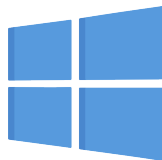




# Operating System Basics for Studying with Efficiency

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An introduction to managing your applications and files, as well as shortcuts to improve efficiency when studying. Information is given for Windows, Mac and Linux.



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Comments, corrections and suggestions to [isaac.mear@eng.ox.ac.uk](mailto:isaac.mear@eng.ox.ac.uk)

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## Introduction to Computer Hardware

An introduction to the key components of a computer. We do not expect you to have a personal computer, but if you get one, it will help to know about each component.

	<p><b>HDD (Hard Drive Disk) or SSD (Solid State Drive)</b></p> <ul style="list-style-type: none"><li>• Computer's <b>long term memory</b>, so data storage.</li><li>• It <b>stores</b> the operating system, software (apps), and your files.</li><li>• HDD is older technology with moving parts, more prone to failure.</li><li>• SSD is newer and therefore more expensive for less storage space.</li></ul> <p><b>What Size?</b> 500GB is considered decent among average users.</p>
	<p><b>Processor or CPU (Central Processing Unit)</b></p> <ul style="list-style-type: none"><li>• <b>Brain</b> of the computer.</li><li>• Gets instructions from apps, performs tasks and calculations and manages data flow. Influences the overall performance of computer.</li></ul> <p><b>Which Processor?</b> Any Intel or AMD x86-64 processor with 2+ cores. More cores is better. e.g. Intel® Core™ i5/i7 or AMD Ryzen 5 or 7</p>
	<p><b>RAM (Random Access Memory)</b></p> <ul style="list-style-type: none"><li>• Computer's <b>short-term memory</b>. Where data is stored that the Processor needs to run your apps and open files.</li><li>• Determines how many tasks the computer can do simultaneously.</li></ul> <p><b>What Size?</b> At least 8 GB of RAM to cope with modern software. The more you can get, the better. The best modern computers have 16GB.</p>
	<p><b>Graphics Card or GPU (Graphics Processing Unit)</b></p> <ul style="list-style-type: none"><li>• Works with the CPU to <b>display images and videos</b>.</li><li>• Having a separate graphics card offloads processing from the CPU, resulting in improved performance and smoother visuals</li></ul> <p><b>Which Card?</b> A dedicated card is better than an integrated card, but only get this if you want to do gaming, video editing or 3D modeling. NVIDIA GeForce GTX or AMD Radeon RX series are popular.</p>
	<p><b>Display</b></p> <ul style="list-style-type: none"><li>• Smaller is more portable, while larger sizes offer better visibility.</li><li>• Higher resolutions (e.g., 1920x1080 or 4K) provide better detail.</li></ul> <p><b>Which Size?</b> Ranges from 11 to 17 inches, 15" is a popular choice.</p>

It is not an easy decision, so do your own research. Things to consider: A dedicated laptop will have more functionality than a tablet. The Department has computers with dedicated graphics cards for you to use. There is plenty of [advice online](#).

- To compare components, [www.userbenchmark.com](http://www.userbenchmark.com) will help.
- Remember to use Student Discounts UniDays, StudentBeans, [Dell](#) etc
- You may want to consider the [MATLAB system requirements](#).



## Useful Applications








Departmental computers will already have all the software you need, however if you are working on a personal computer, you can get free software to install.

### Office 365

Students and staff at the University can access Office 365, which contains many useful applications for University work. The University of Oxford Office 365 system includes a cloud based working environment (called **Nexus365**).

