 /nobreak > nul)
```



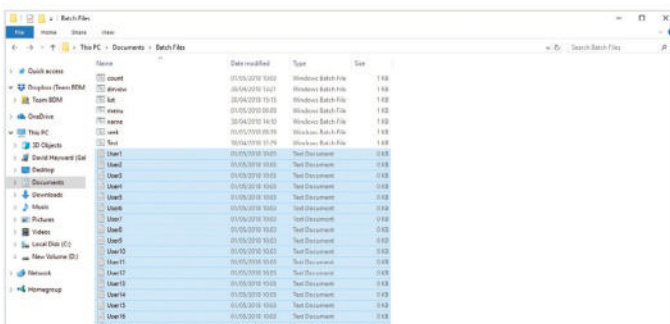
**STEP 6** One of the great time saving uses of batch files is to create multiple, numbered files. Assume that you want twenty five text files within a directory, all numbered from 1 to 25. A For loop much like the previous example does the trick:

```
@echo off
for /L %N in (1,1,25) do copy nul %N.txt
```



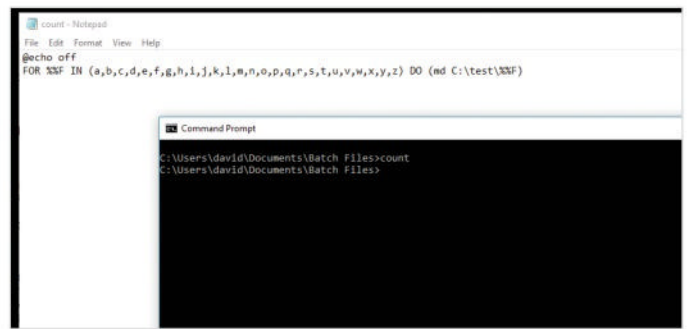
**STEP 7** If you open Windows Explorer, and navigate to the Batch Files directory where you're working from, you can now see 25 text files all neatly numbered. Of course, you can append the file name with something like user1.txt and so on by altering the code to read:

```
@echo off
for /L %N in (1,1,25) do copy nul User%N.txt
```

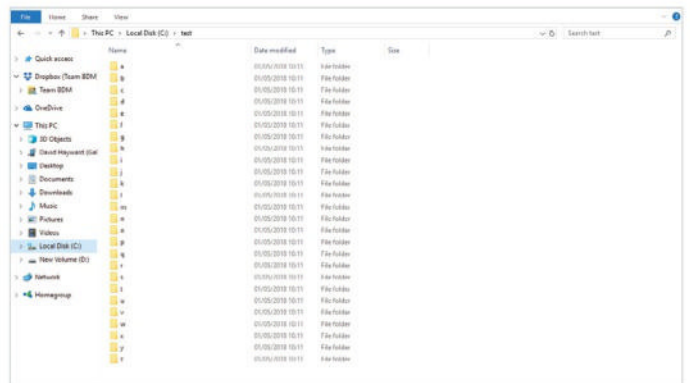


**STEP 8** There are different ways of using the For loop. In this example, the code creates 26 directories, one for each letter of the alphabet, within the directory c:\test which the batch file makes using the MD command:

```
@echo off
FOR %%F IN (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u,v,w,x,y,z) DO (md C:\test\%%F)
```

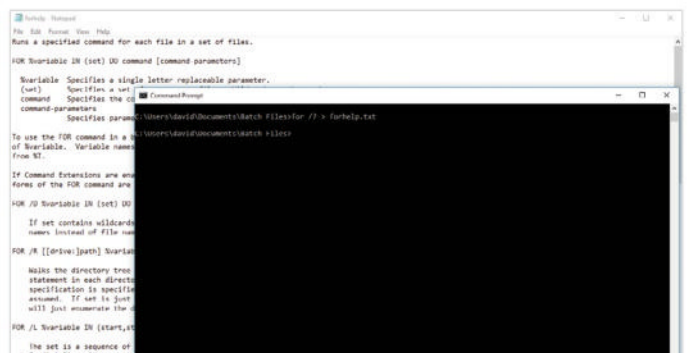


**STEP 9** Loops can be powerful and extremely useful elements in a batch file. While creating 26 directories may not sound too helpful, imagine having to create 1,000 users on a network and assign each one their own set of unique directories. This is where a batch file saves an immense amount of time.

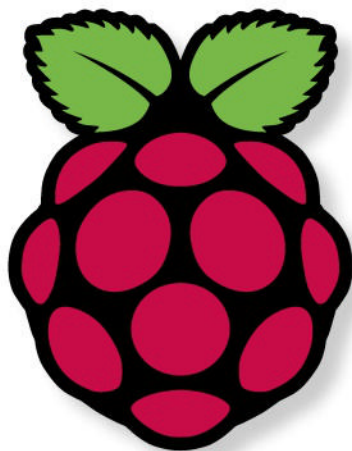


**STEP 10** Should you ever get stuck when using the various commands within a batch file, drop into the command prompt and enter the command followed by a question mark. For example, for /? or if /?. You get an on-screen help file detailing the commands' use. For easier reading, pipe it to a text file:

```
For /? > forhelp.txt
```







Your journey with this amazing little computer begins here. Say hello to the Raspberry Pi; learn how it works, what kind of operating system it has, what you need to get it up and running and much more. This is your first step into the world of the Raspberry Pi.

Here, you'll discover what makes the Raspberry Pi such a fabulous little computer and project board. There are guides to the hardware, operating system and what you'll need to begin with to start enjoying the software the Pi has to offer from your computer's desktop. Now let's see what this amazing computer has to offer.

What Pi is Right For You?

Raspberry Pi in Numbers

Kit You Need and How to Set it Up

Set Up Raspberry Pi Using a Mac

Set Up Raspberry Pi Using a Windows PC

The Raspberry Pi Desktop - What You Need

Debian Buster with Raspberry Pi Desktop



# Starting with Raspberry Pi





# Which Pi is Right for Me?

With several models of Raspberry Pi available to purchase, you can be forgiven for any confusion over which model you should buy. So, to help save you time and money, let's see which Pi is best for your needs.

## THE POWER OF PI

With many different versions across four generations of models, the Raspberry Pi is certainly a busy little board. But while each Pi offers something slightly different, for the newcomer it's a confusing medley of hardware specifications and model numbers. Which, Pi, then is best for you?

Naturally, that questions depends greatly on what it is you want to do with your Raspberry Pi. If you have a particular project in mind, such as a home media centre server, then you'd probably opt for the more powerful and hardware-capable model of Raspberry Pi. If you want to setup a wireless security camera project, using the Raspberry Pi as the core hardware, then perhaps the Pi Zero W would be a better fit. To begin with, let's have a brief look at the models available.

### FIRST GENERATION:

Although now quite old, in computing terms, the first generation Raspberry Pi models are still available to purchase. These are the Raspberry Pi 1 Model A+ and Pi 1 Model B+.

The Pi 1 Model A+ was released in November 2014, and replaced the original Model A. It features the now standard 40-pin GPIO, Micro SD Card, lower power consumption, and better audio circuitry. It's also a smaller package than the original Pi, while having a 700MHz processor and 512MB of memory.

While a worthy Pi, it does lack the built-in networking of its newer model counterparts; both Ethernet and Wi-Fi. The processor is somewhat lacking in the performance department, which can be an important factor if you are thinking of using this model for any serious CPU-related projects. In short, it's probably worth avoiding the Pi 1 Model A+.

The Pi 1 Model B+ is a far more capable design than its sibling Model A+. Released in July 2014, the Pi 1 Model B+ boasts built-in 100Mb Ethernet and four USB 2.0 ports.

It does, however, still feature the same lacklustre processor as the Pi 1 Model A+, but it's extra USB and Ethernet ports make up for any lack in available hardware.

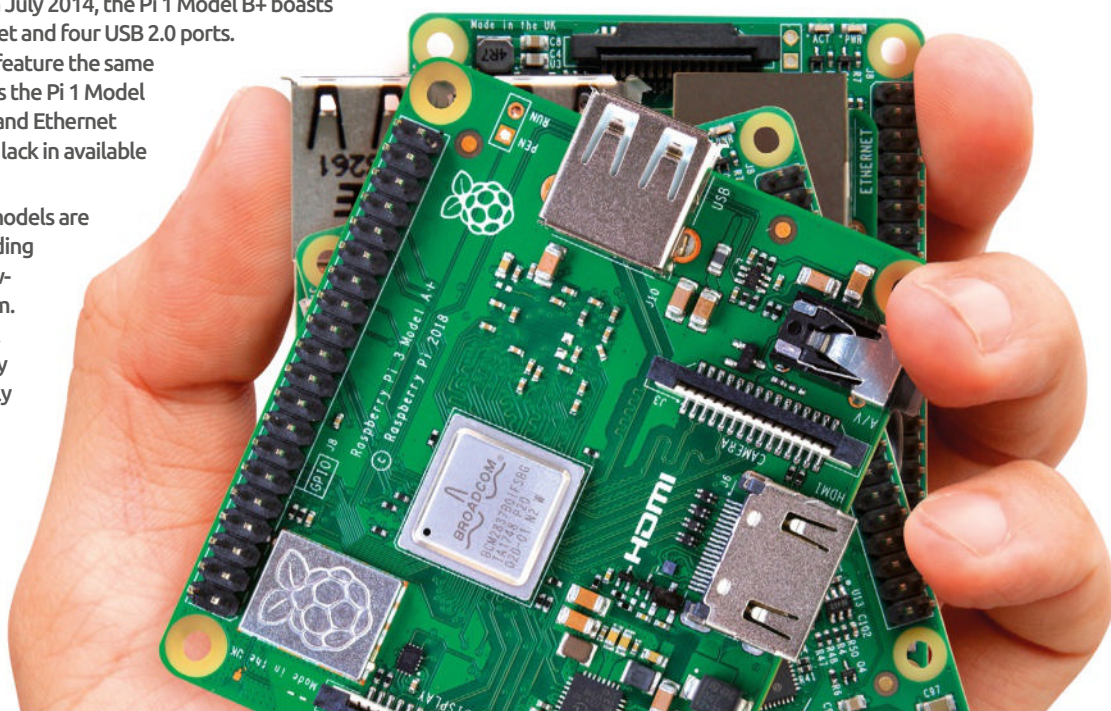
The first generation models are decent enough, providing you're doing some low-level project with them. Although you can pick them up from a variety of online stores slightly cheaper than the current models, they probably aren't worth the savings.

### SECOND GENERATION:

There are two Pi 2, second generation models available: the Model B and the Model B version 1.2. Although, you may be hard pressed to find an original Pi 2 Model B (without the 1.2 version), so we will solely refer to the Pi 2 Model B as the 1.2 version that was released mid-2016 instead.

The Pi 2 Model B offered the user a more powerful Pi experience. With 1GB of memory, an upgraded 900MHz quad-core ARM Cortex-A7 processor, and an improved HDMI port. As with the previous first generation Model B, this version also comes with a built-in 100Mb Ethernet port and four 2.0 USB port hub.

Overall, this is a better choice of Raspberry Pi over the first generation models. The extra processing power, even though it's only 200MHz, does make a difference, alongside the extra 512MB of memory, too. If you find one that's significantly cheaper than a more recent Pi, then it's worth considering.





## THIRD GENERATION:

The third generation Pi models are significantly more capable than the previous, but they may cost slightly more than the second generation model. However, you do get more Pi for your money.

The first third generation model to be released was the Pi 3 Model B, in February 2016. A newer quad core 1.2GHz Broadcom BCM2837 64-Bit processor, 1GB of memory, and a 4-pole stereo output and composite video port meant that this was the power-Pi to have. It's still a very good model to use, and can do most of the tasks its younger sibling, the Pi 3 Model B+ can do.

The second of the third generation models released was the upgrade to the Model B, the Pi 3 Model B+, released in March 2018. With an impressive 1.4GHz quad core processor, 1GB of faster LPDDR2 memory, dual frequency built-in Wi-Fi and a gigabit Ethernet port, the Pi 3 Model B+ is the most powerful Raspberry Pi to date, and will be capable of running all your projects without any problems.

The newest member of the third generation Pi models is the replacement for the second generation A+. Released in November 2018, the Pi 3 Model A+ enjoys the same processor as the more powerful Pi 3 Model B+, but has half the available memory, at 512MB. It also loses the Ethernet port, and three of the USB ports, but it does boast dual band Wi-Fi, and a far smaller footprint than previous models.

Out of the third generation models, the ones to look out for are the Model B+ and Model A+. The B+ will give you a more powerful Pi experience, but it costs slightly more. Whereas the Model A+ is much smaller, but lacks the extra memory and additional USB ports.

## FOURTH GENERATION:

Introduced on 24th June 2019, the Raspberry Pi 4 Model B is a significant leap in terms of Pi performance, and hardware specifications. It was also one of the quickest models, aside from the original Pi, to sell out.

With a new 1.5GHz, 64-bit, quad-core ARM Cortex-A72 processor and a choice of either 2GB, 4GB or 8GB memory versions, the Pi 4 is one-step closer to becoming a true desktop computer. In addition, the Pi 4 was launched with the startling decision to include dual-monitor support, in the form of a pair of two micro-HDMI ports. You'll also find a pair of USB 3.0 ports, Bluetooth 5.0, and a GPU that's capable of handling 4K resolutions and OpenGL ES 3.0 graphics.

In short, the Pi 4 is the most powerful of the current Raspberry Pi models. However, the different memory versions have an increased cost. The 1GB version costs £34, 4GB is £54, and the 8GB version will set you back £74. Remember to also factor in one or two micro-HDMI cables with your order.

## ZEROS:

In between the first and second generation Raspberry Pi models, the foundation launched the Pi Zero and Zero W.

The Raspberry Pi Zero was a significant release, as the extremely popular Pi was now even smaller. Measuring at just 65 x 30 x 5mm, the Zero still managed to pack in a single core 1GHz processor, 512MB of memory, a mini-HDMI port, micro USB port, 40-pin GPIO and a micro-SD card slot. However, it lacked wireless and other networking capabilities, so you would need to factor in a USB hub and network hardware.

The Raspberry Pi Zero W, on the other hand, is a far better choice. The processor and memory are the same, as are the other hardware items, but, as the W indicates, this model comes with wireless networking built-in. With a 2.4GHz single-band Wi-Fi module as well as Bluetooth 4.1, the Pi Zero W is an impressive slim bit of hardware.

