

# Buying a PC/Laptop

An important choice to make when coming to university is whether to buy a desktop or a laptop.

A laptop is light-weight and portable. This is ideal for a student on-the-go as it can be taken to university to write up notes during lectures, and you can work on their laptop during labs in an environment that you are familiar with and have full customisation over.

However, laptops can be more expensive than a desktop of similar spec, and can potentially be stolen while going to university on public transport.

A desktop is bulkier and heavier than a laptop, so it is not as easy to transport. However, you may get a better spec machine compared to a laptop. You can also upgrade or fix parts of a desktop that get broken or obsolete. In a laptop, this is often difficult or impossible to do.

Bear in mind when buying a computer that technology is always changing and computers can become obsolete in a short time.

There are pros and cons to both types of computers but there is no right choice. Choose what is best for you.

## Hardware

### Processors (CPU)

There are two main companies on the market that produce processors for consumer computers. These are Intel and AMD.

Intel processors range from 1<sup>st</sup> to 8<sup>th</sup> generation. In each generation there are Core i3, i5 and i7 models. Typically, consumer desktops and laptops will have anywhere between a 5<sup>th</sup> generation to a 7<sup>th</sup> generation processor. The newer the generation, the more expensive they will be.

You can usually tell what generation the processor is from by the model name. For example, if the name was 'Intel Core i7-8700K', this would be from the 8<sup>th</sup> generation of processors.

The i3 processors are the cheaper end of the processors, while the i7s are the more expensive end. i7s are generally used for high-end machines.

They all range from 2 cores at the lower end, to 6 cores at the higher end.

Intel processors have typically been the favourite to build and ship computers with, however, AMD have been giving Intel increasing competition.

AMD processors are usually called Ryzen, ranging from Ryzen 3, 5 or 7. The high end processors are the Ryzen Threadrippers.

These processor range from 2 cores at the lower end, to 32 cores at the very high end. Consumer desktops and laptops typically have a Ryzen 3 or 5. A higher end gaming machine may have a Ryzen 7.

AMD processors are becoming increasingly common in consumer level computers as Intel have struggled to stay on top of CPU shortages in the past few years.

CPU Recommendation by Use Case						
Use Case	Description	Core i3-8100 - 4C/4T Ryzen 3 1300X - 4C/4T	Core i5-8350K - 4C/4T Ryzen 5 1400 - 4C/8T	Core i5-8400 - 6C/6T Ryzen 5 1500X - 4C/8T	Core i5-8600 - 6C/6T Ryzen 5 1600X - 6C/12T	Core i5-8700 - 6C/12T Ryzen 5 1700X - 8C/16T
Office Productivity	Basic Document Work	✓	✓	✓	✓	✓
	Large Documents, heavy Multitasking	✗	✓	✓	✓	✓
Web Browsing	Basic multi-tab browsing	✓	✓	✓	✓	✓
	Heavy (30+ tabs)	✗	✓	✓	✓	✓
Media Streaming	Audio or video	✓	✓	✓	✓	✓
Image Editing	Basic (Photo tweaking)	✓	✓	✓	✓	✓
	Heavy (Photoshop image editing)	✗	✓	✓	✓	✓
3D modelling or Rendering/ VR	Simple character rendering/ VR Viewing	✗	✗	✓	✓	✓
	3D Scene rendering/ VR Development	✗	✗	✗	✓	✓
Virtual Machines	Single VM at a time 1-2GB Size	✗	✓	✓	✓	✓
	Up to 3 VM's at 1-2Gb Size	✗	✗	✓	✓	✓
	Multiple VM's/ Larger appliances	✗	✗	✗	✓	✓

If you are building your own desktop, remember to decide what type of processor you're getting before choosing a motherboard. CPU sockets on a motherboard tend to be designed for either Intel or AMD CPUs. So, if you get the wrong type of motherboard, then you won't be able to fit your CPU.

Go for an i5 or Ryzen 5 if you want the best performance vs. cost solution, however if you are likely to be doing a lot of number-crunching or rendering, then it is better to go for an i7 or Ryzen 7. It's not necessary to get the latest generation of processors, as these are often very expensive. One, or even 2 previous generations is fine.