Follow the instructions to get started: <https://help.it.ox.ac.uk/nexus365/getting-started>

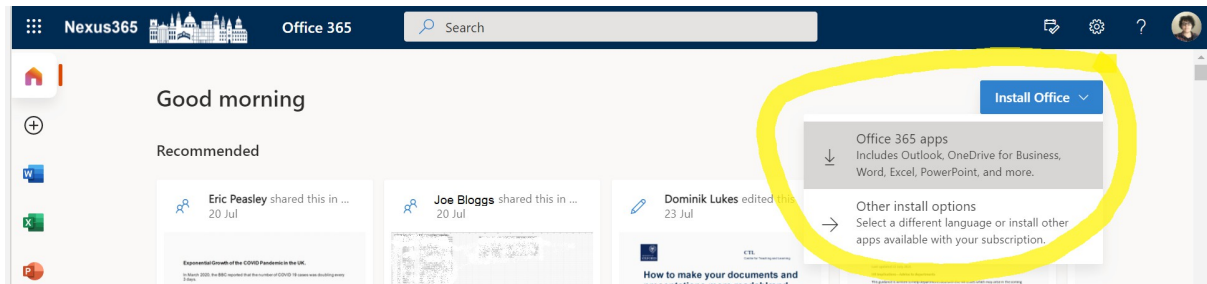
Here you will find:

	<b>Outlook:</b> The Microsoft email client to view your University emails. You may want to learn how to <a href="#">create folders to organise your inbox</a> . You can get the <a href="#">Oxford term dates imported to your calendar</a> .
	<b>One Drive:</b> A cloud based filing system. Use this to <a href="#">backup your files</a> and share files with other people.
	<b>Word:</b> The Microsoft word processor. You can save files as a Word document(.docx) to <b>One Drive</b> or your own computer.
	<b>Excel:</b> The Microsoft spreadsheet. You can save files as an Excel spreadsheet(.xlsx) to <b>One Drive</b> or your own computer.
	<b>One Note:</b> A digital notebook, you can use this for <a href="#">taking notes</a> .
	<b>Powerpoint:</b> Used for creating presentations.
	<b>Teams:</b> Used for videocalls and chat within the University.

If you are new to Office you can see these [Quick Start Guides](#).

Each of the Office365 Apps can be used online, in your browser. Some browsers work better than others so it is worth having multiple installed (e.g. [Chrome](#) / [Firefox](#)).

You can only get full functionality by installing the software directly onto your machine. Once [logged in](#), see the **Install Office** button on the right.



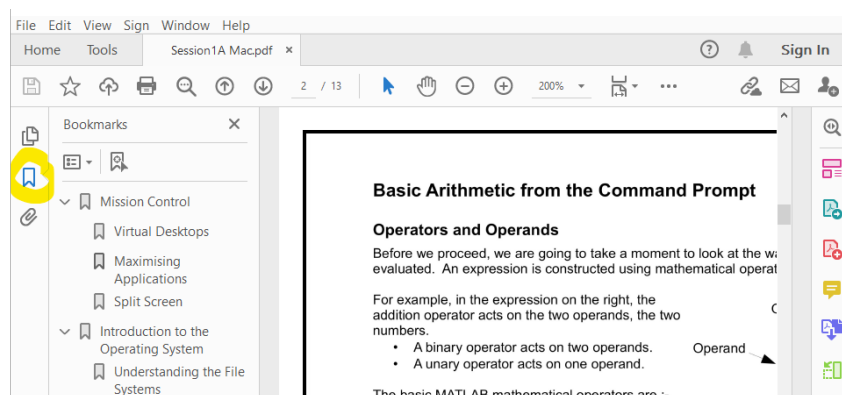
## PDF Reader

You will likely read many PDFs when studying. While most browsers can open PDFs directly, sometimes the functionality is limited. Make sure you can:

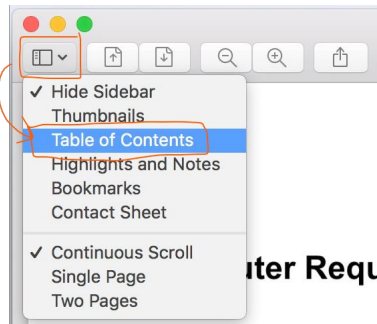
- **Search within PDFs:** You will often work with many documents, searching for key terms using the Search bar is much faster than scrolling.
- **Viewing Headings for Navigation:** You can save a lot of time by enabling the navigation pane to click through Headings
- **Annotation:** PDFs will be your study notes, you will want to write on them.