While the Pi Zeros may sound like a logical choice, considering their far smaller footprint, they do lack the performance power of the newer third generation models. We'd recommend you opt for a Pi Zero W over the older Pi Zero, as networking is available out of the box.

In conclusion, the Pi 4 Model B is the main Raspberry Pi worth considering if you want the full Pi experience; use it for programming, gaming, projects, connectivity and so on. The Pi 3 Model A+ can be used for projects that require more power, but where a smaller size is needed. And the Pi Zero W for projects where a much smaller footprint and lower power draw are needed, and CPU performance isn't too important.

The Pi 3 Model A+ was released in November 2018 and greatly improves over the previous Model A.

The Raspberry Pi 3 Model B+ is one of the best Pi models available.

The Raspberry Pi Zero W, with built-in Wi-Fi and Bluetooth, is a great project Pi.

Of the Pi models available, we'd recommend the Pi 4 Model B, Pi 3 Model B+ and Pi Zero W.





# Raspberry Pi in Numbers

The Raspberry Pi was one of the most successful launches of a computer in decades. With the perfect mix of hardware, cost, connectivity, and development, plus a good, stable Linux OS to back it up, the Pi has proved itself to be a near-perfect educational platform. Here's some facts and figures for our favourite flavour of Pi.

## 3.14159265358979...



There's a Raspberry in Antarctica, where it's as cold as -42C (-45F)



It's estimated that over **250,000** young people every week are learning how to code with a Pi

There are over **2,500** Raspberry Pi Certified Educators



The Pi 4 is between three to four times more powerful than the Pi 3 Model B+

It is estimated that there are over 50,000 code clubs across the world using the Raspberry Pi



During the eruption of the Kilauea volcano in Hawaii in 2018, a Raspberry Pi was used as a seismometer

It was originally going to be called Raspberry Py, as it was only designed to run Python

Sources: The Raspberry Pi Foundation, The Guardian, readwrite.com, Popular Mechanics, CNN, BBC.





It was originally designed for school children to learn electronics and coding

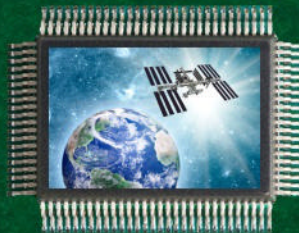


PI Zeros are used as small cameras, placed on the backs of Green Sea Turtles, to monitor habitation

February 2019 marked the point where the **25 millionth** Raspberry Pi was sold



There are several Raspberry Pi's in Borneo's Rainforests, monitoring biodiversity



In 2017 two Pi's went onboard the ISS and ran code developed by school children

The Pi 4 is powerful enough to run Windows 10 as a Thin Client



The two most used Pi projects are retro emulation and as a media centre

It is estimated that there are over 50,000 code clubs across the world using the Raspberry Pi.



Stacked end to end, all the Raspberry Pi's would be taller than the Empire State Building





# Kit You'll Need and How to Set it Up

The Raspberry Pi is as bare bones as a computer can get. You get a motherboard, but not much else. So you'll need a few extras to get it up and running but they're things you're likely to have or at least find it easy to get your hands on.

## ASK AROUND

The kit list required to set up a Raspberry Pi is pretty basic: keyboard, mouse, HDMI monitor, SD Card and an optional case. Many of these items you'll already have, but don't rush out and buy those you don't. Ask around to see if anybody you know has spares.

### STEP 1

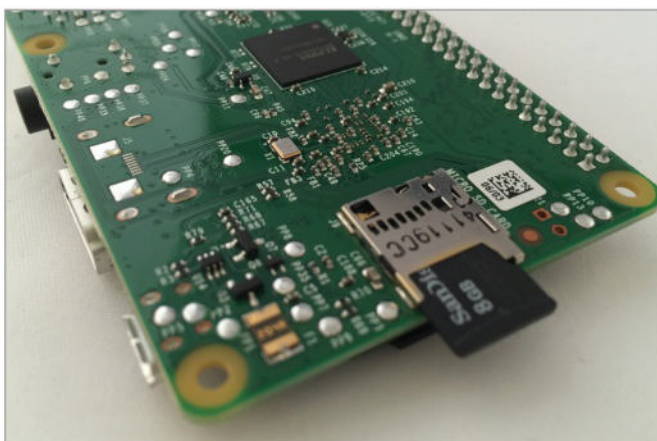
The most important thing you need is an SD Card.

These are the storage cards commonly found in digital cameras. All modern Raspberry Pi boards, including the Raspberry Pi 3 and Pi Zero, use Micro SD cards but the older boards may use a larger SD Card.



### STEP 2

The SD Card plugs into the SD Card socket. On the Raspberry Pi 4, 3, and Pi Zero, you push the card in and pull it out. On some older models, you push the SD Card in again to eject it. All SD Cards have a notch on one corner that ensures it only goes in one way round. Unless you bought a card with NOOBS preinstalled, you'll need to install the software on it first.



### STEP 3

You'll need a HDMI cable to connect your Raspberry Pi to a monitor or television set; these cables are used with modern televisions and video game consoles, so you shouldn't find it too hard to pick up a spare. If you own a Pi Zero, or you've got a Pi 4, you'll need a micro-HDMI cable in order to connect to a monitor or TV.



### STEP 4

You'll want to connect your Raspberry Pi to the Internet. The Raspberry Pi 4 and Pi 3 Model B+, have built in wireless networking and Ethernet. The Model A+ and Raspberry Pi 2 include an Ethernet socket, but the Pi Zero and older boards will require either an Ethernet adaptor or a Wi-Fi dongle to get online.



**STEP 5**

Both the Pi 4 and 3 come with four USB sockets but if you own a Pi Zero, you may need to purchase a USB Hub. These connect into the USB socket, and provide four (or more) USB connections. Typically, you need to connect a keyboard and a mouse, so at least two USB ports are required.

**STEP 6**

Two things that should be easy to find are a USB Keyboard and USB Mouse. We routinely prefer USB devices that plug directly into the Raspberry Pi, but devices with wireless dongles generally work just as well. Only the Raspberry Pi 4 and 3 Model B+ come with Bluetooth as standard, so you're best bet is to opt for USB, if possible.



You can also choose to house your Raspberry Pi in one of many enclosures like the official one pictured here.

**GETTING EVERYTHING CONNECTED**

Now that you've got all the basics you'll need to get everything set up. If you haven't installed the NOOBS files on your SD Card, then it's best to do that first (see the next few pages).

**STEP 1**

Connect your Raspberry Pi to the monitor using the HDMI cable. Now attach the keyboard and mouse to separate USB ports. If your Raspberry Pi only has one USB port, connect the mouse and keyboard to the USB hub and attach it.

**STEP 2**

Now, if required, connect the Ethernet cable to the Raspberry Pi. Connect the other end of the cable directly into your modem/router or into a network socket.

**STEP 3**

Finally connect a Micro USB cable to the power supply and attach the other end to a 5V USB power adapter. This is the type used to power most modern smartphones, so you should be able to source a spare. Press the On button to power up your Raspberry Pi.

**STEP 4**

Consider a case to hold your Raspberry Pi together. Raspberry now makes an official case that you can use to hold all the components and protect it from knocks and drops.



# Set Up Raspberry Pi Using a Mac

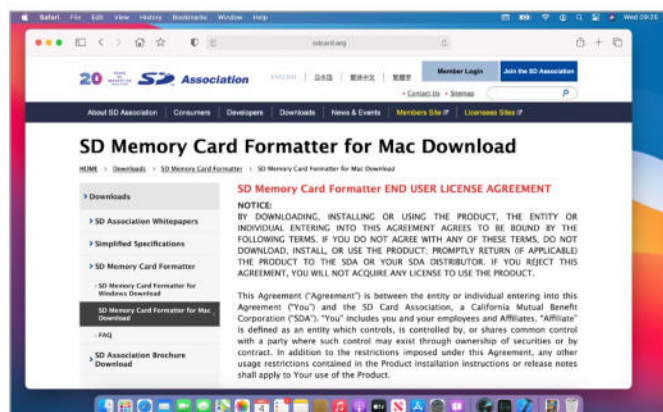
You should install NOOBS (New Out Of Box Software) on your SD Card before you go any further. This feature looks at how to format an SD Card and copy the software using an Apple Mac computer.

## GETTING TO KNOW NOOBS

The easiest way to get up and running is to use NOOBS, a software program created by the Raspberry Pi Foundation. You can buy a NOOBS SD Card from Raspberry Pi but it's easy to make your own with an old unused SD Card (8GB recommended).

### STEP 1

We're going to use a utility called SD Card Formatter 5 to erase the SD Card with correct formatting. You can download this app from [https://www.sdcard.org/downloads/formatter\\_4/](https://www.sdcard.org/downloads/formatter_4/). Click Download SD Formatter for Mac and Accept. Click the SDFormatter.pkg file in your Downloads folder and follow the instructions to install the app.



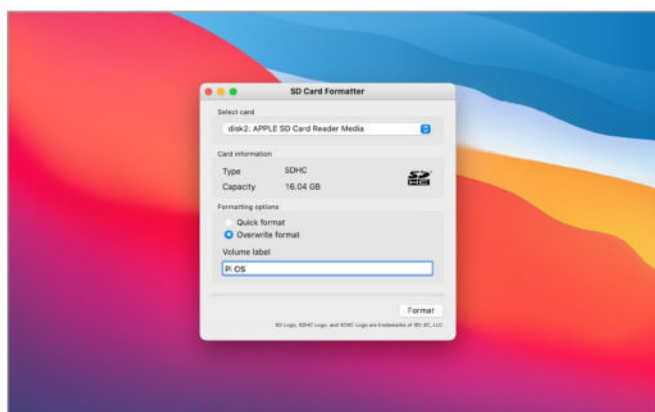
### STEP 2

Use an SD Card of at least 8GB capacity to install the operating system on your Raspberry Pi. The card needs to be formatted, which will erase all the data on it, so make sure you have copied any files from it you want to save. Insert the SD Card into your Mac, either directly into the SD Card slot or with an SD Card adaptor.



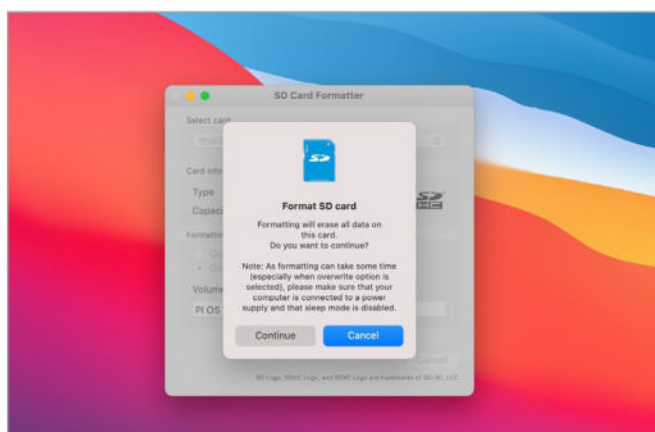
### STEP 3

Make sure the card is present in the Select Card area; you should only have one SD Card inserted into your Mac. Open SDFormatter and choose the Overwrite Format option to ensure that all the old data is removed from the card. Enter a name for the card in the Name field to help you identify it; although this isn't necessary for the installation process.



### STEP 4

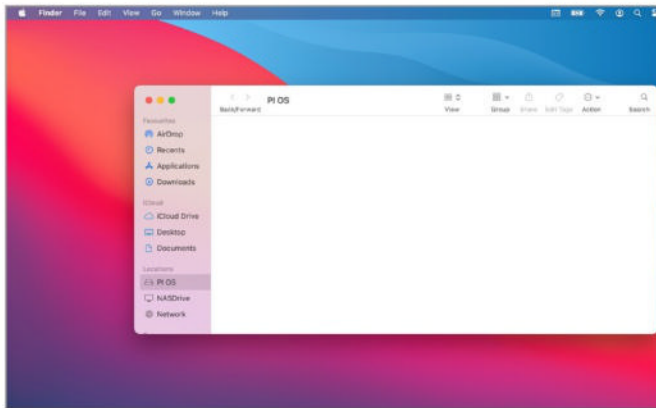
Click the Format button when you are ready to wipe the card. There are other ways to Format SD Cards in macOS (in particular Disk Utility) but the advantage of SD Card formatter is that it wipes SD Cards with the correct FAT32 format and doesn't affect the protected partition. It can take a while to format the SD Card, but the progress bar will show you how the process is going.





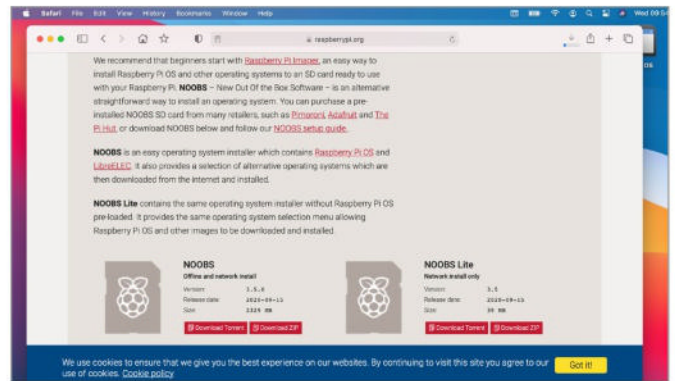
## STEP 5

When SD Card formatter has finished formatting the SD Card it will be mounted so you can access it. By default mounted volumes appear as an icon on the desktop. If not open a new Finder window and check for it under Devices. Check that the SD Card is accessible and click Close in SDFormatter.



## STEP 6

Now it's time to download the NOOBS software from the Raspberry Pi website. Open Safari and enter [www.raspberrypi.org/downloads/](http://www.raspberrypi.org/downloads/) into the Smart Search Field. Scroll down to find the NOOBS section (not NOOBS LITE) and click Download Zip. A zip file containing the NOOBS files will be placed in your Downloads folder.

