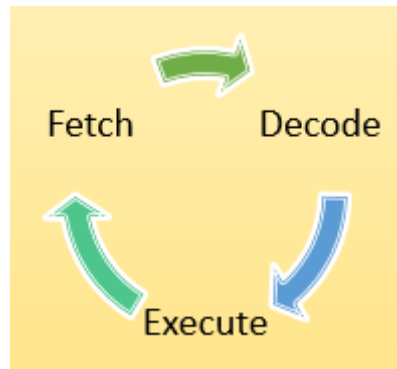




4.1.1 FDE Cycle

FDE Cycle

In order to execute a program, the program's instructions must be retrieved from main memory, decoded and executed one at a time. This cycle is called the fetch-decode-execute cycle.



Fetch

- The **program counter (PC)** holds the address of the instruction that needs to be fetched.
- The contents of the PC are copied to the **memory address register (MAR)**
- The address in the MAR is sent along the address bus to main memory.
- The control unit sends a read signal along the control bus.
- The instruction stored at that memory address is retrieved from main memory and placed on the data bus.
- This is then stored in the **memory data register (MDR)**
- At the same time the **program counter** is incremented.
- Lastly the contents of the memory data register are copied to the **current instruction register (CIR)**.





Decode

During the decode stage the instruction is split into:

- **Opcode** – The type of operation that is to be carried out
- **Operand** – The data, or address of the data, for the operation to be carried out on.

The control unit has a decode unit which decodes the instruction.

Opcode				Operand			
Basic Machine Operation			Addressing Mode				
0	0	1	0	1	1	1	1

The **addressing mode** determines how the operand is interpreted.

- **Immediate addressing** – the operand **is the data** that the opcode should be applied to.
- **Direct addressing** – the operand **is the address of the data** that the opcode should be applied to.
- **Indirect addressing** – the operand is an address which holds the address of the data.
- **Indexed addressing** – used for accessing arrays. The value in the operand is added to the value stored in the index register. The result is the address of the data.

Execute

During the execute stage, the processor carries out the operation specified by the opcode using the operand.

These operations could be:

- Perform arithmetic calculations in the ALU
- Perform bitwise logic calculations in the ALU
- Retrieve data from memory
- Store data to memory
- Change the contents of the PC due to a branch in a program