[Adobe Acrobat](#) is a good free option (you do not need the paid version).

Open **Bookmarks** on the left and add **annotations** using the Toolbar along the top.



MacOS has [Mac Previewer](#). View headings by opening **Table of Contents**:



inter Reql



## Other Applications

There is software available to University students, for free or at a discounted rate, available through the Central IT Pages: [www.it.ox.ac.uk/get-software](http://www.it.ox.ac.uk/get-software)



Sophos Anti-Virus is available for free there.

**Ensure your personal computer has anti-virus!**

There are other applications that are not needed for the Engineering course, but may be of interest. e.g. Parallels for Mac and subscriptions to Adobe Creative Cloud which includes Photoshop/Lightroom etc.



## Security

You should [create strong passwords](#) and [use a password manager](#). Much can be found online, for example from [Reporters without Borders](#).

Single Sign On (SSO) is your main University account, you will need it everyday. It has **multi-factor authentication (MFA)**. <https://help.it.ox.ac.uk/mfa>.



Set up **at least two ways** of authenticating: e.g. App on your mobile and on your laptop. If you lose your phone on a night out, you still need access!

From [mysignins.microsoft.com](http://mysignins.microsoft.com) select **Security Info**, then **Add Sign-in Methods**.

**Password game** for a break and something a bit silly: [neal.fun/password-game/](http://neal.fun/password-game/)

# Managing Applications

Often you will need to work with multiple applications (apps) open. For example, if you are coding you may need a PDF of instructions open as well as MATLAB. Or if you are writing a report you may need an internet browser and a Word document. This section introduces you to different ways to work with multiple apps. Shortcuts improve efficiency moving between different applications. To start, these shortcuts may seem uncomfortable but it is worthwhile spending some time practising, as it will allow you to perform tasks faster.

## Minimising and Closing Apps

To get the best from your computer, it is important to only have the applications open that you need for your current task. Having too many applications open at once will cause your machine to be slow. You might think you are quitting applications by minimising and closing, but they will still be open in the background.

- **Minimise** an app by pressing the minimise button -- in the top corner.
- **Close** windows of an app by pressing the close button **X** the top corner.



Quit rather than close/minimise any applications you are not using.  
This will free up RAM (a type of computer memory).

## Quitting Apps

**Mac:** Use shortcut **Command-Q**, or click the app's name in the menu bar, then Quit.

**Windows:** Shortcut **Alt+F4**, or use the **Task Manager** (see next page)

**Linux:** Use the **System Monitor** (see next page)

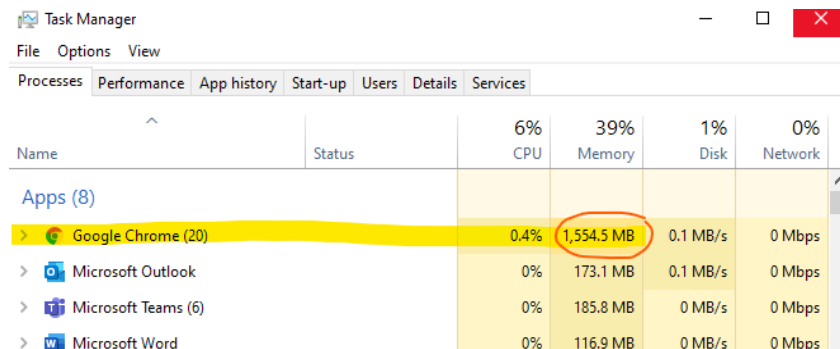
There are ways to see which apps are still be using memory by running in the background, which will slow down your computer. This varies by operating system. For Windows it is the Task Manager, for Linux Systems Monitor.

## Windows: Task Manager

To see what is using up the computer memory, use the **Task Manager**.

Open it by pressing **Ctrl + Shift + Esc**.