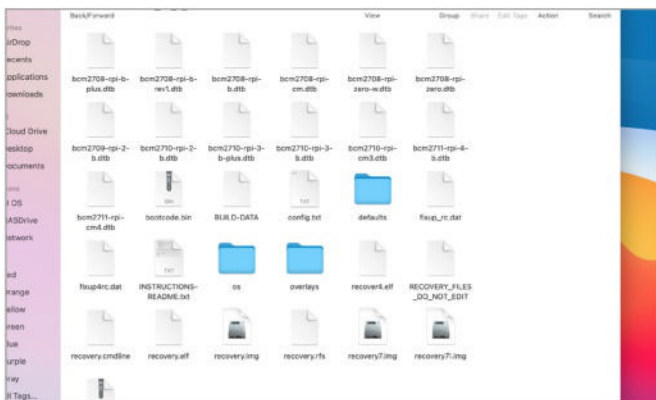


## COPY THE SOFTWARE

Transfer the NOOBS files to your SD Card to continue the setup process.

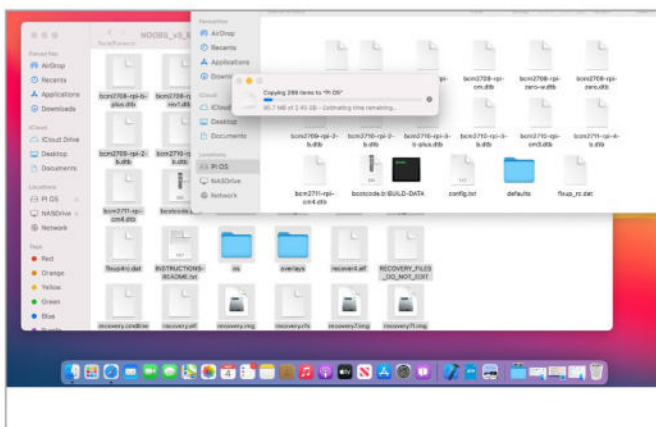
## STEP 1

Open the Downloads folder and click on the NOOBS zip file to unzip it. A NOOBS folder should appear in your downloads; it will be marked with the version number you downloaded from the Raspberry Pi Downloads page. Click on the folder to open it and view all the files contained inside.



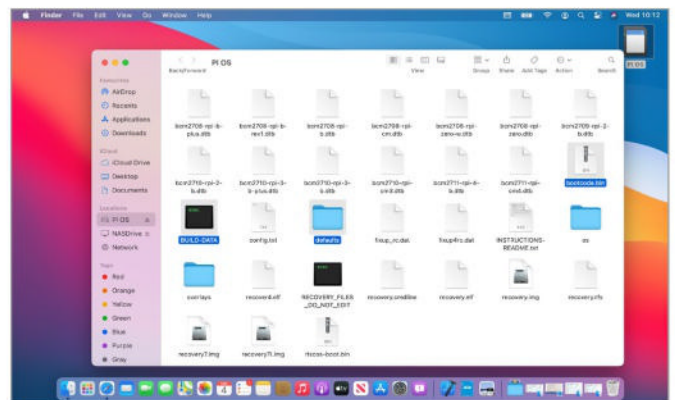
## STEP 2

Press Command-A to select all the files inside the NOOBS folder. Now drag and drop all the files from the NOOBS folder to the SD Card. This will copy all of these files to the root (the base) of the SD Card. Make sure you copy the files and not the NOOBS folder containing them.



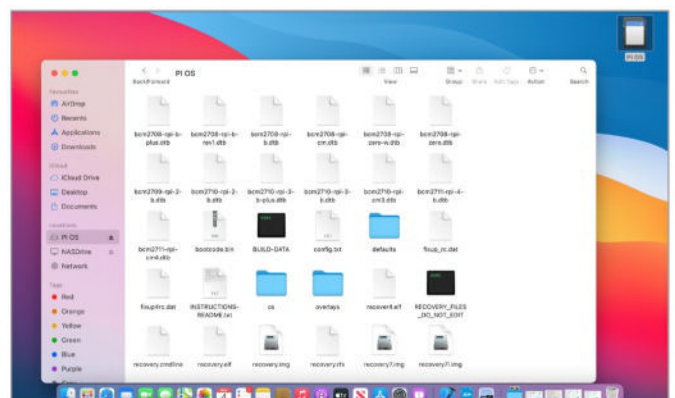
## STEP 3

Wait for all of the files to be copied from your Downloads folder to the SD Card. After the files have finished copying open the SD Card and check that all of the files are in the root. You should see "bootcode.bin" and "BUILD-DATA" files, and a "defaults" folder among other files.



## STEP 4

Make sure you eject the SD Card properly. Do not just remove it from the Mac. Instead, drag the SD Card icon to the Trash to eject it from your system. Or open a new Finder window and locate the SD Card under Devices, click the small Eject icon next to it. Now remove the SD Card from your Mac. It is ready to be inserted into your Raspberry Pi.







# Set Up Raspberry Pi Using a Windows PC

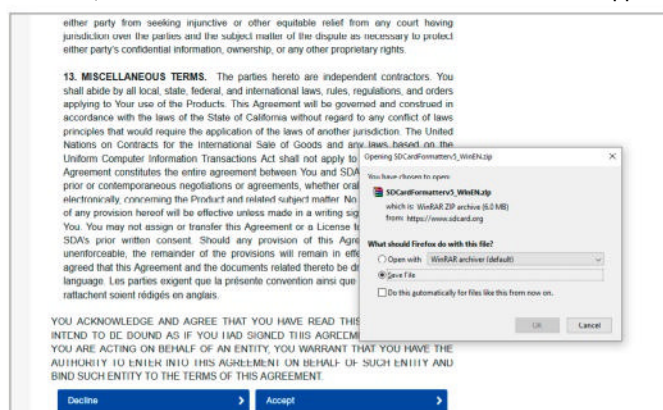
It's easy to set up your Raspberry Pi with a Windows PC by downloading and copying NOOBS. This installs a selection of OS's onto the Raspberry Pi. So let's format your SD Card and install NOOBS using a Windows PC.

## SETTING UP WITH NOOBS

NOOBS (New Out Of Box Software) is a program used to make setting up a Raspberry Pi simple. You can buy SD Cards with NOOBS preinstalled, but here we'll look at how to format your SD Card and install NOOBS using a Windows computer.

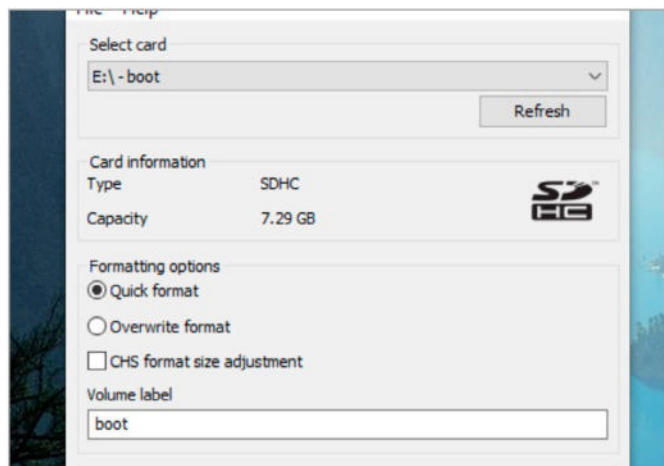
### STEP 1

We're going to use a utility called SD Card Formatter to erase the SD Card with correct formatting. You can download this app from [https://www.sdcard.org/downloads/formatter/eula\\_windows/index.html](https://www.sdcard.org/downloads/formatter/eula_windows/index.html). Click the Accept button to start the download of the latest version of the software. Extract the software, and double-click the executable to install and run the app.



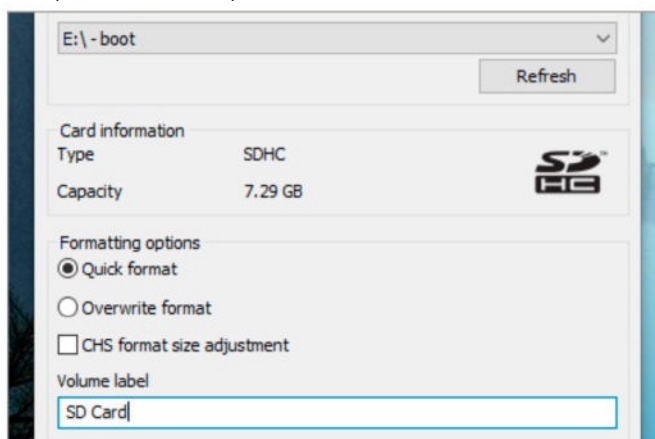
### STEP 2

We're going to use an 8GB SD Card to install the operating system on our Raspberry Pi. The card needs to be formatted, which will erase all the data on it, so make sure you have copied any files from it you want to save. Insert the SD Card into your PC, either directly into the SD Card slot or using an SD Card adaptor.



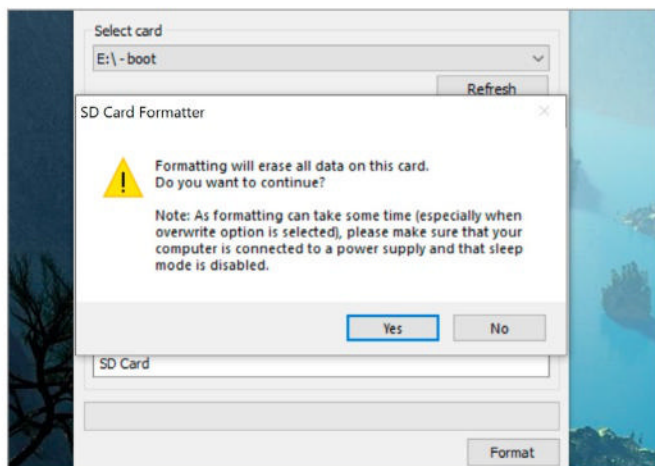
### STEP 3

The Drive letter will be automatically assigned depending on the drive(s) in your PC. Click Refresh if it can't find your SD Card. Ensure the Quick Format option is selected. Enter a name in the Volume Label field to make it easier to identify the card (we used "SD Card").



### STEP 4

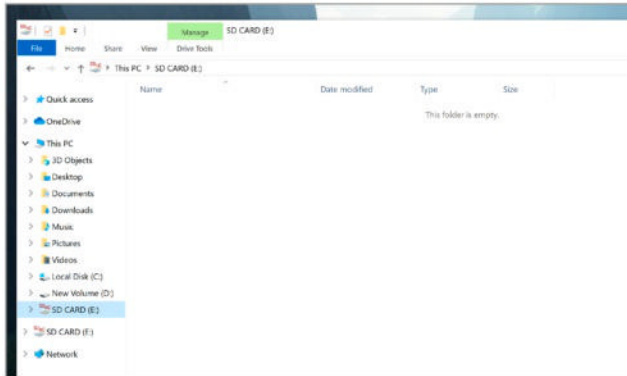
Click the Format button and Yes when you are ready to wipe the card. There are other ways to format SD Cards in Windows, but the advantage of SD Card formatter is that it wipes SD Cards with the correct FAT32 format, and doesn't affect the protected partition. Click OK again, when the format is complete.





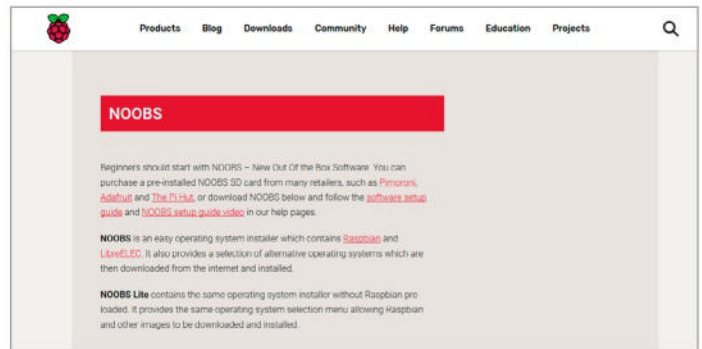
## STEP 5

Click Exit to close down the SDFormatter program. Click Start > File Explorer and choose the SD Card in the sidebar. The drive should be empty, but we will copy the files to it in the next steps. For now just make sure that you can access the empty root of the SD Card.



## STEP 6

Now it's time to download the NOOBS software from the Raspberry Pi website. Open a web browser and enter <https://www.raspberrypi.org/downloads/noobs/> into the URL field. Scroll down to find the NOOBS section (not NOOBS LITE) and click Download Zip and Save. A zip file containing the NOOBS files is copied to your Downloads folder. Click Open Folder when it is done.

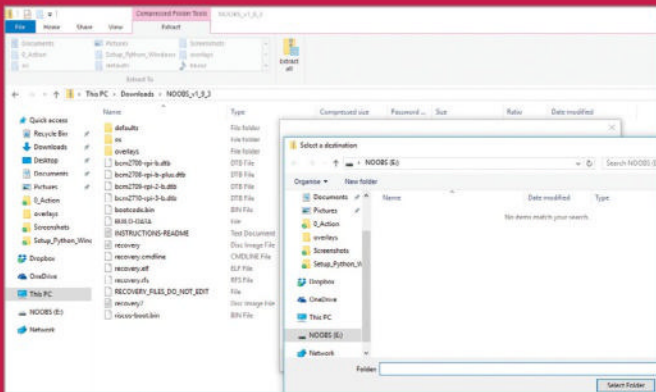


## COPY THE SOFTWARE

Continue making your SD card by copying the files across.

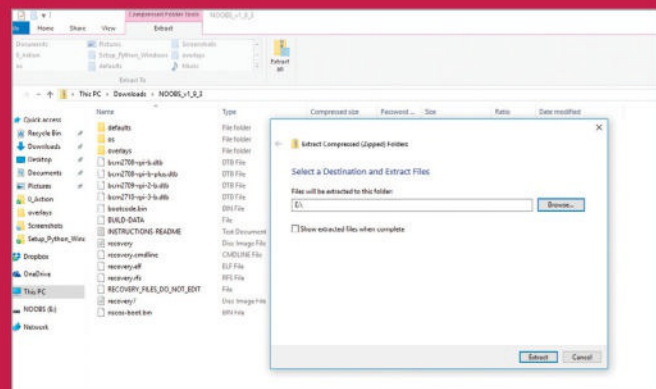
### STEP 1

A NOOBS folder should appear in your downloads. It will be marked with the version number that you downloaded from the Raspberry Pi Downloads web site. Double-click the NOOBS zip file in your Downloads Folder to view the contents. These are the files you need to copy to the root (base) of your SD Card.



