Interrupts 中断

- **Interrupts** are signals sent to the CPU by devices or software, to indicate an event that needs immediate attention.
- They tell the CPU to suspend (temporarily stop) its current activities so that the interrupt can be serviced.
- The computer needs to identify the interrupt type and also establish the level of interrupt priority 优先权.
- The microprocessor then either carries on with what it was doing, or stops to service the device or program that caused the interrupt.
- Interrupts allow computers to carry out many tasks at the same time.

Interrupts

There are **two** types:

- Software interrupts are generated by programs

Example - a divide-by-zero error will cause a calculation to be abandoned and an error message displayed
- two processes trying to access the same memory location

- Hardware interrupts are generated by hardware devices

Example - printer out of paper
- pressing a key on the keyboard
- moving the mouse

Handling Interrupts

Whenever an interrupt is received it needs to be serviced -

-> this is done by the **Interrupt Service Routine (ISR)**
which saves the contents of all the registers

and then loads the start address of the new instruction into the Program Counter (PC).

Once the interrupt has been fully serviced -

-> the status of the interrupted task is restarted (the contents of all the saved registers are then retrieved) and the process continues

Handling Interrupts

Whenever an interrupt is received it needs to be serviced -

-> the status of the current task being run first needs to be saved

-> the contents of the Program Counter (PC) and other registers are saved

-> The **Interrupt Service Routine (ISR)** is executed by loading the start address into the Program Counter (PC).

Once the interrupt has been fully serviced -

-> the status of the interrupted task is reinstated (the contents of all the saved registers are then retrieved) and the process continues

Interrupts

Interrupts allow computers to carry out many tasks or have many windows open at the same time.

Example - downloading a file from the internet at the same time as listening to some music. Interrupts allow these two functions to co-exist, the user has the impression that both functions are being carried out simultaneously (at the same time). In reality, data is being passed in and out of memory very quickly allowing both functions to be serviced.

This can all be achieved by using an area in memory known as a **buffer**. A buffer is a memory area that stores data temporarily.

Interrupts

Buffers and interrupts are often used together to allow standard computer functions to be carried out.

Example : buffers and interrupts are used when a document is sent from memory to a printer. *The important thing to remember here is the time taken to print out a document is much longer than the time it takes for the microprocessor to send data to the printer.*

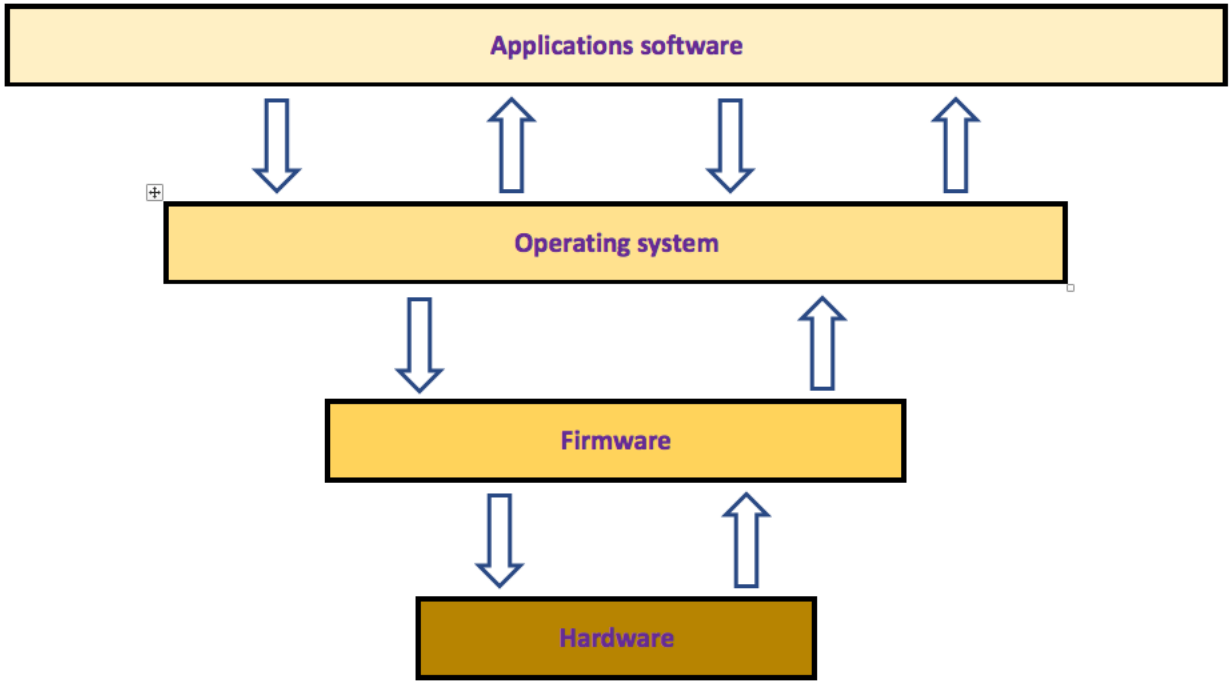
Without buffers and interrupts, the microprocessor would remain idle waiting for a document to be printed. This would be an incredible waste of microprocessor time; the buffers and interrupts allow the microprocessor to carry on with other tasks while the document is being printed, thus maximising its processing power and speed.

Examples of interrupts

- Think of some other events that could cause
  - A hardware interrupt
  - A software interrupt

Running of applications

Hardware, **firmware** and an **operating system** are required to run **applications software**.



Running of applications

- Applications are run on the operating system.
- The operating system is run on the firmware.
- The bootloader (firmware) is run on the hardware.
- The Firmware is a program that provides low level control for devices.
- (see page 160 in your books)

Activity

Complete Worksheet on …

Types of programming language, translators and integrated development environments (IDEs)