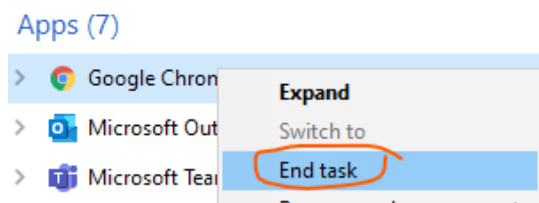
In this example, you can see Chrome is taking up 1.5GB of RAM:



The screenshot shows the Windows Task Manager Performance tab. A table lists running applications with their CPU, Memory, Disk, and Network usage. Google Chrome (20) is highlighted in yellow and has 1,554.5 MB of memory usage circled in red.

Name	Status	6% CPU	39% Memory	1% Disk	0% Network
Apps (8)					
Google Chrome (20)		0.4%	1,554.5 MB	0.1 MB/s	0 Mbps
Microsoft Outlook		0%	173.1 MB	0.1 MB/s	0 Mbps
Microsoft Teams (6)		0%	185.8 MB	0 MB/s	0 Mbps
Microsoft Word		0%	116.9 MB	0 MB/s	0 Mbps

This is why it is best not to keep 30 tabs open at once in your browser. If I decide I want to Quit Chrome, I can force it to quit by Right-clicking and selecting **End Task**.



You can find more tips for speeding up your Windows PC from ex-Microsoft engineer [Kevin Stratvert](#), including disabling some of the startup apps and managing storage.

## Linux: Systems Monitor

To check which applications are using memory, use the **Systems Monitor**.

- Open **Applications** then scroll to **Utilities**. Select **Systems Monitor**.

Under the Processes tab you will see a list of all programs running. To stop an unresponsive program, simply select it and right-click. You can then select:

- **Stop** to pause the process
- **End** which will fully close an application safely.
- **Kill** which forces the app to quit, only use if End Process does not work.

For more information, see this [article](#) on how Linux uses memory.





## Split Screen View

To work with two applications at once, a simple option is to split the screen.

### Windows

- When using one application, e.g. MATLAB, press **Windows key** and **right arrow key** ►. This maximises on the right hand on the screen.
- On another application, say some notes, press **Windows key** and **left arrow key** ◀. This maximises the Notes on the left-hand side of the screen.

### MacOS

- Select and hold the green button in the top-left corner of one of the apps.
- The Desktop splits in two. Drag the application to one half and release.
- You can drag the divide between the two applications to the left and right.

### Linux

- Resize the windows by hovering over the edge of a window, and when an arrow appears resize the window by holding and dragging.

As an example, the image below shows a Desktop that has been split between some notes on the left and MATLAB on the right.

**Basic Arithmetic from the Command Prompt**

**Operators and Operands**  
Before we proceed, we are going to take a moment to look at the way an expression is evaluated. An expression is constructed using mathematical operators.

For example, in the expression on the right, the addition operator acts on the two operands, the two numbers.

Operand

Operator

Operand

1 + 2

- A binary operator acts on two operands.
- A unary operator acts on one operand.

The basic MATLAB mathematical operators are :-

Operator	Symbol	Example	Mathematical Equivalent
Addition	+	1 + 2	1 + 2
Subtraction	-	4 - 3	4 - 3
Multiplication	*	2 * 5	2 × 5
Division	/	4 / 7	$\frac{4}{7}$
Raise to a power	^	3^2	3 <sup>2</sup>
Unary plus	+	+ 2	+2
Unary minus	-	- 2	-2

A limitation of computers is that you are entering mathematical expressions on a keyboard designed for a typewriter. There is no key for multiply, so we use an \* instead. Division and fractions are also a problem. So we use the forward slash key / to signify division. Also, the command input is limited to a single line of text, so you cannot enter 3<sup>2</sup> and have to use 3^2 instead.

This is far from being a complete list of MATLAB operators. There are many more that we will encounter later.

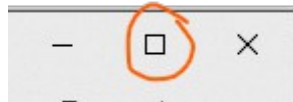


## Maximising

The approach of splitting the screen is not always the best option – particularly if you have a small monitor. Sometimes we need to work with an application which has been maximised to fill the screen.