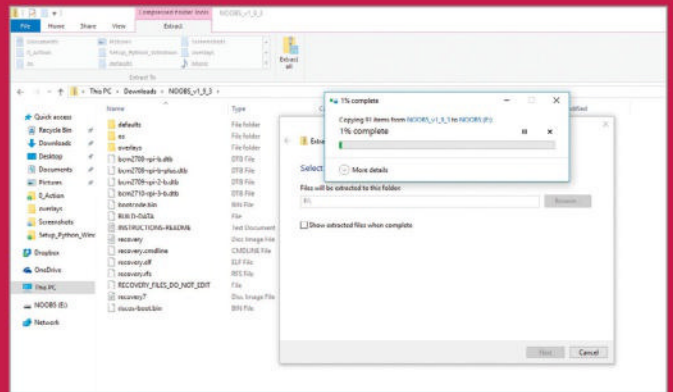
### STEP 2

Click Extract All to expand the zipped file and extract its contents. Click Browse in the Select a Destination and Extract Files folder and choose "SD Card(F:)" in the Select a Destination window. Click Select Folder and Extract. The files will now be copied directly from the zip file to your SD Card.



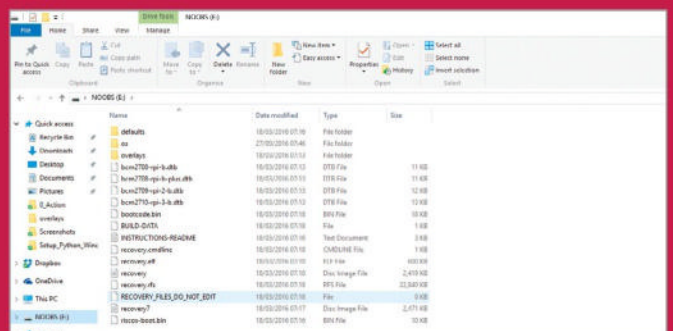
### STEP 3

Wait for all of the files to be copied from your Downloads folder to the SD Card. The files that are copied will install an operating system of your choice on the Raspberry Pi when you first boot it up. It is important that the files are copied to the root (base) of the SD Card and are not inside another folder such as the NOOBS folder.



### STEP 4

Click Start > File Explorer and choose "SD CARD (F:)" in the sidebar to display the contents. It should now contain all the files NOOBS needs to setup an operating system on your Raspberry Pi. Check that you can see a Defaults folder, bootcode and BUILD-DATA files along with the other files shown here. Remove the SD Card from your Windows PC. It's now ready to be inserted into the Raspberry Pi.





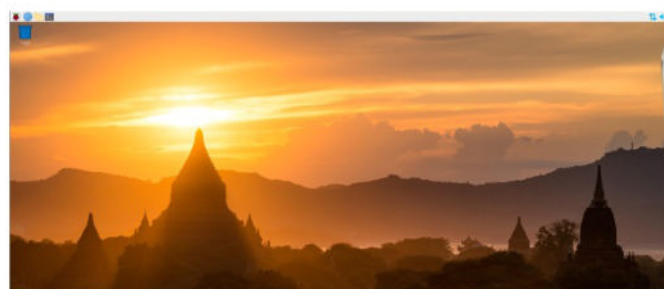


# The Raspberry Pi Desktop: What You Will Need

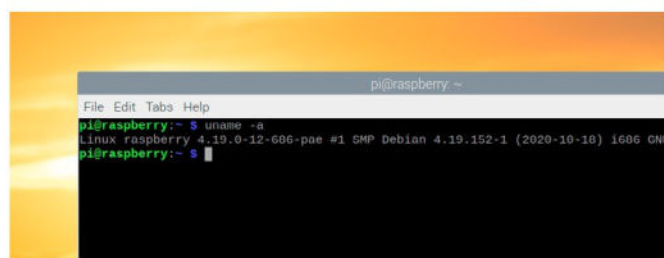
Did you know that there is a way in which you can run the full Raspbian OS desktop without even needing a Raspberry Pi? The Raspberry Pi Desktop edition is a fully working, Debian-based installation of Raspbian that can run on a standard PC.

In 2016, the Raspberry Pi Foundation started work on an x86 version of its popular Raspbian operating system. By the end of the following year, there was a link on the Downloads page and non-Pi owners could now install and use Raspbian in almost the exact same way as if they were in front of a Raspberry Pi.

Since then, the Raspberry Pi Desktop, or as it's correctly called: Debian Stretch with Raspberry Pi Desktop, has followed the same release path as its Pi-based sibling. However, there are some differences you need to be aware of prior to throwing your Pi away and opting for this version instead.



The Raspberry Pi Desktop (x86 version) allows you to view the same desktop and pre-installed software as the Full Desktop version available for the Raspberry Pi. You can install it on any decent PC, or laptop, one that's at least six or seven years old would be perfect and as a PC that age usually struggles with the latest version of Windows 10, you can now install Raspbian instead of boxing that old kit and resigning it to a life of gathering dust in the loft.



The major difference is that this version has been compiled to run on x86 processors, that's Intel and AMD PC processors. Whereas, the version of Raspbian that you will find on a Raspberry Pi has been compiled and created exclusively for ARM processors; the type of CPU a Raspberry Pi uses. These CPUs use a different architecture to that of an Intel or AMD CPU, so the software required to run on one won't run on the other unless the developer has specifically made either an x86 or ARM version. In short, if you've found a piece of software that you enjoy using on your Raspberry Pi, you won't be able to use it on the Raspberry Pi Desktop x86 version – UNLESS, there's a dedicated x86 version of the software.



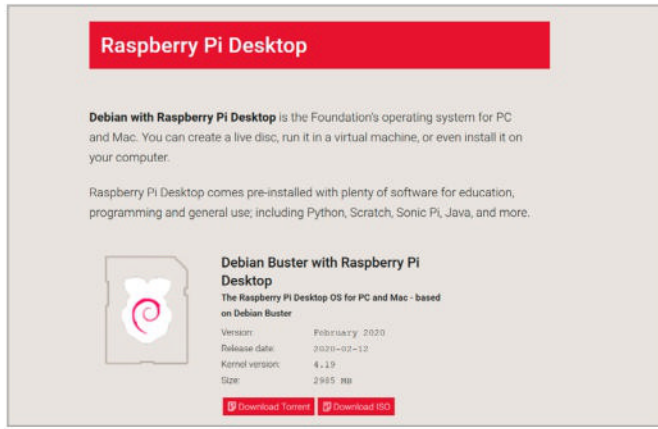
Another caveat worth mentioning is that you won't have access to the 40-pin GPIO that the Raspberry Pi features, as this isn't a standard piece of hardware on a normal PC. There is, however, a way around this. If you own a Raspberry Pi Zero (either with or without the W), then you're able to connect the Zero to a spare USB port on the PC, via the Zero's micro USB port and the Raspberry Pi Desktop OS will recognise the Zero as extended hardware and allow you access to the Zero's 40-pin GPIO, which, you have to admit, is pretty clever stuff.



## WHAT YOU WILL NEED

Here's a list of items needed if you want to test out the latest version of the Debian Stretch with Raspberry Pi Desktop OS on your PC.

**THE OS** Naturally you'll need the Raspberry Pi Desktop OS, just as you would with Raspbian or the Pi. Open a browser and download the ISO file that contains the OS from: <https://www.raspberrypi.org/downloads/raspberry-pi-desktop/>.



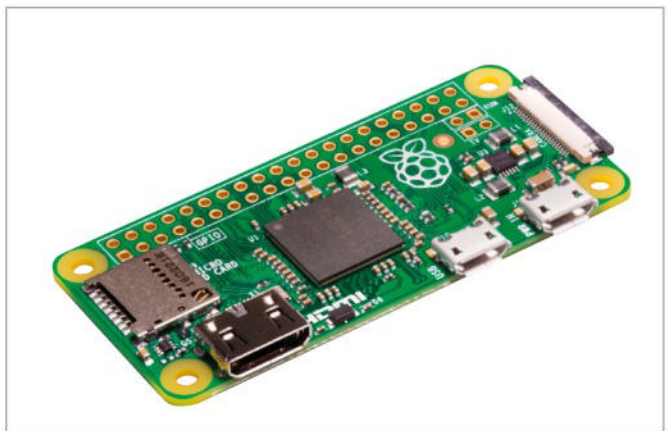
**USB STICK** The best method of transferring the ISO to a PC for installation is to use a combination of a tool such as Rufus (found at: [https://rufus.ie/en\\_IE.html](https://rufus.ie/en_IE.html)), which is a piece of software that can create a bootable USB driver from an ISO file and, at least, an 8GB USB stick.



**A COMPUTER** An older desktop PC or laptop is an ideal candidate for running the Raspberry Pi Desktop OS. While you can easily use the latest PC/laptop, it's a bit overkill for this particular operating system.

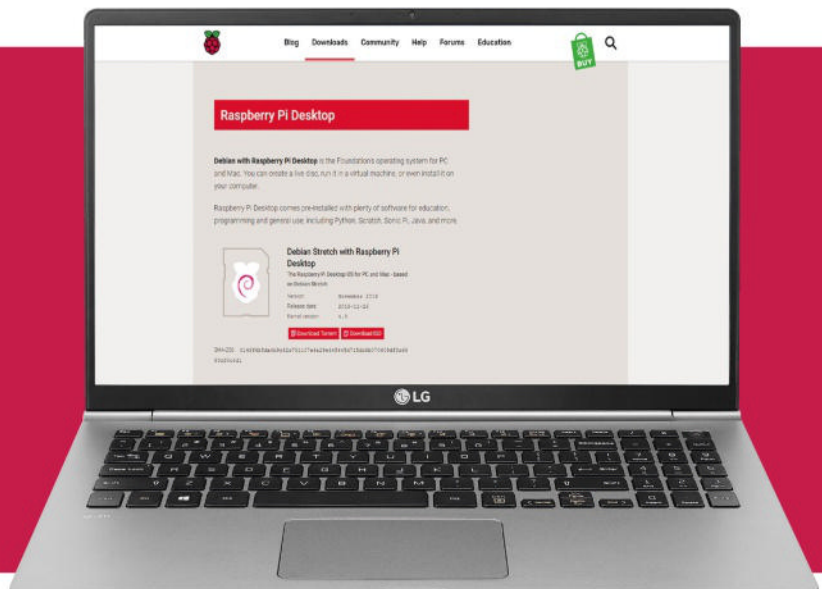


**RASPBERRY PI ZERO** Although not strictly a necessity, a spare Raspberry Pi Zero will allow you to access the 40-pin GPIO from within the Raspberry Pi Desktop OS. If, however, you don't have a spare Zero, it's not a problem as there's still plenty you can do with Raspbian on a PC.



## HOW TO SET UP THE RASPBERRY PI DESKTOP

Setting up the Raspberry Pi Desktop version on a PC or laptop is very simple, and follows roughly the same method as the previous Mac and Windows setups for the Pi. Begin by downloading the ISO image from <https://www.raspberrypi.org/downloads/raspberry-pi-desktop/>, then download Rufus from [https://rufus.ie/en\\_IE.html](https://rufus.ie/en_IE.html). Insert an 8GB USB stick and run Rufus, then follow the on-screen instructions to locate the downloaded Desktop ISO. Once the image has transferred to the USB stick, remove it from the computer and insert it in the spare laptop/PC. Select **Boot from USB** from your system's BIOS/UEFI then follow the instructions to use and install the Raspberry Pi Desktop OS.







# Debian Buster with Raspberry Pi Desktop

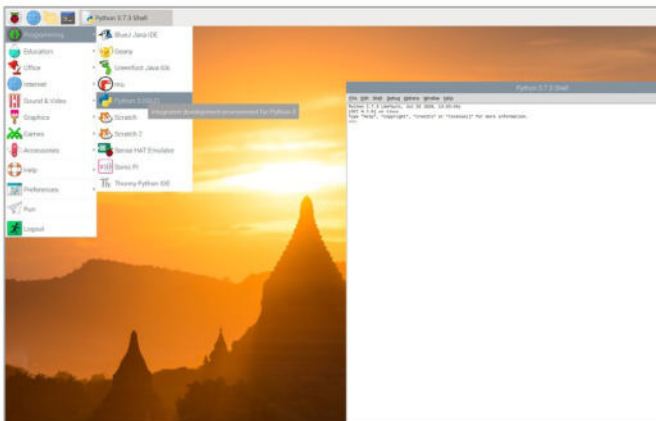
You can be forgiven for thinking that a version of the Pi OS that isn't on a Raspberry Pi is somehow lacking, and therefore a bit pointless in its use. However, there's a lot that you can do with the Debian Buster with Raspberry Pi Desktop version.

## 10 THINGS TO DO WITH X86 RASPBERRY PI OS

There's just as much you can do with this version of Raspberry Pi OS as with the dedicated Pi version. Here's ten great projects, and things to do with Debian Buster with Raspberry Pi Desktop.

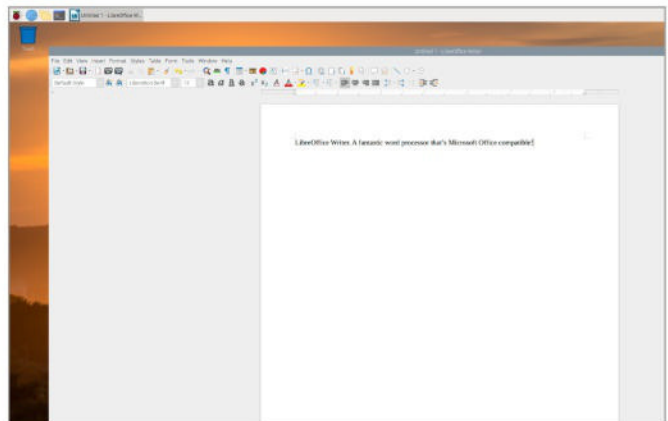
### CODING

This version of Raspbian apes the Full Desktop version for the Raspberry Pi, so that means it comes with all the necessary programming languages out of the box. Learn Python, C++, use the HAT emulator, and even learn JAVA. It's all there under the Programming menu option.



