Computer Science – Non Negotiables!

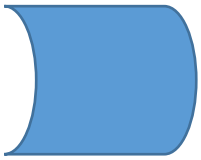
Computer Systems

1) Define hardware and software
    a. **Hardware** is a physical component of a computer system e.g. mouse, CPU etc.
    b. **Software** are the programs the computer system runs to complete tasks e.g. Microsoft Word, Google Chrome etc.
2) There are three types of software, application, utility and system software.
    a. **Application software** is designed to perform a specific task e.g. Photoshop, Internet Explorer, PowerPoint etc.
    b. **Utility software** is used to help maintain or configure a computer system
    c. **System software** is designed to run a computer system. The main type of system software is the **Operating System (OS)** e.g. Windows, Android, Mac OS etc.
3) The **operating system** has many functions. You must remember these – try using DIGSPAM to remember them:
    a. **D** – **Disk Management** – the organisation of data through files, folders etc.
    b. **I** – **Input/ Output Device Management** – Uses device drivers to allow communication between the OS and the hardware.
    c. **G** – **Graphical User Interface** – Gives the user an interface to interact with through windows, icons, menus and pointers.
    d. **S** – **Security Management** – Help to keep a computer system secure through the use of user accounts (usernames and passwords) etc.
    e. **P** – **Processor Management** – Allocates processing time to applications and tasks allowing multi-tasking.
    f. **A** – **Application Management** – Gives applications a platform to run on and allows access to the main memory and secondary storage.
    g. **M** – **Memory Management** – Copies the necessary parts of the applications to the main memory (RAM).
4) There are two types of computer systems, embedded and non-embedded.
    a. **Embedded** systems are built into other devices and are used to control them for one particular purpose e.g. washing machine, TV etc. **Non-embedded** systems are general purpose and can be used for many tasks e.g. PC, laptop, smart phone etc.

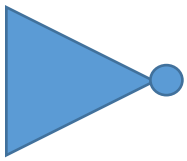
5) **Logic gates** take binary information and give an output based on the type of gate: **AND**, **OR** and **NOT.**
    a. **AND** gate rule – both inputs must be 1 for the output to be 1
    b. **OR** gate rule – at least one of the inputs must be 1 for the output to be 1
    c. **NOT** gate rule – the output is the opposite of the input

AND Gate 

A	B	A AND B
1	1	1
1	0	0
0	1	0
0	0	0

OR Gate 

A	B	A OR B
1	1	1
1	0	1
0	1	1
0	0	0

NOT Gate 

A	NOT A
1	0
0	1

6) The **CPU** is responsible for fetching, decoding and executing data and instructions. There are five main parts of the CPU:
    a. **Control Unit** – Controls the flow of data between the other components within the CPU and the main memory/ input and output devices.
    b. **Arithmetic Logic Unit** – Completes all the calculations and logic tasks the computer does e.g. addition, multiplication, AND, OR etc. The **registers** are used to store the immediate results of the calculations.
    c. **Cache** – This is very fast memory that is used to store frequently used data.
    d. **Clock** – Sends a signal that continuously cycles between 1 and 0 and a constant rate.
    e. **Buses** – These are wires that are used to send data between the components of the CPU and the rest of the computer system.
7) What can affect the performance of the CPU?
    a. **Clock speed** – This the number of clock cycles per second and is measured in GHz. The higher the number of clock cycles, the faster the CPU.
    b. **Number of cores** – This determines the number of instructions that can be processed at the same time e.g. dual core = 2 instructions, quad core = 4 instructions etc.
    c. **Cache size** – The larger the cache, the quicker the CPU is to access frequently used data
    d. **Cache type** – There are 3 levels of cache. The higher the level, the more it can store but the slower it is to access.

8) Explain the differences between the two types of main memory, **RAM** and **ROM**.
    a. RAM stands for **Random Access Memory**. It stores programs and data that are currently in use. RAM is **volatile** meaning that it loses any data it is storing once the computer is turned off. A computer system usually has more RAM than ROM.
    b. ROM stands for **Read Only Memory**. It stores the data and instructions required to boot up your computer. This is known as the bootstrap loader. ROM is **non-volatile** meaning it does not lose its data once the computer is turned off.
9) Describe how RAM is used in the fetch-execute cycle.
    a. Data and instructions are stored in the RAM.
    b. The data and instructions are **fetched** to the CPU from the RAM.
    c. The data and instructions are **decoded** by the CPU and **executed**.
    d. The results of the processing may be returned to the RAM.
10) Know the three main types of **secondary storage**.
    a. **Magnetic** – data is stored by on high speed spinning disks called platters. 1's and 0's are stored magnetically (1 points in one direction, 0 points in the other). This data is then read by a reader which converts it back to 1's and 0's for the CPU to understand. Examples are magnetic hard drive, magnetic tape.
    b. **Optical** – Data is stored as pits and flats. A pit is burnt into the surface of the disk by a laser. The laser is also used to read the surface of the disk. If the laser reflects (flat) it reads a 1, if there is no reflection (pit) it reads a 0. Examples are CD, DVD and BluRay.
    c. **Solid State** – Data is stored by trapping electrons in electronic circuits meaning solid state storage needs no moving parts. Examples are solid state hard drive, memory stick, SD card.
11) Define cloud storage and know the benefits and drawbacks.
    a. Cloud storage allows users to upload files onto a server in a remote place.
    b. Advantages of cloud storage:
        i. Users can access files from any connected device
        ii. Files can be shared with others or made public
        iii. Easy to increase how much storage is available
        iv. No need to purchase expensive hardware to store data
        v. No need to pay IT staff to manage the hardware
        vi. Cloud hosts manage security and backups for you
        vii. Can be cheap/ free if not much storage is required

c. Disadvantages of cloud storage:
    i. Need connection to the internet to access files
    ii. Upload/download speed of files depends on bandwidth
    iii. Dependent on host for security and backups
    iv. Data can be vulnerable to hackers
    v. Unclear who has ownership over cloud data
    vi. Subscription fees for using cloud storage may be expensive in the long term