Introduction to Computers

What makes up a computer?

• Hardware

• Software

Hardware by itself is useless - only lumps of metal, plastic, glass, silicon (not the implant), etc.

It is the software that makes a computer useful - ie. the computer programs make a computer useful. The same hardware can be directed by the software to perform a variety of tasks.

A computer achieves this versatility by following step-by-step instructions provided by the software. Changing the instructions makes the computer do something else.

For now, these step-by-step instructions can be thought of as the algorithm. A computer is programmed by:
1. designing an algorithm
   eg. How pages will be displayed in a browser, how the computer responds to user interaction … etc. In this example, the algorithm describes the format of the document. More complicated algorithms use Java and JavaScript.

2. converting the algorithm to a form which is understandable by the machine
   eg. Expressing the above design in c, JavaScript, Java, … etc..

Most of us have used some sort of algorithm to solve some problem. For example when we follow a recipe to bake a cake, we are executing an algorithm for baking a cake.

When we follow the instructions in a DIY book/manual to repair a fence, we are executing a fence repair algorithm.
Types of Hardware:

Input

for entry of data and instructions into the computer (2 kinds)

1. Keyboard entry ie a keyboard

2. Direct entry (ie. keyboard is not used)

   a. Pointing devices
      eg. Mouse, Touch Screen, Light pen,
      Digitiser
b. Scanning devices
   eg. Image scanner, FAX, Bar-code readers, Character and Mark recognition devices (Magnetic ink character recognition - MICR, Optical Character recognition - OCR, Optical mark recognition - OMR)

c. Voice input devices
   Continuous speech recognition systems
   Discreet-word recognition systems
Output

usually to display/communicate computer output

1. Display devices/screen (monochrome or colour)
   a. Cathode Ray Tube (CRT) monitors
   b. flat-panel displays
      eg. Liquid-crystal display (LCD), Electroluminescent display, Gas-plasma display

2. Printers
   eg. Dot-matrix, Laser, Ink-jet, Thermal, Daisy-wheel, chain

3. Plotters
   eg. Pen, Ink-jet, Electrostatic, Direct Imaging
4. Voice-output devices

Storage Devices

1. Primary storage
   eg Random Access Memory (RAM) - volatile
   Read Only Memory (ROM) - nonvolatile

2. Secondary storage
   eg. Floppy Disk, Hard Disk, Optical Disk (eg CD-ROM), Tape

Processing

Central Processing Unit (CPU)
   - consists of 2 main parts - control unit (CU) and the arithmetic and logic unit (ALU)
- also has registers which are used as high speed temporary storage areas within the CPU

a. CU - directs the movement of data and control signals between memory (eg. RAM) and the ALU

b. ALU - performs maths operations like +, -, *, and /. Also performs logical operations like comparing 2 quantities.
Simplified structure of a computer system

hardware
Peripheral devices:

a. bulk storage devices - secondary storage

b. input/output (I/O) devices

Types of Software

Application Software:

Are application packages used by people to perform a variety of tasks.

a. Word Processors - used to type out assignments, type out this lecture notes

b. Spreadsheets - used to manipulate numbers and perform calculations. A budget can be worked out on a spreadsheet.
c. Database Managers - manage databases which (for example) store information on business clients

d. Graphics programs - used to draw, manipulate and/or present pictures

e. Communication programs - allows communication between programs; resources on other computers can be shared

**System Software**

- support the operation and use of the computer itself
- so called “background” software - acts as an interface (intermediary if you like) between the computer and the user; between the application program and computer hardware.

a. operating system (OS) - manages the resources of the computer. eg. DOS, Windows-95, Windows NT, UNIX. Linux. Without the OS the machine is useless.

The operating system also provides a number of utility programs for formatting disks; copying, erasing, renaming, and backing-up files.
b. bootstrap program - starts the computer when the power is turned on. It locates OS from floppy or hard disk and loads it into memory (ie. RAM). Control is then transferred to the OS. This is called booting the system. This bootstrap program is stored in ROM. (why?)

c. compilers and assemblers - convert algorithm written in a computer language (eg. Pascal) into machine language. The computer does not understand Pascal. It understands machine language. JavaScript is not converted to machine code – it is translated when it is being executed. Modern browsers come with JavaScript translators.
d. diagnostic routines - programs that test the hardware to see that the hardware is functioning properly. Stored in ROM.

e. basic input-output system (BIOS) – enables the computer to interpret the keys typed onto the keyboard and move characters to the display.

Multimedia

The term “multimedia” as defined in this unit actually refers to Interactive Multimedia (IMM).

“Interactive” means the user has control and can for example, influence the order in which information is being provided. The computer responds to the user.
“Multimedia” on its own refers to any combination of media (text, graphics, audio and video) used for some purpose. Any television advertisement uses multimedia. The advertisement is not interactive. ie. You can’t interact with the advertisement itself – at least not yet in many countries.

Note: Fiddling with the sound or controls on the TV is not considered to be interactive because it is not possible to influence the advertisement itself while it is playing. Interacting with the device on which the ad is playing of being displayed is not considered to be interactive.

Earlier we came across the term “software”. Multimedia (we will use multimedia to mean IMM) is actually technology implemented in software. Multimedia can be delivered via a computer network (eg. Internet), on CD-ROM,
on a floppy disk or any secondary storage device.

**IT’s perspective**

There are two important aspects of software. Firstly, it is important that people know how to correctly use such software, and secondly, given this, it is essential that this software perform correctly. This involves a variety of concepts including correct specification of the original design problem, correct method of solution and successful implementation of the software.

Someone, or more common nowadays, teams of people, are involved in the development of such software. The complexity of most modern software requires years of work in development, testing and maintenance. This means money and resources, not only from
the point of view of equipment but also in the training and skills required by employees.

It has therefore proved useful, as with engineering, to develop a framework and methodology, for problem specification, program design, implementation, testing and documentation. The usefulness of this methodology is well known for developing “traditional” (non-multimedia) software.

Unfortunately, development of multimedia software is at the stage where traditional software development was some decades ago. If multimedia (and web) software developers do not make effective use of the lessons learnt, then, we might end up with a major software problem. The current trend for \textit{ad-hoc} approach to multimedia and web development has to stop. Rigorous software
development principles have to be applied for all software development.

Visit http://wwwzenger.informatik.tumuenchen.de/persons/huckle/bugse.html to find out examples of bugs and the problems they have caused.