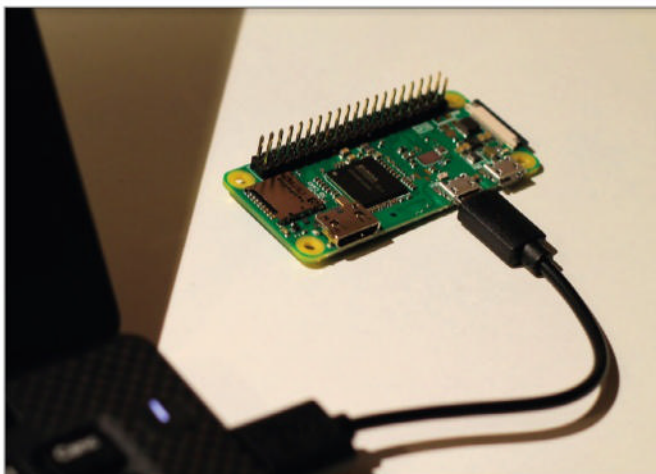
### FULL DESKTOP

As the x86 version of Raspbian follows the Full Desktop Pi version, there's an entire office suite pre-installed. That means you can use that old laptop or PC as a fully functional desktop replacement for Windows or macOS. LibreOffice is also Microsoft Office compatible.



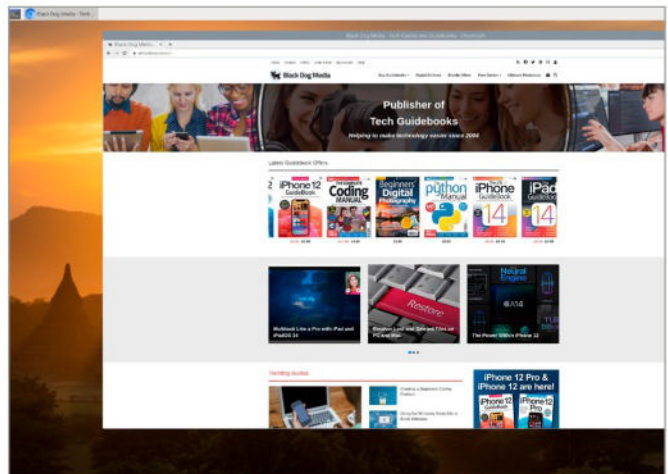
### HARDWARE

Hook up a Pi Zero without an SD installed, and select GPIO Expansion Board from the options, and you will be able to talk to the Zero's 40-pin GPIO via the likes of Python or Scratch. By doing so, you'll have all the benefits of a Raspberry Pi, with the power of your laptop.



### WEB BROWSING

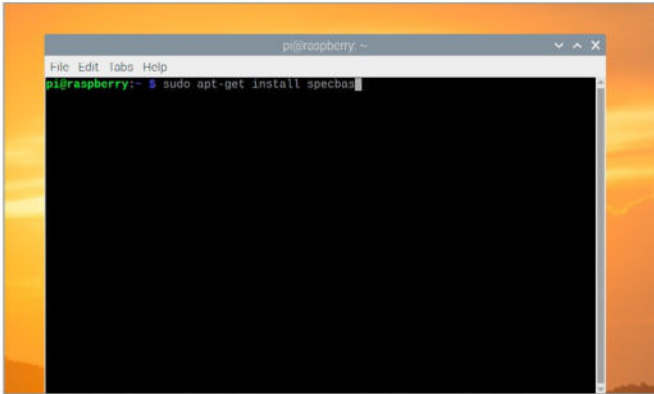
As with most modern operating systems, you can also browse the Internet exactly the same as you would with the likes of Windows 10 or the latest macOS. As this is a Linux-based OS, there's also an added element of security, as Windows-targeted viruses won't affect it.





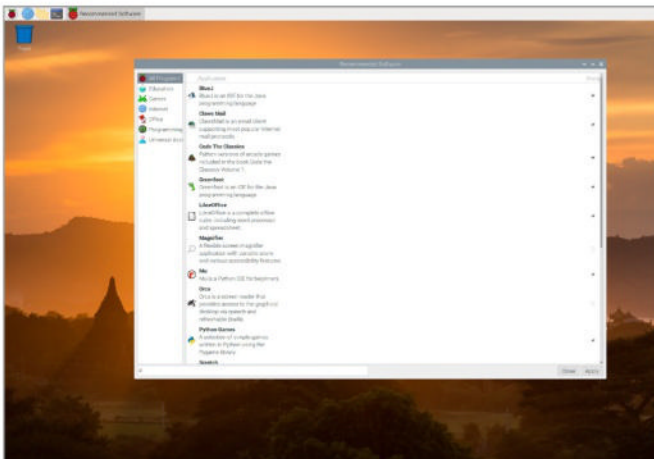
## LINUX X86-BASED SOFTWARE

As this is a Debian based version of Linux, you can naturally install any of the tens of millions of Linux x86-based software currently available. Remember though, only software that has both an ARM and an x86 version will work on both the Pi version and this version of Raspberry Pi OS.



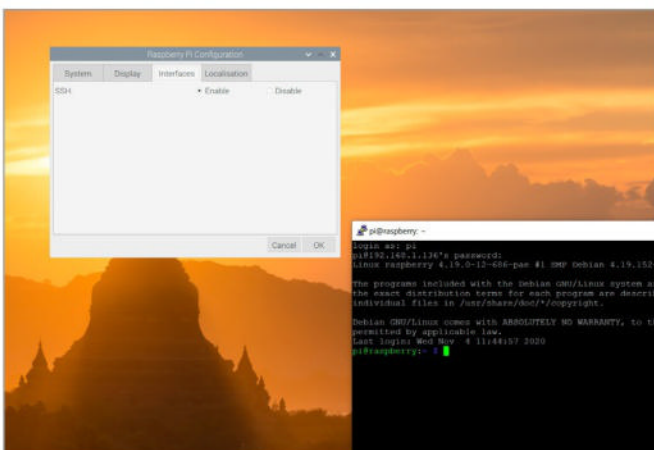
## RECOMMENDED SOFTWARE

The Recommended Software option is also available with the version of the PI OS. This tool allows you to pick and choose which of the Pi-favoured software you can add or remove. Simply tick the box next to the name of the app.



## SSH

It's easy to use SSH from within the Raspberry Pi Configuration tool. Select the Enabled option, then use a client such PuTTY to SSH into the OS. Here we've enabled SSH and have connected from another Windows PC, using PuTTY as the SSH client.



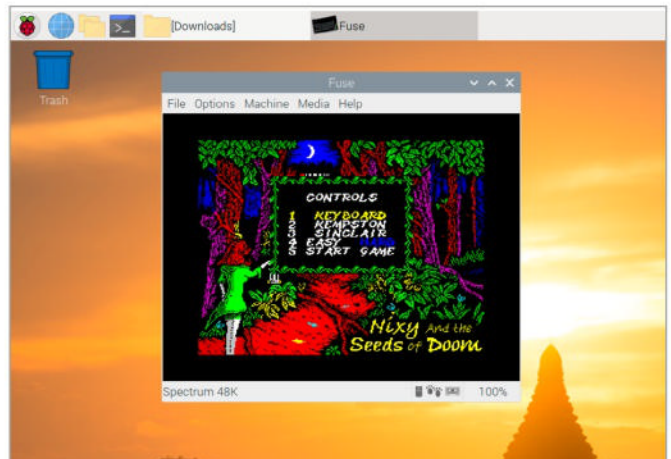
## MINECRAFT

The Raspberry Pi, even the Pi 3 Model B+, isn't the most powerful computing device available. Your older laptop is probably significantly more powerful, and as such, you will be able to play the likes of Minecraft without too much trouble.



## RETRO GAMING

If retro gaming is more to your tastes, then Debian has a huge number of retro emulators available covering consoles and home computers. You will need legal ROMs, however, to play the games, but these are widely available from reputable sites.



## GAMING

Of course, there's also an equally large selection of modern gaming available for Debian; most of which will run perfectly well under the Pi OS in an x86 environment. You will need to Google what's available, and try out a few examples, the list is simply too big to mention.





# Tech Round-Up

If you're looking for something different for your device, this is the place to start. Each issue, we take a look at some of the best and worst peripherals, gadgets and apps that have crossed our path.



## Hardware

STM ChargeTree Swing

I1601P AOC 16 LCD Monitor

AirLit Smart Fan

HaloLock Adjustable Wireless Charging Stand

Cubbit Cell

Groov-e Jazz Buds

ESR Gear HaloLock Kickstand

## Software

DxO PhotoLab 5

DxO FilmPack 6

AKVIS Magnifier AI 11

HUMANITY app

Motif Photo Canvas Service

Cloud Battery

## Games

SpongeBob Patty Pursuit

Double Dragon Trilogy

Pokemon UNITE

Zombie Night Terror



# STM ChargeTree Swing Charging station

Charge three, with Qi!

**Info//**

**STM Ltd.**

**[www.stmgoods.com](http://www.stmgoods.com)**

**£69.95, \$79.95, TBA €**



**T**his second-generation STM ChargeTree makes a few minor, but welcome, changes from the original model. Like the original ChargeTree it's available in black or white, and it once more charges a Qi-compatible iPhone, AirPods (with a wireless charging case), and an Apple Watch – all at the same time, using only one power socket. You just need a USB-C mains adapter of at least 20W. It's not supplied, but they're not hard to come by. As before, you charge your iPhone by resting it on the backward-leaning mat at the front of the ChargeTree Swing. It's comfortably cushioned, and there's an optional rubber raiser to fit over the foot if you have a smaller iPhone that needs the extra height. Also as before, your earbuds



sit on a charging pad mounted horizontally on the stand. As it's designed with Apple fans in mind, this is intended for wireless-charging AirPods, though there's no reason a third-party set of earbuds shouldn't charge there, as long as they have a wireless-charging case. Mine, for instance, do.

### Leading the charge...

The main change from the previous ChargeTree is the way it handles the Apple Watch. This is now charged on an extending arm, which can be retracted when not in use. It looks much smarter there, and if you want to know the time, you can just nudge your desk or bedside table to illuminate the watch face. Like the original ChargeTree, this one can charge an Apple Watch

Series 2 or later; the first-generation device not being Qi-compatible.

But our favourite change is the way the lights that indicate your tech is charging work. As before, there are three LEDs in the foot of the ChargeTree Swing, one for each device. When you place your iPhone, Apple Watch and/or your earbuds on its charger, a corresponding LED lights up to let you know it's correctly seated and charging. But now these lights go off after a few seconds. At last, you can use a ChargeTree in your bedroom without being kept awake by always-on illuminations. The original ChargeTree was good, but the sleep-destroying LEDs and inability to see the watch face from your pillow were serious oversights. The new STM ChargeTree Swing corrects both these faults, and lets you use it however you want, including on the bedside table.



# I1601P AOC 16

## LCD Monitor

Is this portable screen a worthy addition to your travel bag?

### Info//

AOC  
<https://eu.aoc.com/en>  
 £199, \$199, 239 €



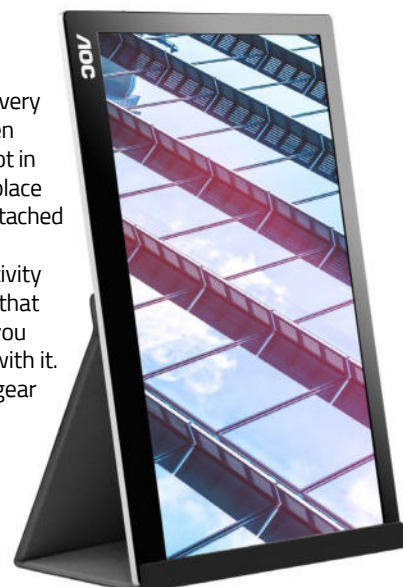
**T**he problem with working away from home on your notebook is you've probably got no access to a second monitor. Sure, there's your iPad using the Sidecar feature, but do you miss the high-definition, 16-inch behemoth you have on your desk? This portable screen from AOC is designed to fill precisely that gap.

The I1601P (why must monitor manufacturers use such boring names?) is 15.6 inches corner to corner and has a resolution of 1920x1080 (1080p). Not a match for your 3072-by-1920 16-inch Retina MacBook Pro, but it's a decent screen in its own right. One area where it can't compete with Apple's screens is the colour gamut. Whereas the current range of Mac notebooks all support millions, and possibly a billion, colours, the AOC external screen can only manage 262 thousand. Fine for general computing, spreadsheets, word processing and other mobile-office tasks, but graphic designers should use it for notes and tool windows, keeping the actual designs on the Mac's screen.

### USB, See?

Weighing in at 800g and measuring just 37.5x23.5x0.7cm, the I1601P is very portable. It has a useful kickstand which attaches to the back of the screen magnetically, and can hold it in portrait or landscape orientation. When not in use, the kickstand folds flat and acts as a screen protector, again held in place magnetically. The screen draws its power from the device to which it's attached too, so there's no bulky power brick to carry around.

This leads us to the screen's main drawback. It only has one connectivity method. Basically, this monitor is only for notebooks with USB-C ports that offer DisplayPort over USB, which includes Thunderbolt Macs, though you might need a Thunderbolt cable instead of the USB-C cable that came with it. You can even use it with an iPad Pro (mirrored screen only), but if your gear is too old for this connectivity, this monitor is not for you.



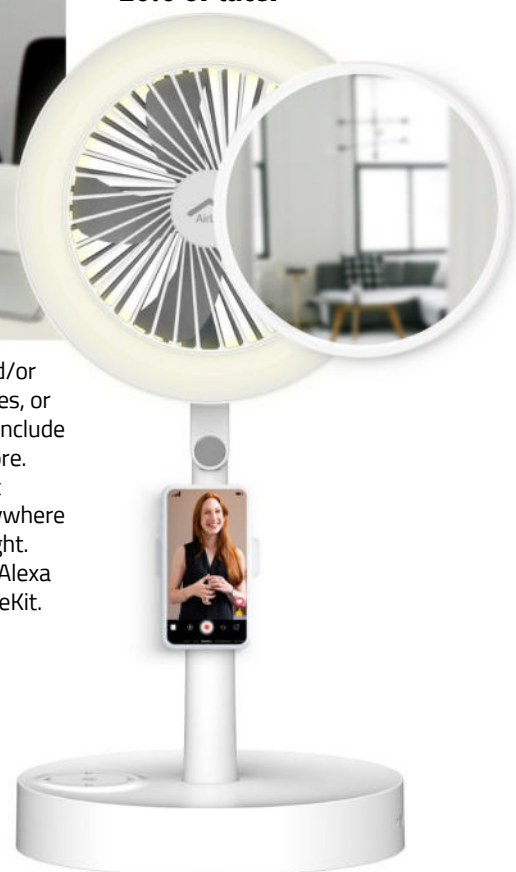
# AirLit Smart Fan Desk Fan

Don't sweat it – AirLit is here!