## Windows or Linux

Any window can be maximised by pressing the square icon in the top right:



The windows can be resized by dragging any of the corners or sides. Move your mouse until you see an arrow, and then click and drag.

## macOS

- Maximise an application by clicking the green maximise  button in the top-left corner of an app window.
- You can also double-click an app's title bar to maximise the window (as long as the option to do so is set to "zoom" in [Dock & Menu Bar preferences](#)).
- When an application is maximised, you can view the banner and the menu bar by moving the pointer to the very top of the screen.





## Switching between Windows


If you have windows hidden behind other windows, there are ways to automatically space these out so that you can select which window you want in front. In **macOS** it is called **Mission Control**. In Windows it is called **Task view**.

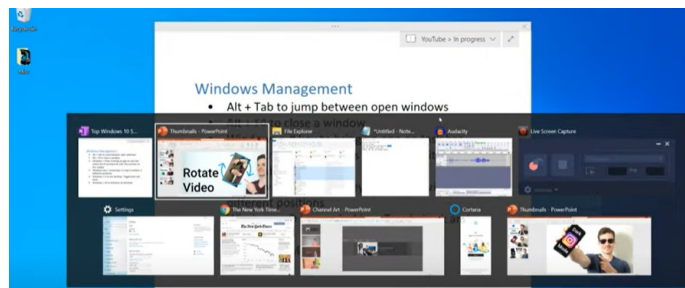
### Mission Control in macOS

Mission Control offers a quick way to switch between multiple screens, for users of macOS. There are many ways to start Mission Control:

- Press the **Mission Control Key**, as shown on the right. 
- Hold down the **control** key and press the up arrow key, ▲.
- On a **trackpad**, swipe up with three fingers.   
Swipe down to leave.



### Task View in Windows

Task View offers a quick way to switch between multiple applications. Holding **Alt** and then pressing **Tab**  will allow you to see all the open Windows. If you have windows hidden behind other windows, this view spaces out all the windows so that you can select which window you want in front. Pressing **Tab** will move through each window in turn, or you can select one with the mouse or arrow keys.



This is a quick way to move between different pieces of software.

Other useful shortcuts include:

- **Windows key**  and **M** to **minimise** all windows and see the desktop.
- **Windows key**  and **E** to **open the file Explorer**.


You can find more here [in this video](#). If you have [Windows 11](#), see [this video](#).

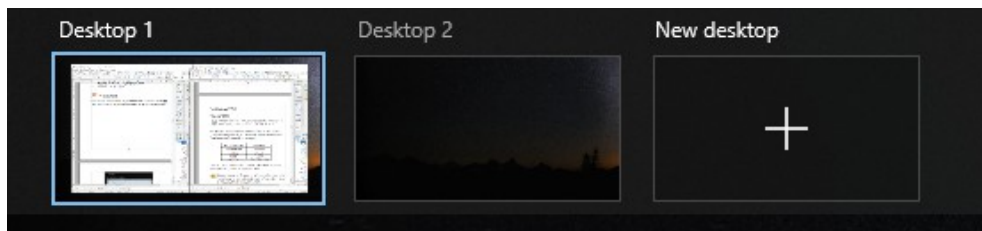


## Virtual Desktops

Another way to switch between different applications, it is use multiple instances of the Desktop. Each desktop can have one app maximised and the others minimised. For example, you could have notes open in one Desktop and MATLAB in another.

## Windows

Holding **Windows key** and pressing **Tab**  will allow you to open a New Desktop. This is a new desktop with all apps minimised.

