MICROPROCESSOR
B.Tech.  th ECE

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Microprocessor Architecture

• The microprocessor can be programmed to perform functions on given data by writing specific instructions into its memory.
  – The microprocessor reads one instruction at a time, matches it with its instruction set, and performs the data manipulation specified.
  – The result is either stored back into memory or displayed on an output device.
The 8085 Architecture

- The 8085 uses three separate busses to perform its operations
  - The address bus.
  - The data bus.
  - The control bus.
The Address Bus

- 16 bits wide (A₀ A₁...A₁₅)
  - Therefore, the 8085 can access locations with numbers from 0 to 65,536. Or, the 8085 can access a total of 64K addresses.

- “Unidirectional”.
  - Information flows out of the microprocessor and into the memory or peripherals.

- When the 8085 wants to access a peripheral or a memory location, it places the 16-bit address on the address bus and then sends the appropriate control signals.
The Data Bus

– 8 bits wide \( (D_0 \, D_1 \ldots D_7) \)
– “Bi-directional”.
  • Information flows both ways between the microprocessor and memory or I/O.

– The 8085 uses the data bus to transfer the binary information.

– Since the data bus has 8-bits only, then the 8085 can manipulate data 8 bits at-a-time only.
The Control Bus

– There is no real control bus. Instead, the control bus is made up of a number of single bit control signals.
Operation Types in a Microprocessor

• All of the operations of the microprocessor can be classified into one of three types:
  - Microprocessor-Initiated Operations
  - Internal Operations
  - Peripheral-Initiated Operations
Microprocessor-Initiated Operations

• These are operations that the microprocessor itself starts.

• These are usually one of 4 operations:
  – Memory Read
  – Memory Write
  – I/O Read (Get data from an input device)
  – I/O write (Send data to an output device)
The 8085 can perform a number of internal operations. Such as: storing data, Arithmetic & Logic operations, Testing for condition, etc.

- To perform these operations, the microprocessor needs an internal architecture similar to the following:
• **Registers**
  Six general purpose registers used to store 8-bit data during a program execution.
  The registers are identified as B, C, D, E, H, and L.
  They can be combined as register pairs: BC, DE, and HL to perform 16-bit operations.

• **Accumulator**
  8-bit register that is part of the ALU.
  Used to store 8-bit data and in performing 8-bit arithmetic and logical operations, and in storing the results of operations.
The Internal Architecture

• Flags will be discussed later

• The Program Counter (PC)
  – This is a register that is used to control the sequencing of the execution of instructions.
  – This register always holds the address of the next instruction.
  – Since it holds an address, it must be 16 bits wide.
The Internal Architecture

• The Stack pointer
  – The stack pointer is also a 16-bit register that is used to point into memory.
  – The memory this register points to is a special area called the stack.
  – The stack is an area of memory used to hold data that will be retrieved soon.
  – The stack is usually accessed in a Last In First Out (LIFO) fashion.
Externally-Initiated Operations

- External devices can initiate (start) one of the 4 following operations:
  - **Reset**
    - All operations are stopped and the program counter is reset to 0000.
  - **Interrupt**
    - The microprocessor’s operations are interrupted and the microprocessor executes what is called a “service routine”.
    - This routine “handles” the interrupt, (perform the necessary operations). Then the microprocessor returns to its previous operations and continues.
The Tri-State Buffer

• This circuit has two inputs and one output.
  – The first input behaves like the normal input for the circuit.
  – The second input is an “enable”.
    • If it is set low, the output looks like a wire connected to nothing.
A Memory “Register”

• If we take four of these latches and connect them together, we would have a 4-bit memory register.
A group of Memory Registers
– If we represent each memory location (Register) as a block we get the following
The Design of a Memory Chip

– So, the previous diagram would now look like the following:
The Design of a Memory Chip

• Since we have tri-state buffers on both the inputs and outputs of the flip flops, we can actually use one set of pins only.