## Info//

**GeoSmartPro**  
**www.geosmartpro.com**  
**£89.99, \$119.99, 99.99 €**  
**Compatibility: iOS 10.0 or later**



**B**ritish start-up GeoSmartPro specialises in smart-home gadgets. Its latest release is AirLit, a n iPhone app-controlled smart fan that's packed with extra features.

As a fan, it's 44cm high with its telescopic stand retracted, or 100cm with it extended. The fan itself is 45cm wide. An eight-hour battery in the stand means you can use it all day without mains power, or you can plug it into a mains adapter using a USB-C cable. You can control the fan using your iPhone and the GeoSmartPro app. Use your phone to switch it on (obviously), set its wind speed to one of four levels and more. On the lowest setting it's very quiet, and even when pumping out as much air as possible, it's not all that loud as fans go.

### LED of the Rings

There's a ring of LEDs surrounding the fan, which you can also switch on using the app. You can also change the colour temperature, but not the colour itself; white LEDs only. And there's a mirror you can place over the centre of the device. It attaches magnetically and allows shadow-free make-up application with the lights on your face, but not in your eyes. There's a phone holder thrown in for good measure too. It clips on the telescopic stand in portrait or landscape mode, and with the lights switched on, it makes for a perfectly illuminated video chat. And if you need a ring light for photography, you can use it for that too.

Naturally, being a smart device, you can set

up automatic routines to have the fan – and/or its lights – turn on and off at scheduled times, or when the weather changes. The latter can include humidity, temperature, wind speed and more.

GeoSmartPro AirLit Smart Fan is a great addition to anyone's bedroom, study or anywhere else where you need a decent fan or ring light. Our only complaint is while it's Google and Alexa compatible, it doesn't play nicely with HomeKit.





# HaloLock

## Adjustable Wireless Charging Stand

One-touch mounting, convenient charging...

### Info//

ESR Gear  
[www.esrgear.com](http://www.esrgear.com)  
£41.39, \$45.99,  
41,39 €



To no one's great surprise, third-party manufacturers have been quick to release MagSafe-compatible gear for the newest smartphones, you're spoiled for choice when it comes to chargers, cases and more that fit to your phone magnetically; for pop-on, pop-off convenience. This adjustable wireless charging stand is just such a product.

With four pivot joints on a 20cm stand, you can bend the HaloLock into any position you choose. It's ideal for your desk, where you can place your iPhone, to glance at incoming notifications as it charges. You can rotate it into portrait or landscape mode, and powerful built-in magnets securely hold it in place, even when it vibrates. It connects to your mains power using a bundled

USB-C to USB-C cable, but the power adapter is not included. Unfortunately, the cable connects to the square charger atop the flexible arm rather than the stand's base, which would be more convenient and out of the way.

The HaloLock Adjustable Wireless Charging Stand is compatible with a caseless iPhone 12 or 13, or with an older Qi-charging iPhone, with a MagSafe-compatible case. Note that there's a discounted iPhone 12 version of the product that's not compatible with the iPhone 13, and a version that works with both. Make sure you get the right one for what you want.

# Jazz Buds Bluetooth Earbuds

Can affordable earbuds impress in the audio department?

## Info//

**Groov-e**  
[www.groov-e.co.uk](http://www.groov-e.co.uk)  
 £29.99, \$39.99,  
 34.99 €  
**Compatibility:**  
 Bluetooth audio  
 devices



Not everyone wants or needs to spend three figures on a set of Bluetooth earbuds. Thankfully, the quality of lower-priced buds is improving all the time. This sub-30 pair from Groov-e might not be a match for top of the range models, but their performance belies the price.

Jazz Buds closely resemble Apple's own AirPods in appearance; a speaker unit placed in the ear, with an aerial extending downwards from it. They have a four-hour battery life, which isn't great, but there's another 21 hours of power in the charging capsule. As long as you don't need to listen to them all day without a recharge, they should be fine.

They don't isolate well, so you can't block ambient sounds without turning the volume up, but they don't leak much sound either. Listening to them in the living room while your family watch TV shouldn't be a problem.

And they sound great. Audiophile quality? Of course not, but for such a low-cost set of earbuds, they're certainly impressive. Bass is surprisingly rich without overshadowing the mid section, and vocals are reproduced with clarity. The sound stage isn't as broad as you'd get with expensive earbuds, but it's by no means squashed. All in all, they're a bargain.



# HaloLock Kickstand by ESR Gear

Is this the MagSafe device you've been looking for?

## Info//

**ESR**  
[www.esrgear.com](http://www.esrgear.com)  
 £32.39, \$35.99, 32,39 €  
**Compatibility:** iPhone 12 or  
 later



This disc-shaped MagSafe charger connects to the mains through USB-C (adapter not included), and fastens to your iPhone using the magnets built in to the last two models. It's a small, pocket-sized device that's pretty handy when you're out and about, as long as you've access to a USB-C mains adapter. It's well built, with an aluminium body and stand, and a black or white charging surface. With the leg folded away it can function as a flat charging mat, and when used as a stand you can prop up your iPhone in landscape orientation (but not portrait) and watch a movie or a YouTube video.

As a product, the HaloLock Kickstand falls between two stools; as a permanent stand, there are more versatile devices out there, and for travellers, you might as well just take your Lightning cable. Even so, we can't fault the quality on offer here.





# Cubbit Cell Network Storage Drive

A new kind of storage drive; NAS, but not as you know it.

## Info//

Cubbit Cell  
[www.cubbit.io](http://www.cubbit.io)  
1TB: £303, \$419,  
349 €



Where do you keep your computer's data files? You could use an external hard drive, but then you can't access your files over the Internet, and if you're burgled and it gets stolen with your computer, you've lost your data. You could use a NAS drive, but these are notoriously user-unfriendly, and again, if it gets stolen with your Mac, you've lost your data. What about the cloud? There's no danger of having your files stolen with your equipment there, but you have to pay a monthly fee for whatever storage space you need. Or you could use Cubbit Cell, a new kind of cloud storage.

Cubbit Cell is a storage drive that connects to your router. A product rather than a service, it demands no fees beyond the price of the unit itself. It's available in 1TB, 4TB or 8TB capacities,

and you can add up to 3TB by plugging in an extra hard drive or two. When it's plugged in and switched on, your Cubbit Cell forms a network with all other Cubbit Cells, keeping them connected on a peer-to-peer basis. Instead of directly storing your files locally in just one piece of hardware like a NAS drive, the Cubbit Cell first encrypts them to AES-256 standard, splits them into chunks, duplicates those chunks so there's more than one of each and spreads them across the Cubbit network. Your files are thus disaster proof, available for online access and no one other than you (including the Cubbit staff) can access them. As they're stored in several places and accessed with parallel peer-to-peer connections, accessing them over the Internet is much faster than with NAS drives too.



### It's so easy!

Another advantage Cubbit Cell has over some other forms of data storage is it's easy to use. All you need to do is plug it in, then sign up for an account at the Cubbit website. Download an app for Macs, Windows and Linux, and you're done; you can move files into and out of your Cubbit Cell storage, and access them on any device with a web browser. On a Mac, you're restricted to files of 200MB or lower when using the web interface, but this restriction does not apply if you're on the desktop app. And like any folder, you can drag your Cubbit storage folder into the Finder window's sidebar and access your files from Finder.

There are a few things the team need to iron

out. Multiple cloud accounts on a single Cubbit Cell are promised, as are mobile apps, including one for the iPhone. We're also told speed will be optimised over time too. It's a little slow at the moment, but perhaps this is inevitable as the device grows in popularity and the huge peer-to-peer network establishes itself. Remember, Cubbit Cell is a first; no one has ever attempted anything like this before. It's inevitable the system will grow and improve as it beds in. If you're after a secure remote storage option that you can access over the Internet, it's definitely worth a look.





# DxO PhotoLab 5

Significant improvements, but should you upgrade?

## Info//

DxO

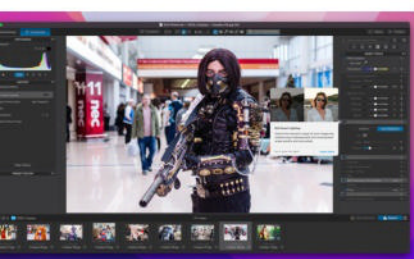
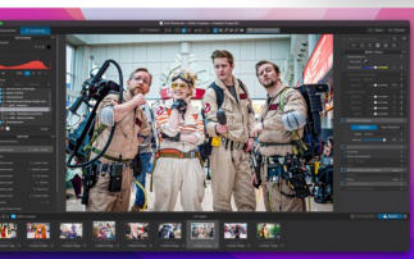
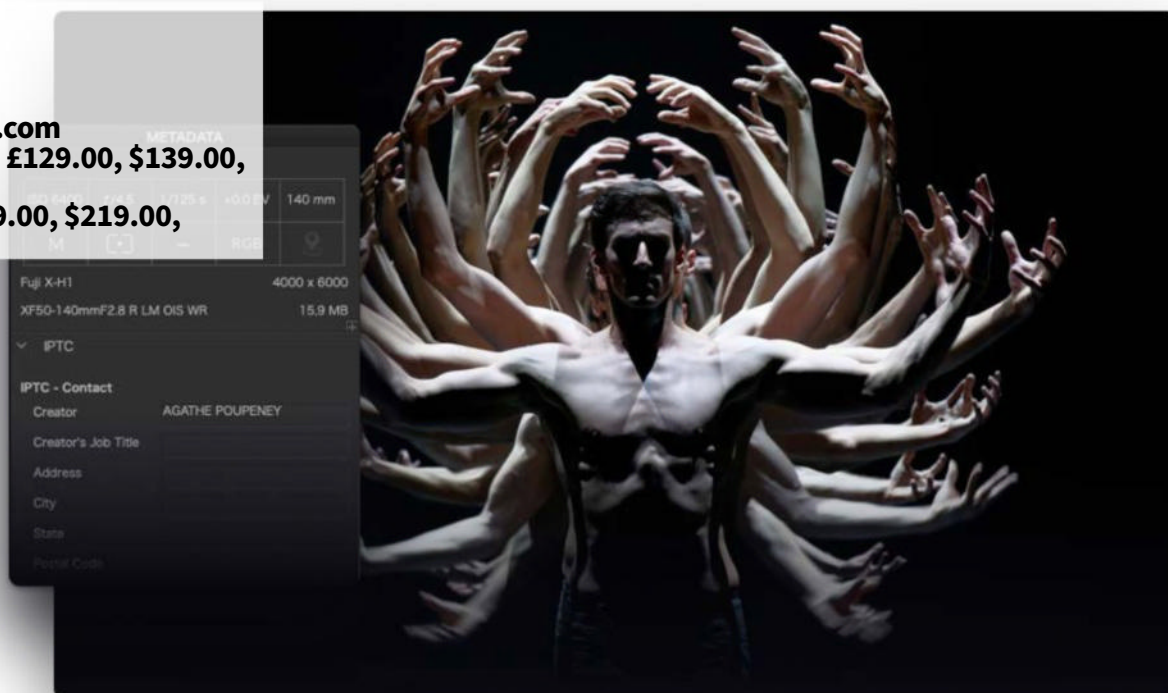
[www.dxo.com](http://www.dxo.com)

Standard: £129.00, \$139.00,

139,00 €

Elite: £199.00, \$219.00,

219,00 €



**D**xO is back with this year's annual update of its flagship PhotoLab high-end photo editing suite. Version 5 offers a small but significant update from last year's release, is available in Standard and Elite versions and there's a discount if you've already bought PhotoLab 3 or 4. There's also a launch discount available, so if you buy before 14th November 2021, you get a substantial knockdown on the prices listed here.

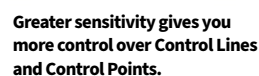
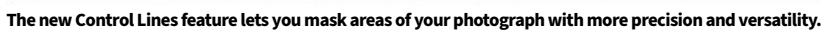
As regular readers know, DxO PhotoLab is an image editor designed specifically for photographers. It's a high-end suite of tools that takes a while to master, but can produce excellent results. During set up you can choose between three levels of difficulty, depending on your skills and experience, and you can switch between Standard and Advanced Workspaces at any time. The easier user settings allow the application to do more for you, while at expert level, you have full control over the application's adjustments and corrections.

### On the line...

The new release of PhotoLab gives you more control over your workflow and your tools. A brand new tool introduced with PhotoLab 5 is Control Lines, which is designed to make

retouching a photo far more intuitive. It's long been possible to define Control Points, which mask part of a photograph so you can apply a filter to the rest of it, letting you touch up parts of a photo while leaving the rest alone. Now, with Control Lines, you can give larger areas a lift without having to define multiple Control Points. For example, you could draw a Control Line along a horizon, and redefine the sky's colour palette to give it a more intense shade of blue. Before, you had to place a number of Control Points along the sky until you've covered it completely, but now you can do it more efficiently. For an even greater degree of precision, both Control Lines and Control Points have sensitivity settings, which means you can adjust the intensity of their effects.

You can now edit EXIF and IPTC metadata in PhotoLab, and add keywords to your photographs, using an interactive tree structure. For example, if you took a bunch of pictures in London, you can label them all 'London'. If a portion of these pictures were taken in the British Museum, you could add that as a sub-label, so their keywords are 'London > British Museum'. You could then label pictures of individual exhibits as (for example), 'London > British Museum > Rosetta Stone'. This means



## More speed

Silicon Macs. Testing on a Mac mini with an M1 processor and 16GB of memory, DeepPRIME proved 4.5 times faster. That's a massive leap in speed.

One of DxO PhotoLab's major selling points is it has settings optimised for specific models of camera. The new release supports 18 new camera bodies; from the Fuji-X range.

DxO PhotoLab has a well deserved reputation for quality photo processing that can satisfy even the most discerning professional photographers, and PhotoLab 5 continues the trend. Our only reservation is it can prove very expensive if you upgrade every year, though you're getting a lot of software for your money.





# DxO FilmPack

Give your pics an old-school make over.