The more cores and threads a CPU has, the more tasks it can do simultaneously.

## Hard Drives

Computers today typically have 1TB of storage space for files, installed applications and the operating system. Laptops can have anywhere between 500GB and 1TB of storage, while desktop computers can have 1TB or more depending on the size of the case or user preference.

There are two types of hard drives, a hard disk drive (HDD) or a solid-state drive (SSD). HDDs are mechanical and generally slower at reading and writing data than a SSD, which has no moving parts.

HDDs are cheaper than SSDs, however they are slower and there is a higher chance of it breaking, such as the disk getting scratched making the computer unable to read the data. SSDs are more expensive than HDDs, however they are faster at reading and writing data, and there is less chance of them breaking. The operating system, and some frequently used applications can be installed onto the SSD. This will make the computer faster to boot up, compared to being stored on a HDD.

Some machines may use a hybrid drive, or SSHD, which has a small section of the disk that is solid-state. This section is used exclusively for the operating system, while the rest of the data sits on the mechanical section.

	SSD	HDD
Access Time	0.1ms	5.5-8.0ms
Reliability (failure rate per year)	0.5%	2-5%
Backup Rate	6 hours	20-24 hours

There are a number of brands that manufacture and sell HDDs and SSDs. The most reputable ones are:

- Samsung
- Crucial
- Western Digital (WD)
- SanDisk
- Seagate

Bear in mind that standard HDD bays are larger than SSDs, so if you were to fit an SSD into a desktop tower, it requires a bracket to keep it in place.

While building a desktop tower, it is common to have one SSD for the boot partition, and multiple HDDs for other data needing stored. This is like the hybrid SSHD drive, however this is split over multiple drives rather than one drive having two partitions.

## Memory (RAM)

Memory, or RAM (Random Access Memory), is a place where data that the CPU needs to access frequently and quickly is stored. For example, while playing a game, textures need to be loaded frequently and quickly so it's unnoticed by the player. The texture data would be stored on the RAM so the CPU can access this quickly.

Laptops can have anywhere between 4 and 16GB of RAM. Sometimes this can be upgraded in older laptops.

Desktops can have anywhere between 4 and 32GB RAM. This can be upgraded by adding additional RAM sticks into the motherboard.

If you are using your computer to run things such as virtual machines, 8GB of RAM is the recommended amount of memory to have. However, if you are running more than 3 virtual machines at a time, more RAM may be needed.

There are multiple companies that produce and sell RAM:

- Crucial
- Corsair
- HyperX (Kingston)

The more RAM the system has, the faster the system will run. This is because more instructions and data can be stored, so the CPU doesn't have to talk to a HDD (slow, mechanical drive) to access the data it needs. RAM is faster than an SSD to access, as it is plugged directly into the motherboard, near to the CPU. While an SSD is plugged into the motherboard, it has to be plugged in via a cable, which will always take longer over being plugged directly into the motherboard.

RAM Recommendation by Use Case						
Use Case	Description	2Gb	4Gb	8Gb	16Gb	32Gb
<b>Office Productivity</b>	Basic Document Work	✓	✓	✓	✓	✓
	Large Documents, heavy Multitasking	✗	✓	✓	✓	✓
<b>Web Browsing</b>	Basic multi-tab browsing	✗	✓	✓	✓	✓
	Heavy (30+ tabs)	✗	✗	✓	✓	✓
<b>Media Streaming</b>	Audio or video	✗	✓	✓	✓	✓
<b>Image Editing</b>	Basic (Photo tweaking)	✗	✓	✓	✓	✓
	Heavy (Photoshop image editing)	✗	✓	✓	✓	✓
<b>3D modelling or Rendering/ VR</b>	Simple character rendering/ VR Viewing	✗	✗	✓	✓	✓
	3D Scene rendering/ VR Development	✗	✗	✗	✓	✓
<b>Virtual Machines</b>	Single VM at a time 1-2GB Size	✗	✓	✓	✓	✓
	Up to 3 VM's at 1-2Gb Size	✗	✗	✓	✓	✓
	Multiple VM's/ Larger appliances	✗	✗	✗	✓	✓

## Graphics Cards (GPU)

Graphics cards are a separate card that slots into the motherboard. These cards have more cores which can be used for rendering images or games. They can also be used for number crunching. A computer doesn't necessarily need a graphics card, as the motherboard will have an on-board graphics card.