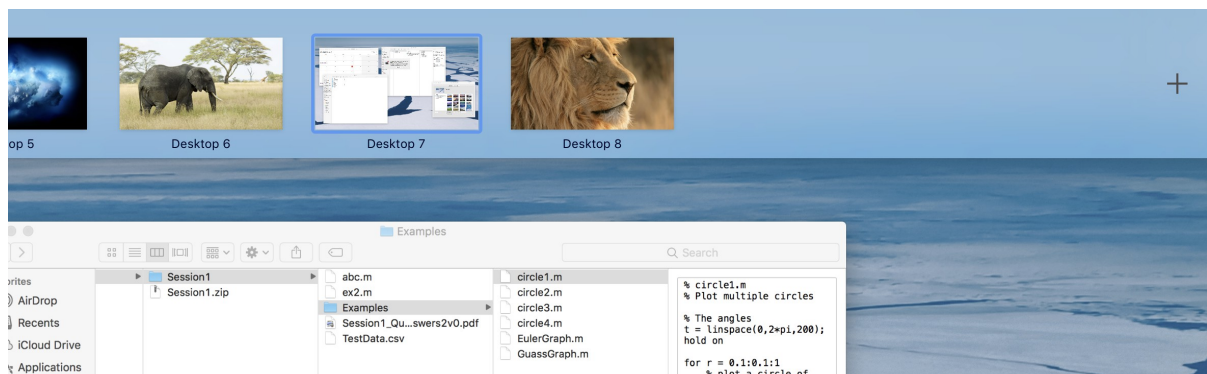


You can have multiple virtual desktops, each with different applications maximised in.

You can quickly switch between virtual desktops by holding down the **Windows** and **Ctrl** keys, then pressing the left arrow key, ◀ or the right arrow key, ▶ to move back and forth. You could have notes open in one Desktop and MATLAB open in another.

## MacOS

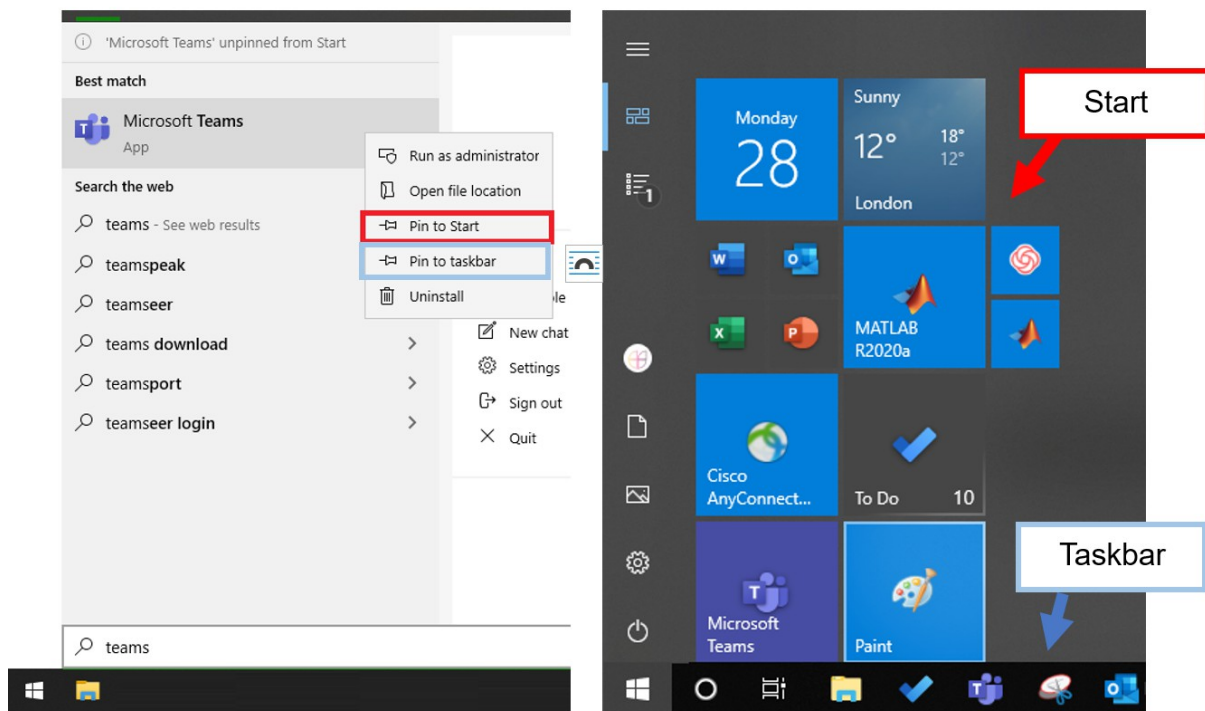
- To create a **new desktop**, press the plus sign **+** on the far right of the **Spaces Bar**. This is on the top of the screen, in Mission Control.
- You can have many different Desktops, all shown on the Spaces Bar.
- Quickly switch between desktops by holding down the Control key and pressing the left arrow key, ◀ or the right arrow key, ▶ .



