Definitions of components of CPU architecture

Parts of the CPU (registers/von Neumann architecture

- **The control unit =** Manages the flow of data through the processor. The control unit assigns signals to different parts of the CPU and hardware of the computer to manage the activity of devices/prepare CPU for next cycle. The control unit uses the control bus to transfer these signals between CPU, memory and other peripheral devices.

- **Memory** = The storage referred to as RAM. It is volatile so only retains data when power is running through it. It stores parts of programs and the operating currently in use as well as instructions and data of programs. They are stored within addresses so that the CPU can quickly fetch them (the data bus transfers contents of addresses). The memory stores both instructions and data and the data bus is used for both (only applies to von Neumann architecture).

- **Decode unit:** Contains an instruction set which defines the operations to be carried out by instructions given in the CIR (current instruction register). This interprets the opcode (instruction) from the CIR and so signals are sent around the processor to prepare it for the next process (execution of this instruction). Every CPU model will have a unique instruction set.

- **Execute unit containing ALU–** This carries out the execution of the instruction in current instruction register on the data stored in the memory data register MDR.
  The execute unit contains –

  - **The Arithmetic logic unit (ALU**) = This calculates all of the arithmetic logic of instructions from programs (on the data). The arithmetic part can carry out simple +,-,X,/ operations on the data whereas the logic part can carry out comparisons such as <,> and =. All results are output and stored in the accumulator (a type of register in the CPU).

Bus types

- **The address bus** = responsible for identifying locations within the memory, transferring memory addresses to different components.
- **The control bus =** coordinates the flow of data by sending signals that manage the activities of peripheral devices.
- **The Data bus** – transfers data and instructions between peripherals, memory and the CPU.

Registers

Registers are special memory cells that operate at very high speeds. All arithmetic, logical or shift operations take place in registers and there are typically up to 16 different registers in a CPU.

Most modern computers have multiple registers, but for simplicity, the Computing course says that there is an accumulator which takes the place of all general-purpose registers. All calculations occur here.

There are several other special purpose registers…….

Registers in the CPU

- **The MAR = The memory address register** = stores the memory address of the instruction or data being fetched.
- **The PC = Program counter** = Stores the address of the instruction next to be fetched. Every time an instruction is fetched, this will increment by 1.
- **The MDR = The memory data register =** stores the data read from (fetched) or to be stored to the RAM.
- **CIR – the Current instruction register** = Stores the instruction currently being executed
- **ACC = the accumulator** = Stores the result from the calculations of the ALU.