There are two main companies that produce graphics cards. These are AMD and NVIDIA. NVIDIA produce GeForce cards for general consumer machines. There are two types of GeForce cards, desktop GPUs and mobile GPUs. Some laptops use mobile GPUs as they are smaller and can fit inside a laptop case. These will end in 'M'. For example, a GeForce 860M is a mobile graphics card. However, higher end gaming laptops may have a desktop GPU as these cases tend to be larger to accommodate them.

Some older laptops use Intel Integrated Graphics. This is usually built into the motherboard of the laptop. These are not as powerful as a full graphics card and are usually less efficient. They do not have their own cooling systems. Newer laptops now sometimes use Intel HD

Graphics. These are better than the previous Intel Integrated Graphics. Intel HD Graphics cards are used in late 2015 Apple Macs, which feature a high resolution screen. Newer Intel HD Graphics can run newer games, although these will not be at the highest settings.

NVIDIA also produce a more expensive line of Quadro cards which are used for number crunching experiments.

The latest graphics cards from NVIDIA are the GeForce 16 series and the GeForce 20 series. However, these can be quite expensive. Older graphics cards can still be used and as newer cards are released, these will come down in price.

AMD also produce graphics cards for desktops and laptops. They are usually called Radeon RX cards. The high end cards are called Vega cards. The mobile cards, again, end in 'M'.

For running virtual reality simulations, a decent to top end graphics card is required.

These cards can be bought directly from AMD or NVIDIA themselves, or different brands often sell the same cards, adding a case, fans and additional memory to the graphics card.

Some of these brands are:

- MSI
- Gigabyte
- ASUS
- EVGA

Graphics cards come with their own memory built in. These can range from 4GB – 32GB. The memory on-board a graphics card allows it to store higher resolution graphics for games or rendering. This is linked with the resolution of your monitor. For example, a graphics card with 4GB may struggle to display graphics on a 4 or 8k screen. So, the more memory your graphics card has, the higher resolution the graphics will be.

GPU Recommendation by Use Case						
Use Case	Description	2Gb*	4Gb	6Gb	8Gb	12GB+
<b>Image Manipulation</b>	Light Photoshop use	✓	✓	✓	✓	✓
	Heavy Photoshop use (advanced features)	✓	✓	✓	✓	✓
<b>Video Editing</b>	1080p video editing	✗	✓	✓	✓	✓
	4K Video Editing	✗	✗	✓	✓	✓
<b>Mixed Reality/VR</b>	VR Development	✗	✗	✓	✓	✓
<b>3D modelling or Rendering</b>	Simple character rendering	✗	✓	✓	✓	✓
	3D Scene rendering	✗	✗	✓	✓	✓
<b>Machine Learning</b>	Entry Level Machine Learning	✗	✓	✓	✓	✓
	Postgraduate Level Machine Learning	✗	✗	✓	✓	✓
	Advanced Machine Learning	✗	✗	✗	✗	✓

\* Typically found on shared memory graphics cards

## Monitors

Laptops come with their own monitor, but a second one can be purchased and connected to via a HDMI, VGA or Display Port cable (or any other variants).

A desktop does not come with a monitor and a separate one will need to be purchased. Be sure to decide on what resolution of monitor you want. A HD monitor is best, however if you are working with detailed graphics or rendering then you may want a higher resolution screen such as a 4 or even 8k monitor.

## Wireless Cards

Laptops come with a wireless card built in. Desktops do not come with a wireless card, but the motherboard should have an Ethernet port to plug into. A separate wireless card can be purchased and slotted into the motherboard, or a USB wireless adapter can be purchased and plugged into a USB port on the motherboard.

## Bluetooth

Most laptops come with a Bluetooth adapter to connect to your phone/wireless headset. Desktops do not, so a separate Bluetooth card or USB Bluetooth adapter should be purchased if you require a Bluetooth enabled device.