## Pinning Apps to Start or Taskbar

### Windows

You can pin frequently used Apps to the Start Menu or Taskbar. You can Right-click and select **Pin to Start**, this will mean you always have the Apps you need available in the start menu. You can also select **Pin to Taskbar** which will create an icon along the bottom.



It is worth taking some time to arrange these icons in the most useful way to you. Here I have grouped the most common Office365 applications all in a minigrd.

### MacOS

The dock can be fully customised, see <https://www.youtube.com/watch?v=5rHVhF-KtBc>

# Managing your Files

## Files and Folders



A **file** is just a lot of ones and zeros stored in a permanent location on the computer. Each file is used to store a particular type of object.

Each file has a name, which may also include ending • ('dot') something. This is the file type, which helps to show what the file contains. For example **.jpg** is an image, **.docx** is a document.



A **folder**, also known as a **directory**, is a location where all the files related to a particular topic are stored. Folders help keep related files together, so they do not get mixed up with other files on the system.

Files and folders may seem basic, but keeping them organised can be a difficult habit to develop.

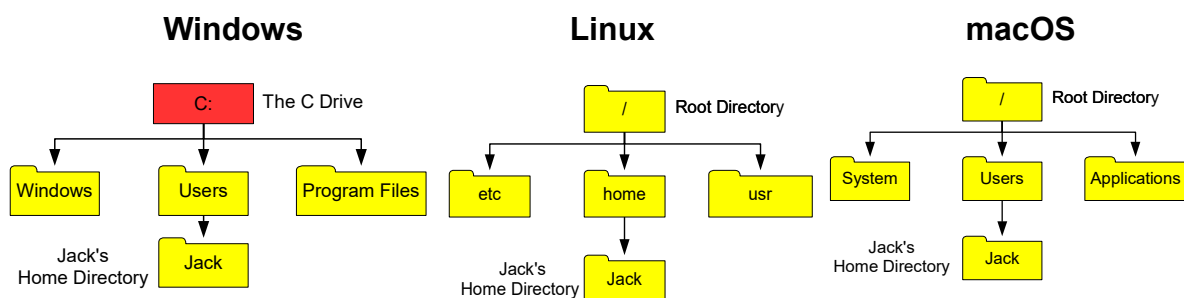


When you download a file, it is usually stored automatically in your **Downloads** folder. If you want to store it long term, **move this file** so it is **stored in a sensible folder elsewhere** in your file system.



## A File System

A **hierarchy** of folders within folders creates a **file system**. The diagrams below shows the top of a file system, for Windows, Linux and MacOS. For Windows the top folder has a letter e.g. **C: Drive**, for Linux and macOS it is called the **Root Directory**.







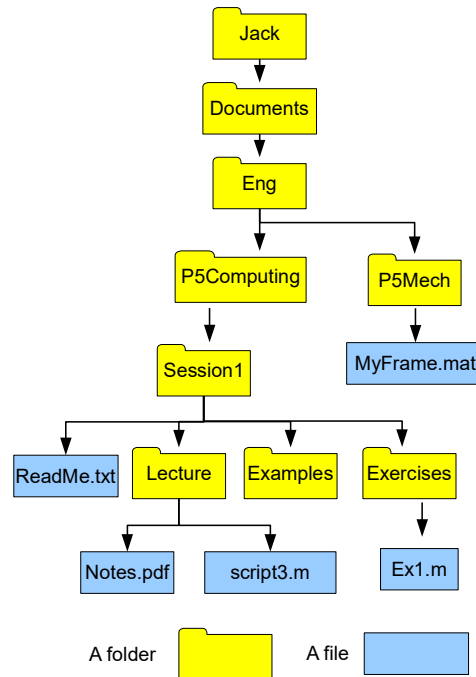
## Home Directory

We need to avoid mixing up our personal files with those used by the operating system and even other users. To store their personal files, each user on a system is allocated a **Home Directory**. Here is an example of an organised Home Directory:

