Basic Computer Architecture

A computer system is very complex, but through the magic of abstraction, we can simplify and draw the following diagram:

- **CPU**: The hardware “brain” of the system and usually the first thing that come to mind when we think of a computer. A CPU on a silicon chip, such as a Pentium, is called a microprocessor. The CPU is composed of two main parts: the arithmetic logic unit (ALU) that does all the computation and is considered the worker, and the control unit (CU) that decides what the CPU should do next and is considered the boss.

- **Input**: We need to be able to supply information to the computer system. The most important devices to do input are keyboard and mouse.

- **Output**: The computer system must be able to provide information to the person using the system. The most important output devices are the monitor and printer.

- **Main Memory**: A computer must be able to remember data that is input. Main (primary) memory is used when speed is important, for example to hold a document while a user is doing word processing. All programs run from main memory. Also called RAM (random access memory), main memory is volatile, i.e. it loses its contents when power is turned off.

- **Secondary Memory**: Because RAM goes dead when a computer is powered off, secondary memory is needed. Also called secondary storage, it is used to store information permanently. Secondary storage devices include floppy disk drive, hard disk drive, flash drives and CD ROM. Secondary memory is cheaper than main memory, but it is slower.

Though it does not appear in the simplified system above, a third type of memory, ROM (read only memory) is needed. ROM holds the initial “boot-up” instructions for the computer system.
Note that computers can really do only four basic things:

1) Receive input.
2) Process information (data).
3) Produce output.
4) Store information.

Digital Information

Computers are based on the **binary system**, which uses 0’s and 1’s. A single 0 or 1 is called a **bit** (short for “binary digit”). All information in a computer is encoded using these two digits: in order for information to be stored in a computer, it must be in digital form!

**Examples:**
- 1 is encoded as 0000 0001
- 7 is encoded as 0000 0111
- ‘A’ is encoded as 0100 0001
- ‘a’ is encoded as 0110 0001

Measuring the Size of Digital Information

A computer can process chunks of information larger than a bit by treating groups of bits as a unit, for example a group of 8 bits is called a **byte**. A byte is often used to represent a single character. Storage capacity is usually measured in bytes. The following definitions are useful:

- A **Kbyte** (kilobyte) (sometimes called **KB**) is 1024 bytes of information.
- A **Mbyte** (megabyte) (sometimes called **MB**) is approximately 1000 KB, or 1 million bytes.
- A **Gbyte** (gigabyte) (sometimes called **GB**) is approximately 1000 MB
- A **Tbyte** (terabyte) (sometimes called **TB**) is approximately 1000 GB, or 1 million MB.

Computer Software

So far, we have considered only computer hardware, but a computer system is not useful without computer **software**, or **programs**. These are sets of instructions written in the native language of the computer. (Computers do no understand English or anything which remotely resembles English. They understand **machine language**, also called **machine code** or **binary** language.)

An **operating system** is a collection of complex programs which allows convenient access to computer hardware. When a computer is powered up, machine “boot-up” code from ROM is loaded into RAM and executed. The boot code does a system check and some other chores, then tries to run an operating system that is stored in secondary memory. Once loaded, the OS takes control of the computer and expects the user to run **application software**, such as a word processor.

The most popular operating system which runs on PCs is called **Windows**. Versions of this are Windows 3.1, Windows 95, Windows 98, Windows XP and Windows Vista. Other operating systems are Linux, Unix and Mac OS.
Writing Software

Software, like all info stored in the computer, is in digital form. Thus, a portion of an application program might look like:

```
001010010010001
100100010111001
110111000011110
011100101000001
111001001000111
```

In the early days of computers, the persons who wrote software (programmers) were forced to work with this sort of difficult and error-prone language. About the time a programmer would get comfortable with a machine language, a new machine (with a different machine language) would be purchased! It didn’t take long for programmers to think of a better way of writing software. FORTRAN (FORmula TRANslator) was invented in 1957. FORTRAN was the first high-level language. When using FORTRAN, the programmer would first write a source program using FORTRAN statements, which are relatively easy to use, similar to English. Once the source code was written, a program called a compiler was used to translate the source program into machine language. If a new machine was purchased, any program written in FORTRAN could be recompiled and would then run on the new machine.
Computer Literacy Review Questions

1) _____ Which is not part of a typical computer system?
   A) Transition device  B) Input Device  C) Output Device  D) main memory

2) _____ The actual computation done in a CPU is done by the ______.
   A) control unit  B) arithmetic logic unit  C) registers  D) decision unit

3) _____ Which of the following is not an operating system?
   A) MS-DOS  B) Windows XP  C) MS WORD  D) UNIX

4) _____ The number system used for counting inside a computer is the ___________ system.
   A) binary  B) byte  C) ASCII  D) decimal

5) _____ The term for a storage unit that can hold a 0 or 1 is called a ______.
   A) byte  B) zero-or-one  C) nibble  D) bit

6) _____ A byte is equal to
   A) 2 bits  B) 4 bits  C) 8 bits  D) 16 bits

7) _____ A kilobyte is approximately
   A) 1000 bytes  B) 10,000 bytes  C) 100,000 bytes  D) 1,000,000 bytes

8) _____ The capacity of a 3.5 inch floppy disk is approximately
   A) 1 Gbyte  B) 1 Kbyte  C) 1.4 Mbyte  D) 360 Kbyte

9) _____ Which of the following allows a computer to record information, so it can be read later by the same computer or another computer?
   A) ROM  B) printers  C) primary storage  D) secondary storage

10) _____ Instructions that a computer can understand are in
    A) C++  B) Machine language  C) Computereze  D) Basic

11) _____ Secondary storage ____________________.
    A) requires sequential access  B) has small capacity compared to RAM
    C) is expensive compared to RAM  D) is slow compared to RAM

12) _____ Which of the following is volatile (goes dead if power is turned off)?
    A) RAM  B) secondary storage  C) ROM  D) CD

13) _____ Which of the following is likely to hold the least information?
    A) A:drive  B) main memory  C) C:drive  D) CD ROM drive

14) _____ Programs that do tasks such as word processing and web browsing are called __ software.
    A) application  B) system  C) programming  D) utility

15) _____ Memory that contains instructions placed in it during manufacturing to accomplish the computer startup process is called?
    A) ROM  B) RAM  C) registers  D) cache