## DVD/CD Drives

Nowadays, DVD/CD drives have become obsolete and are no longer used, instead being replaced by USB pens. Some laptops still come with a CD drive.

A CD drive is not necessary for a desktop computer, but they can still be purchased and fitted into a desktop tower if required.

## SD Card Readers

Most laptops come with SD card readers built in. Nowadays USB SD card readers are easily available to purchase for both laptop and desktop use.

## Printers

Printers are available at RGU for students to use. This is a pay to print service. Personal laptops can be connected to the printer network while on campus. All RGU desktops are connected to this automatically.

Printers can also be purchased separately, however, these can be costly to maintain as ink cartridges are expensive to replace.

## OTHER ISSUES

### Backups

Any data stored on a laptop or desktop should be backed up. Hardware can always fail, get broken, or stolen. Remember to back up your work at least once a week, or more often if required. You can back up your data onto external hard drives, USB pens, or a cloud service such as Dropbox or Google Drive. Also remember that external hard drives and USB pens can fail, so ensure you have made multiple backups of important work.

RGU Students get 1TB of Microsoft OneDrive space. Bear in mind that you cannot upload a file that is more than 15GB.

GitHub can be used to store code as a method of backing up your work, or sharing coursework with your lecturer. You can get one private repository for free, but other repositories will be public.

### Warranty

Laptops often come with a year's warranty in case anything happens to it during that time. Some companies offer longer warranty periods, or extended warranty once the initial warranty has ran out.

If you have built your own desktop, this will not come with a warranty. Individual parts may come with a warranty in case they fail or arrive broken.

## Software

### Academic

Some software we use in the Computing labs is available for free. These are available to download by following the free software link on the [www.comp.rgu.ac.uk](http://www.comp.rgu.ac.uk) website.

RGU Students can also download Office 365 for personal use. This includes OneDrive, OneNote, Word, Excel, PowerPoint and Teams.

Open Office is another free alternative to Office 365.

Students can get a free year's licence for VMWare. To obtain another free licence, return to the store and re-download VMWare. This will give you another free licence key.

### Virus Protection

There are plenty of virus scanners available for free online. Windows defender is included with Windows.

Avast antivirus is a free downloadable antivirus program which can help to protect your system.

Malwarebytes anti malware is a good tool that scans your computer for spyware, adware and other harmful programs.

Nowadays, good internet browsers such as Firefox and Google Chrome will warn you of suspicious sites and downloads.

Remember to keep your system up-to-date with the latest security patches for the operating system and applications that you may have installed.

## School Facilities

The School of Computing has computer systems that are maintained by the Systems Support team in N425. The school has multiple labs for School of Computing students to use, with all the software needed for the courses installed onto every machine. These labs are available to access during building opening hours (usually 8AM – 10:30PM).

There is a 3 year replacement cycle for lab machines (excluding Apple Macs).

Our windows machines have 21” screens. Our current specification is:

- HP EliteDesk 800
- Windows 10
- ~3.5GHz Intel core i5 processor
- 8GB RAM
- 250GB SSD
- Intel UHD Graphics 630
- 1 front USB C port
- 2 front USB ports
- 1 front headset port
- 2 rear Display ports
- 4 rear USB ports
- 1 rear HDMI port
- 1 Ethernet port

Some of our windows machines have a different specification. For example, our cyber security labs have three separate network cards for each virtual machine.

Our Apple Macs (late 2015 model) have 21.5” screens. The current specification is:

- Mojave 10.14.5
- 2.8GHz Intel core i5 processor
- 8GB DDR3 RAM
- 1TB SSHD
- Intel iris Pro 6200 1536MB Graphics Card
- 4 USB ports
- 2 Thunderbolt ports
- 1 Ethernet port
- Headset port
- SD Card reader

All Apple Macs have been dual booted with Windows 10.

Contact Details

We are open from 8AM to 6PM in Room N425 during the week.

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Please note: None of the courses run by the School of Computing require students to own a computer. Students can come in during building opening hours to use the computers and installed software.

It is, however, useful to have a personal computer. Many students purchase their own computer to work from home