## Info//

**DxO**

**www.dxo.com**

**Essential: £75.00,**

**\$85.00, 85,00 €**

**Elite: £129.00,**

**\$139.00, 139,00 €**

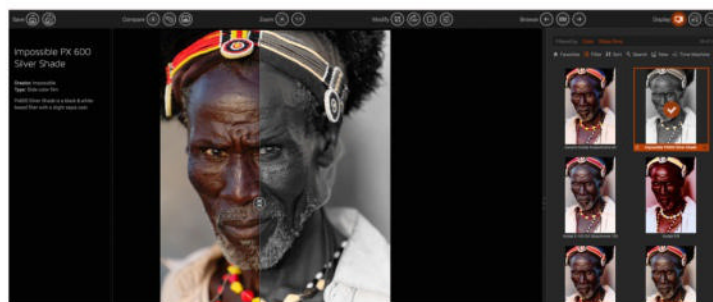
**W**hile few would like to go back to analogue film processing, there's no denying old school development processes had a style and character of their own. FilmPack is designed to bring the look and feel of photographs from eras gone by, to your modern digital pictures. It's less intense, less 'geeky' than DxO's flagship PhotoLab application. The sweet science is there, but it's more of an everyman's suite of tools; very capable, but a good deal less scary.

DxO FilmPack reproduces the grain and colours of legendary analogue films as closely as possible. The software recreates the hues, saturation, contrast and grain of 84 authentic analogue films, including the Kodak Tri-X 400, Polaroid 690, Ilford HPS, and Fujifilm Superia. It also uses a decidedly original approach to navigating the progression of development and processing technologies through the different photographic eras. And it's here the app is at its most interesting.

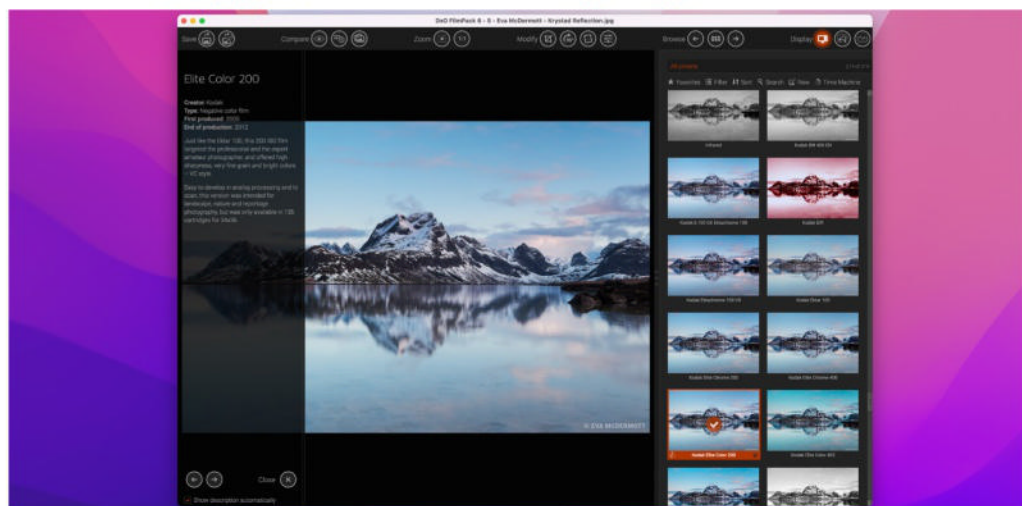
After opening a photo in FilmPack, you

can choose from a predefined set of filters that interpret the picture according to what it might have looked like in days gone by. If you want to see how your photo might have looked had it been taken by French inventor and photography pioneer Nicéphore Niépce back in 1827, or as seen by Japanese photographer Kusakabe Kimbei in 1880 or even on cross processed Fuji Superia 200 in the 1990s, you can. Some, but not all of, these processes have information panels in which you can read about the techniques and technologies they recreate. We hope more will be added over time.

You can install FilmPack as a stand-alone application or as a plug-in for Lightroom, Photoshop CS5, CS6 or CC; or Photoshop Elements 12 or above.



Compare the original image with the processed results using a slider.



Read all about the processes you're recreating in an interesting side panel.



# AKVIS Magnifier AI 11.0

Who says 'size doesn't matter'?

Finding the digital image you need can be a frustrating exercise, especially if you come across a picture that's perfect for your project, but too small to use. That's where AKVIS Magnifier AI 11.0 comes in. Available as a stand-alone app or a Photoshop plug-in, Magnifier AI uses trained neural networks for image upscaling to increase the size of digital pictures without the annoying pixelation associated with zooming in too far. New features for version 11.0 include colour processing improvements, a redesigned user interface, support for more RAW files, and better program stability.

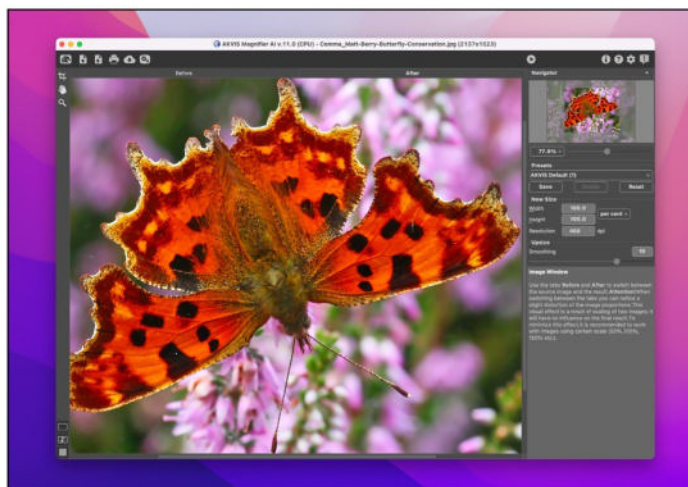
It's easy to use. Import a photo or other such image into the app, and use a slider to blow it up in size; to up to 800%. You can set other parameters like the image's final size and DPI, the smooth slider and more. There are plenty of presets to

get you started too. When you're ready, just click a Play icon (for some reason), to process the file using the settings you've chosen.

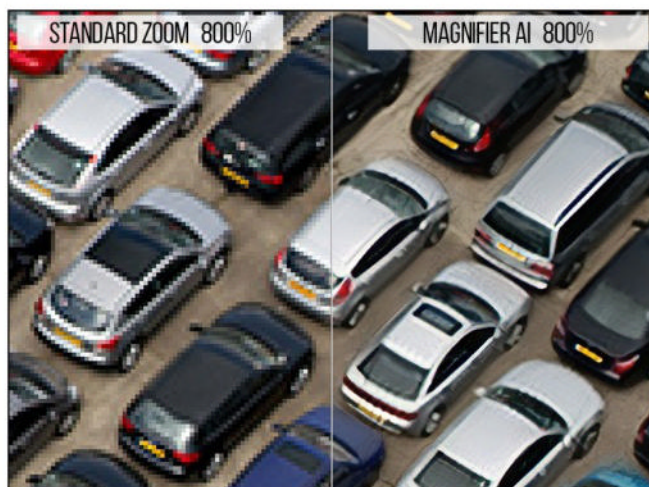
In our tests, the results were good, but not fantastic. You can take the pictures up a small amount and they still look great, but if you push the application to its limits and blow them up a few hundred percent, they take on an unnatural feel, with hard edges and details not looking quite right. They're a lot better than enlarged but unprocessed photos, of course, but we wouldn't want to print them as posters, or include them in BDM's printed magazines. If you're the editor of the church newsletter or regularly design fliers, AKVIS Magnifier AI 11.0 should prove a useful addition to your Applications folder, but maybe not for pro-level print publications.

## Info//

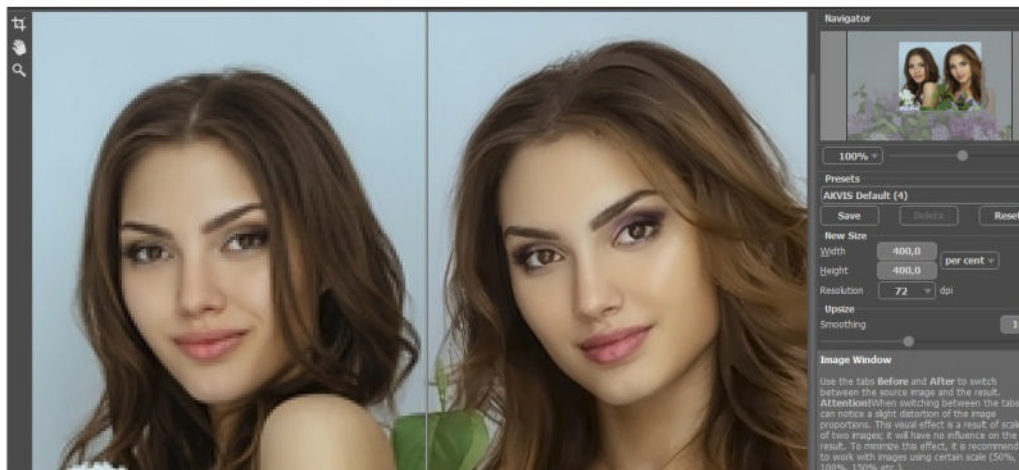
**AKVIS**  
<https://akvis.com>  
**£65.00, \$89.00,**  
**82,00 €**



The interface is clean and intuitive; it's not a difficult app to use.



It's an improvement, but it's not pro-level print quality.







# HUMANITY app

Stay younger for longer.

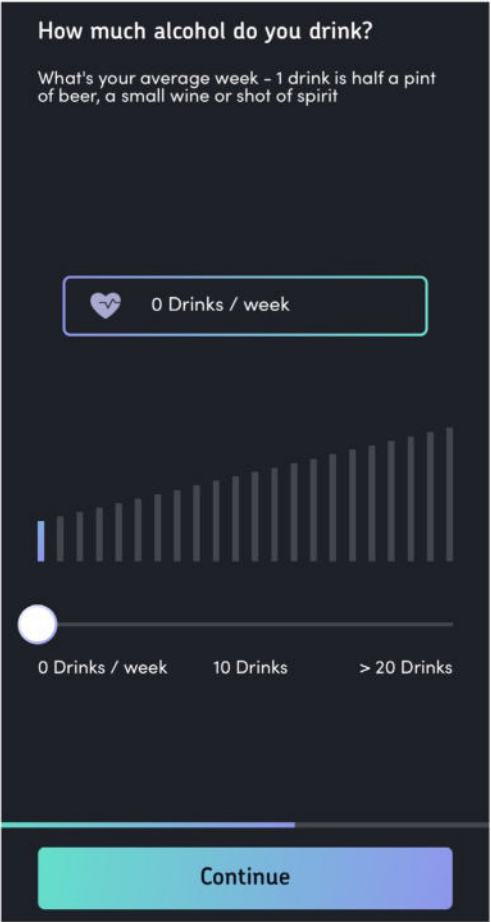
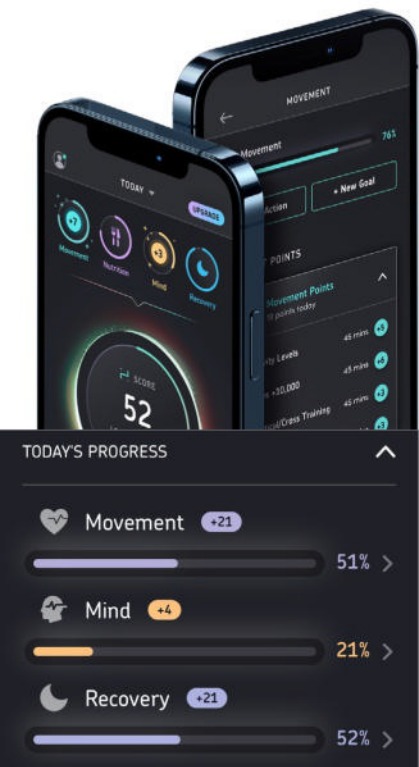
**Info//**  
**Humanity Incorporated**  
**www.humanity.health**  
**Free: Offers In-App Purchases**

**H**UMANITY is aimed at slowing down the ageing process and keeping you healthier for longer. You can download a limited-function version for free, but to get the benefit of the premium app requires an in-app purchase costing £29.99/\$29.99/29.99 €. The app continuously monitors your actions, rate of ageing and your 'biological age' (premium version only) using data gleaned from your iPhone and any health-orientated wearables or accessories you might use. This information is analysed, and the app reports back with advice and guidelines personalised specifically for you. According to the developers, benefits of using the HUMANITY app include a reduced biological age, a slower rate of ageing, staying healthy and happy for many more years, managing stress and more. Definitely worth the money in theory, but how does it work in practice?

## Young at heart?

On launching the app, you must first register for an account and then link HUMANITY with your Health app. You then input data, or confirm information taken from the Health app, such as your height, weight (in kg or lbs, but not stones and lbs), how much sleep you get, whether you smoke, how much you drink and more. It's probably nothing you haven't seen before, but collating it in one app and using the information to give tailored health advice is no bad thing.

Designed by experts, HUMANITY app has a laudable goal and does a good job of achieving them, but obviously it only works for you if you stick with it. Make sure you enter information into the app on a regular basis, and you might well find the advice it delivers to be useful in keeping you fit and healthy.



This is where non-drinkers feel very smug.



# Motif Photo: Canvas Prints

Wall mount your memories...

Remember when Apple sold prints, photo books, calendars and cards, all made from your own photographs? The printing and distribution back in the day was handled by Motif, and although Apple no longer sells printed works, its one-time partner has stepped into the gap and now sells them directly. Just download the app for your Mac (a plug-in that works with Photos), your smartphone and/or tablet, and get started.

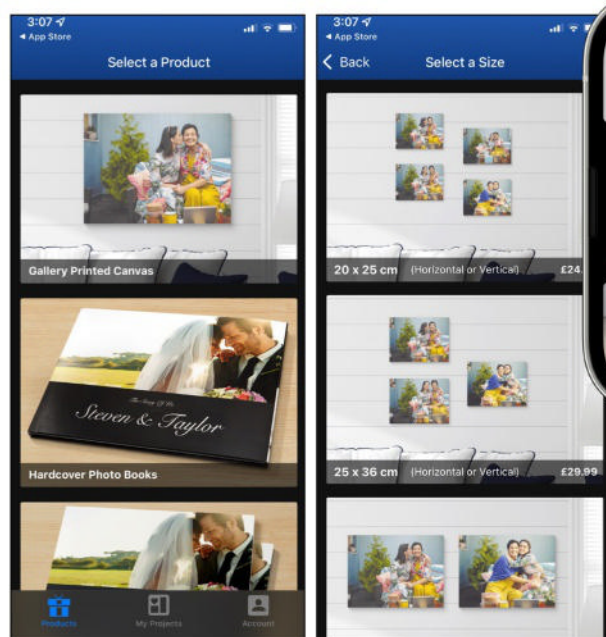
Motif has recently added canvas prints to its range of products. It's a simple process. You choose a size from 20x25cm (£24.99) to 61x91cm (£79.99). Then choose a photograph from the

device you're placing your order on, which can be in portrait or landscape orientation. Choose from a few options, then preview your canvas if you wish. Doing so shows the picture you're about to order in a living room context, to give you an idea how it might look in your home. You then input your address and payment details (if you haven't use Motif before, that is), and order your canvas.

