CSE 331/L-1/08.02.2024/

Google Classroom: kpbmkcm

Quiz ⇒ 2 out of 3/4

Syllabus will be repeat in every exam

Others Section!

5 ⇒ 9:25 ⇒ SAC 503

6 ⇒ 10:50 ⇒ NAC 992

7 ⇒ 12:15 ⇒ SAC 513

Text Books:

Microprocessor ⇒ Barry B Brey (70-75 ।)

Interfacing ⇒ N. Mathivanan

For Lab ⇒ Charles Marut

L-2/10.02.2024/

* Component of a simple microcomputer:
  - Central Processing Unit (CPU)
  - Memory (RAM or ROM)
  - I/O Ports
  - I/O Devices

⇒ For internal connectivity:
  - Data Bus ⇒ Both way
  - Address Bus ⇒ One way
  - Controll Bus ⇒ Both way

Microprocessor!

- Multipurpose
- Programmable
- Clock-driven
- Register based

- reads binary instruction
- accept binary data as inputs
- process according to instruction
- provides output

- Sync.
- External Source

In case of PC (Personal Computer), CPU refers to microprocessor

CPU!

- Data processing
- Data movement
- Logical operation

⇒ BIU ⇒ BUS Interface Unit
⇒ Used for data movement

Microprocessor is a data processing unit. ⇒ Main function

data computation & movement → performed by ALU

ALU!

- Arithmetic and Logic Unit
- function that cause data changes
  - Add
  - Subtract
  - AND
  - OR
  - Compare
  - Increment
  - Decrement
- cannot itself move data from place to place.
- Performs operation where data found and leave result in the same place.

* Fetch/Execute cycle:

↱ Fetch → Decode → Execute → Store ↰

* Microprocessor can do nothing itself. Needs
  - Memory circuits ⇒ to store program instruction
  - I/O Circuits ⇒ for data movement
  - Power Supply

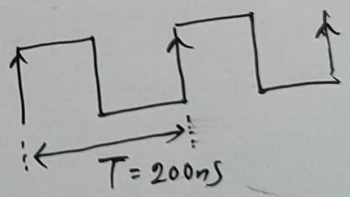
  Controll by control logic

* Power of a Microprocessor:
  - capacity to process data
  - three measurement
    - length of the microprocessor data word (Data Bus)
    - number of memory words that the microprocessor can address (Adress Bus)
    - Speed of executing an instruction (clock speed)

*

$$f = 5\ MHz = 5 \times 10^6\ Hz$$

$$T = \frac{1}{f} = \frac{1}{5 \times 10^6\ Hz} = 0.2 \times 10^{-6}\ s = 200 \times 10^{-9}\ s = 200\ ns$$



* BUS cycle ⇒ cycle needed for executing a single instruction (CPI)

Let's say Bus Cycle = 4 T

= 4 × 200 ns

= 800 ns

4x than previous

$f = 20\ MHz = 20 \times 10^6\ Hz$

$T = \frac{1}{f} = \frac{1}{20 \times 10^6\ Hz} = 0.05 \times 10^{-6}\ s$

$= 50 \times 10^{-9}\ s$

$= 50\ ns$

$\frac{1}{4}$ of previous

1 BUS Cycle = 4T

$= 4 \times 50\ ns$

$= 200\ ns$

$\frac{1}{4}$ of previous

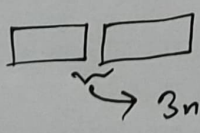
World's first microprocessor:

- developed by intel
- 4004
- 1971
- 2300 transistor
- 10-bit address bus
- 4 bit databus
- 108 kHz
- Addressable memory 640 bytes

⇒ 8086

- 1978
- 5 MHz
- 16-bit data bus
- 29,000 transistor
- 20-bit address bus
- 1M addressable memory

CD ⇒ Critical Dimension

- Difference between two transistor
- 

Types of Microprocessor:

(i) Dedicated Controllers:

- known as microcontroller
- used to control smart machines
  - microwave oven, washing machine etc.
- a complete computer with limited capacity.
- contain application ⇒ ADC, Timer, PWM Generator etc.
- TMS-1000 ⇒ 4-bit microprocessor
  - by Texas instruments
- 8048 ⇒ 8-bit CPU (1976)

(ii) Bit-Slice Processor:

- used to build a custom CPU
- used for parallel processing
- AMD-2900 ⇒ 4-bit ALU
  - multiplexer
  - sequencers
- Intel-3000
- 4-bit is a slice of the whole word capacity of the computer.
- connected in parallel can works as 8-bit, 16 bit, 32 bit etc.
- custom instruction set (microcode)

(iii) General Purpose CPU

- used in PC, Laptop
- can do all computational work

* There are two part in a CPU
  - BIU (BUS Interface Unit)
  - EU (Execution Unit)

* Physical Address = Code Segment × 10H + Instruction Point (offset)

⇒ Code segment address = xxxx H (16 bit binary)

⇒ xxxx H × 10 H

⇒ xxxxx H (20 bit binary)

Instruction Point/ offset = xxxx H

∴ Physical Address = xxxxH × 10H + xxxx H

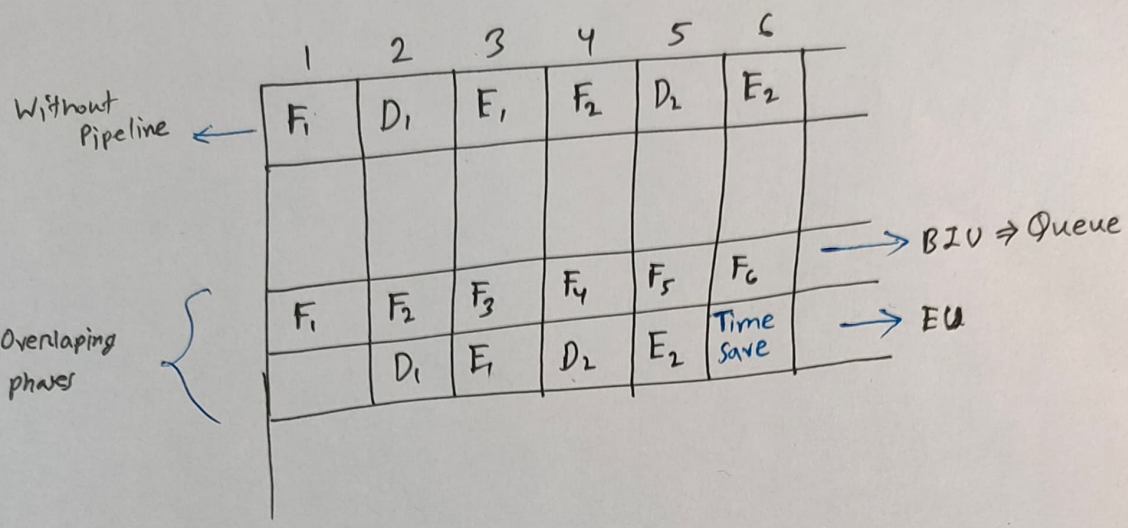
= xxxxx H + xxxx H

= xxxxx H (in binary - 20 bit)

* 20 bit address,
  - can locate 2^{20} location in a memory
  - Memory size 2^{20} = 1M (byte addressable)
  - in call of one address, there will be movement of 6 byte to the queue. → FIFO

* 8086 ⇒ 14 Register

Instruction Queue:



The Queue Operation:

i. Decode first byte to decide opcode lengths and update queue

Go to step (ii)

ii. Is it single byte?

Yes ⇒ Go to step (iv)

No ⇒ Go to step (iii)

iii. Take second byte from queue as opcode. Decode second byte.

Go to step (iv)

iv. Execute it with data bytes decoded by decoder.

Go to step (i)