The diagram looks a bit like a family tree.

The words **Parent** and **Child** are used in computing to describe the relationship between folders or other objects:

- The **Parent** of **Session1** is **P5Computing**.
- **Lecture** and **Examples** are the **Children** of **Session1**.



There are apps to view your files and folders:

## Windows



- Press **Windows Key + E** to open **File Explorer**
- **This PC** and then **C:\Users\username** is your **Home Directory**

## macOS



- Along the **Dock**, use the application called **Finder** to view your files.
- **Finder** has [great preview capabilities](#) to help navigating your files.



- In Finder, your Home is a house icon. If you cannot see it in menu: Finder > Preferences > SideBar > Tick **home** under **Favourites**

- [This video shows you 10 different ways](#) to move files on your Mac

## Linux



- There are different applications on different Linux distributions. A common one is called GNOME.



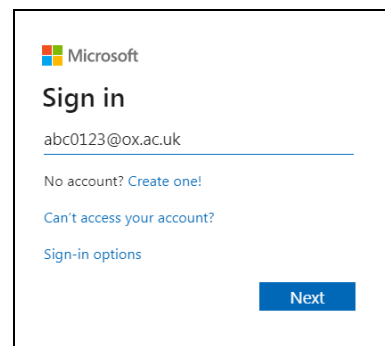
## Local vs Remote Storage

A file system can be stored **locally** on a computer, or in the **stored remotely** (such as 'the cloud'). If the files are stored locally, then they only exist on that computer. If the computer is damaged then there is no way to recover them. Therefore it is best to always store files remotely too.

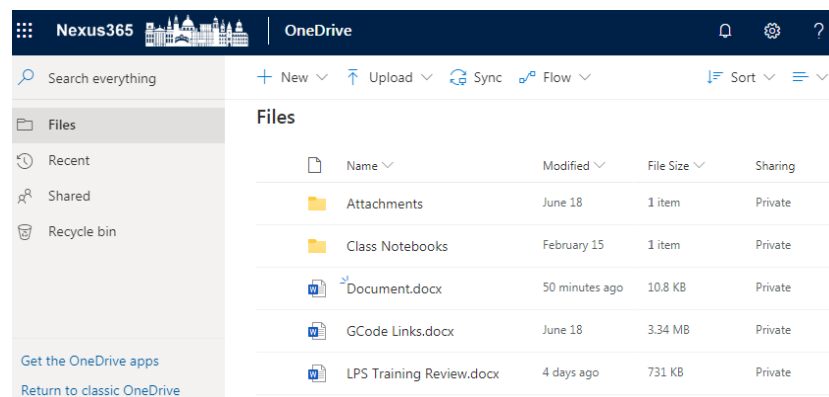
## Using OneDrive

As part of your University Single Sign On (SSO) account, you have access to **One Drive**. This is a file storage area linked to the Microsoft Office Suite available online.

- Visit [Office.com](https://office.com) and click **Sign In**.
- Use your SSO username  
e.g. **abc123@ox.ac.uk**
- Use your SSO username and password.



Once you logged in, select **OneDrive** on your **dashboard** to open your file storage:



- Use the **Upload** button to add files/folders to your area, or drag and drop.
- You can also use the **OneDrive application** for [macOS](#) or [Windows](#).



Spend 5 minutes organising [your OneDrive](#).

For example you could set up folders for Labs, Tutorials and Lectures.

If you have a personal computer, set up the OneDrive App.