The pictures are sent promptly, and as you'd expect from a former Apple partner, they're of a very high quality. It's a great way of displaying your best pictures, and they look lovely on your wall.

## Info//

**RR Donnelley**  
**www.motifphotos.com**  
**From £24.99,**  
**\$29.99, 24,99 €**



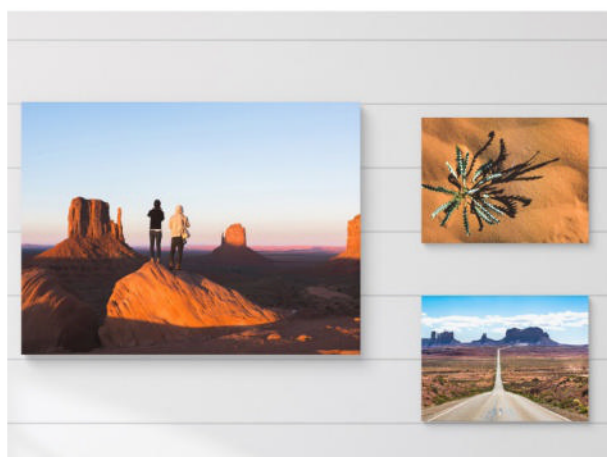
Motif now offers canvas prints from your photographs.



You can preview the picture you're about to order.

## Exclusive 25% Discount!

BDM Publications has teamed up with Motif to give our readers an exclusive 25% off and free shipping for your next order. To claim this awesome offer, just download the Motif app on to your Mac or mobile device, place an order and use the code **BDM25** as you go through the checkout. It's that simple!







# SpongeBob:Patty Pursuit

Save the Krabby Patty Formula.

## Info//

**Nickleodeon  
Apple Arcade  
Exclusive**



I have to admit, I never saw the appeal of SpongeBob SquarePants. I'm probably too old, and my kids were never into it either, so it kind of passed me by and as such I never got into it. I was shocked to discover that SpongeBob first appeared on our screens in 1999, and has made over \$13 billion in merchandising revenue as of 2019. More fool me, then.

In this Apple Arcade exclusive, Sheldon J. Plankton is trying to steal the secret Krabby Patty formula and along the way he has also kidnapped SpongeBob's friends. Your task is to steer SpongeBob along a platform, undersea world in order to stop Plankton, get the formula back and rescue your friends. Not an easy task.

You'll run and jump, collect coins and dash through legions of Plankton's cousins who try to stop you on your quest. There are also spatulas to collect to unlock the next level, and if you collect all the coins, you get a bonus spatula. Make it to the

end of the level, and you can opt to re-run it and locate the hidden areas, or continue your quest to the next level.

It's a tried and tested formula, in true platform style. You bash through obstacles, jump to greater heights with certain trampoline-style areas and swing from various elements to collect more coins. Each area contains a certain number of levels, and you need to fight a boss at the end of each area. There are bonus levels too.

Graphically, the game is excellent. It's bright, colourful and enjoyable to play. Sounds and music will be familiar to those who watch SpongeBob, and give the game the same kind of appeal as the cartoon series. Controls, which are usually picky on such titles, work really well here and are responsive enough to keep the frustration levels down to a minimum.

Overall, it's a fun game and one the kids (and adults alike), will certainly enjoy.



Stop Plankton from opening the formula, and rescue your pals.



A good platformer, which will appeal to many.





# Double Dragon Trilogy

A knee to the face, then get thrown over the shoulder. Beautiful.

I blooming love Double Dragon. Back in the late Eighties, at the local arcade a dingy, dishevelled dive, complete with sticky carpet and drenched in eye-watering neon my mate Daz and I would force-feed ten pence pieces into the Double Dragon arcade machine and settle in for an afternoon of cooperative digital violence. It was superb.

Imagine how happy I was to get my hands on the complete trilogy on the iPad. Sadly, Daz and I have parted ways in the years since 1987, but these days I have a couple of children who can help me take on the bosses and finally rescue poor old Marian from the clutches of the Black Warriors gang.

Often, when it comes to arcade conversions for mobile devices, the end result is far from what you fondly recall as a youth. However, developers DotEmu have done a wonderful job of recreating the style and ambiance of the original arcade machines.

Graphically, it's as you remember but with a slightly more polished sheen to it. There's still the clunky arcade graphics, but this time with smoother edges, and the end result is still the same. It's a near-perfect port of the original. The controls are a little tedious to get to grips with, but after a few rounds you soon get used to them. Grab a friend, and the pair of you can

Bluetooth your way through the gang along to the original eight-bit soundtrack, or choose a newer remastered version.

There are different modes, too. Arcade plays with a single credit, where you fight to get highest score, and Story Mode unlocks stages and achievements. Mobile, Original and Expert difficulty modes keep you entertained, and getting your name on the leaderboard is just as tantalising. For only 89 pence, the Double Dragon Trilogy is worth every penny. It's splendid, and we loved it.

## Info//

dotEmu

£0.89, \$0.99, 0,99 €



A wonderful blast from the past, in all its arcade glory.

Here we go, the first gang member to taste your wrath!







# Pokémon UNITE

Gotta beat 'em all!

## Info//

The Pokémon Company  
Free, with in-app  
purchases



Pokémon, Assemble!



We've seen a slew of really quite decent multiplayer online battle arena (MOBA)-style mobile games over the past few years. Each offers its own unique spin on the genre, and while some shine throughout the various app stores, others let the side down considerably. It's like any other gaming genre, really, but MOBA games tend to get the brunt of the negativity from the popular media.

Taking some of the better aspects of a MOBA game, Pokémon UNITE lets you engage in five-on-five battles on Aeos Island, against NPC trainers and human ones alike. As with the other Pokémon titles, you get to tackle the creatures in the wild, level up and evolve. Then you face off against another trainer and see who can score the most points within the allotted time.

The game certainly has a number of

tantalising features on offer. Different wild Pokémon, once beaten, offer you boosts of some description. There are Holowear options, which allow you to dress your Pokémon in a variety of holographic outfits. There are new Pokémon moves, exclusive to UNITE, which can turn the tide when in battle. Ranked matches move you either up or down in the global leaderboards. There's an in-game communication setup, using signals, quick chat functions and even voice chat so you can better manage your team of trainers. Finally, Pokémon UNITE has taken the advanced step of enabling cross-platform play, which means your Pokémon Trainer Club account can be used on the Nintendo Switch, as well as your mobile devices.





Holo-dress your Pokémon, and get ready to battle.



Some favourites are available, with new and unique abilities.



### Pika-Pika-Pikachu!

This is a different aspect to the usual Pokémon game, and it's one that works reasonably well. True, there is a sense of pay-to-win when you dive a little further into the game and let's face it, there aren't many MOBA-type games out there that aren't but the initial qualities of Pokémon UNITE allow you to bypass that feeling for some time before the grind begins to wear you down. One element that did bug us a little was the 30-second countdown until a game begins. You wait for 30-seconds for someone to tap a button to begin, then you wait another 30-seconds for someone else. Although it's not a huge amount of time, we live in a world where instant gratification is necessary to keep attention spans alive. The wait could well stop

some players from continuing with the game.

Another aspect that may frustrate some is the surrender function. If you have a selection of particularly irksome teammates who decide to surrender at the slightest thing, you too suffer the loss despite doing well yourself. It's an annoyance, but one that's inherent with this type of functionality.

Overall, Pokémon UNITE is a good game. It's got its negative points, as with most games in general, but it's going to offer fans of the Pokémon series many hours of frantic battles.





# Zombie Night Terror

Braiiiiins...

**Info//**  
**Plug In Digital**  
**£4.99, \$5.99,**  
**5,99 €**

**D**eveloper, Plug In Digital, has taken a classic Lemmings-like concept and introduced it to the zombie culture in a gory, blood-soaked 2D strategy game. And it all works rather well.

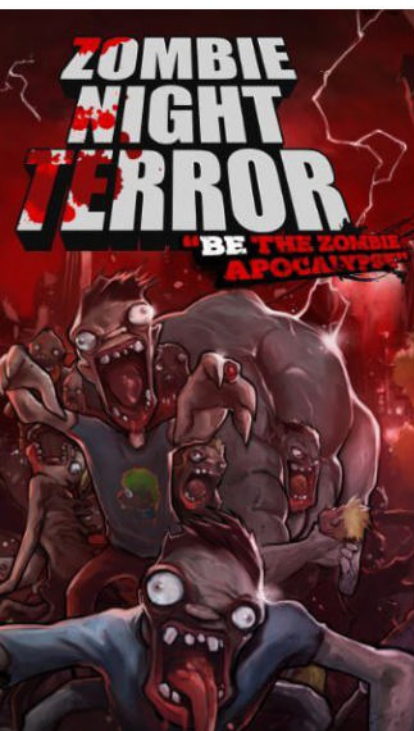
Set in a semi-monochromatic, film-noir, 16-bit pixel art world, you are the mastermind behind this zombie invasion and your goal is as simple as trying to infect as many people as possible. Doing so, though, is quite tricky.

You have a set number of zombie DNA points in which to infect the on-screen non-zombie population. The more people you infect, and in turn which they bite and infect, the more DNA points you have available. The DNA points you gain unlock zombie mutations, which can then be used to direct,

explode, speed up or leap to otherwise unreachable areas of the scrolling levels.

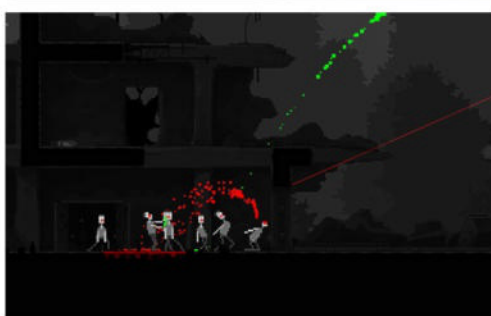
Each zombie used up is one less in your horde, so you need to feed off the humans who are scattered throughout the levels. Some humans are easily eaten, cowering in a corner while your zombies approach. Others carry an assortment of weapons, which can quickly decimate the number of zombies you have under your control. Too much damage from a well-armed human and you're reduced to just a few zombies who won't be able to complete the level or the challenge.

The trick, therefore, is to carefully plan the march of your zombie army, taking in as many human hot-spots as possible, to increase your



Infect the living and guide the undead to the zombie apocalypse.





numbers and DNA points, while still being able to reach the end of the level goals. The further you advance, the more special abilities you unlock until you're able to chain certain abilities and create the ultimate zombie horde.

### Raising the dead

The graphics are well produced, with a mixture of comic instances and cleverly devised sections in each level. The film-noir look works well, especially when mixed with the stark red of your victim's blood or the luminous green of zombie DNA. Later levels can get tricky though, and you find yourself restarting more often than not, due to a miscalculation or a particularly nasty human.

The environment can be as deadly to your zombies as the humans. A drop that's too high kills off a group of zombies, or if you don't get them off the train tracks quick enough, they're mowed down, reducing your army to just one or two stragglers.

While *Zombie Night Terror* is an addictive and fun lurch through the eyes of a zombie horde, it can become frustrating as your supply

It can be tough, being an evil mastermind behind the zombies.



of DNA is soon limited, and a badly-timed applied ability goes horribly wrong. If you're over halfway through a challenging level when that happens, it's back to the start again. While that's part of the game, it can leave you feeling a little annoyed at the mechanics. However, perseverance is key, and you soon come to learn to take advantage of zooming in and out of the action to pinpoint and target individual zombies or areas.

*Zombie Night Terror* is an interesting, challenging and fun game to play, at a very affordable price. There's enough to keep coming back for more, and it's well presented.



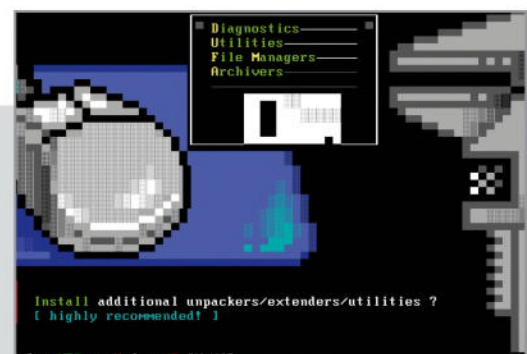
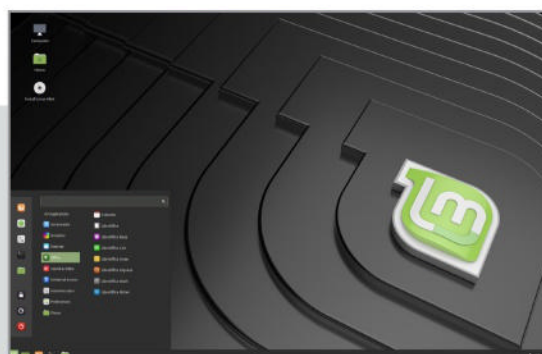
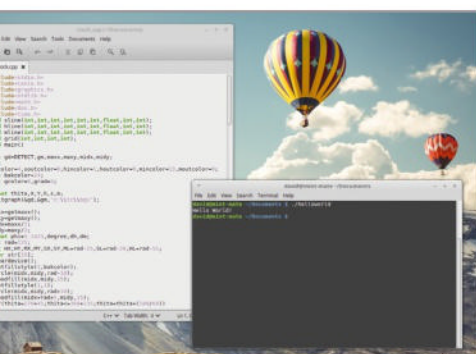


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