Lecture-1
Wednesday
9/8/23

Overview

CSE 2203: Microprocessors and Microcontrollers

Introduction + course profile

Lecture-2
Monday
14/8/23

Microcomputer History

Different microprocessor with features:

What is n-bit microprocessor?

microprocessor size = ALU size

Intel 4004:

→ 1971
→ 4-bit microprocessor
→ 4-bit data bus, 12-bit address bus
⇒ we use 4 wire lines for data computation.
⇒ n-bit address = 2^n address can be define.
→ 4-KB of memory (outside)
→ 45 instructions.

→ Problems:

① Speed

② Word width

Intel 8008 → Intel 8080 → Intel 8085 → 8086/8088

⇒ First modern 8-bit processor ⇒ last 8-bit μprocessor

*** Particular generation ৭ difference.

Microprocessor (***)

→ microprocessor and cpu are used interchangeably.

→ A μprocessor is a multipurpose, programmable, clock-driven, register based electronic device that reads binary instructions from a storage device called memory, accepts binary data as input and process data according to those instructions and provides results as output.

Lecture-3

Wednesday

23/8/23

Introduction to Microprocessor

Assignment: Lecture-3 Topics

→ Submission: Next class

Why we need to learn microprocessor?

General purpose, no special purpose, we use it in any device.

Difference between μprocessor & μcontroller:

Microprocessor	Microcontroller
1. CPU stand alone, RAM, ROM, i/o separate.	1. CPU, RAM, ROM, memory integrated in one single chip.
2. Designer can decide on the amount of ROM, RAM & i/o ports.	2. Fixed amount of on-chip ROM, RAM, i/o ports.
3. Expensive	3. For application in which cost, power are critical.
4. General purpose.	4. Single purpose.
5. High processing power.	5. Low
6. High power consumption	6. Low
7. Customizable	7. Not customizable.

8086 Architecture

1. Clock Speed:

→ Per second এ কতগুলো clock cycle produce করতে পারে, তাই clock speed.

→ Fasten the clock speed, fasten the processing speed.

* 800 MHz = 800×10^6 clock cycles.

2. Uses of transistors in computer:

→ Building Block of computers

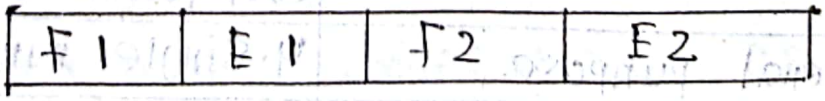
→ memory location = pair of transistors.

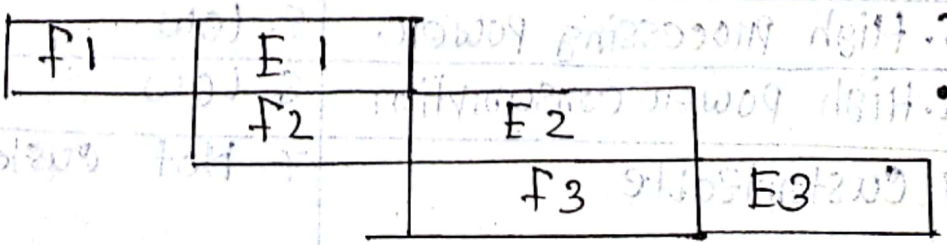
3. Moore's law:

→ integrated circuits double every two years.

4. 8088/86 pipelining:

8085 not pipelined μprocessor.





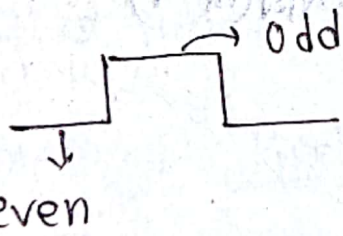
8086 microprocessor:

Features:

1. 20 bit address bus, 16 bit data bus.
2. multiplexed address and data bus.
   ↳ একই wire but অনেক কাজ করতে পারবে।
3. +5v needed
4. 40 pin dual in package

address bus } same bus দিয়ে
data bus } কাজ করে।

* NMI → Non Muskable Interrupt.



8086 internal Architecture: Draw + explain (***)

↓
Block Diagram

Main Unit:

① BIU
② EU

Registers:

*** Flag Registers

```
#  0101  0100  0011  1001
   0100  0101  0110  1010
-------------------------
   1001  1001  1010  0011
```

Sign flag, SF = 1 (MSB = 1 হলে 1, না হলে 0)

Parity flag, PF = 1 (even no !)

Carry flag, CF = 0

Auxiliary flag, AF = 1 (First nibble এ carry এসেছে 1)

Zero flag, ZF = 0

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8086 Microprocessor

Bus Interface Unit (BIU):

→ Contain 6 byte instruction queue.

→ Segment Register (CS, DS, ES, SS) → Special Purpose register

→ Summation Block, Σ = offset +

→ Instruction point ⇒ current instruction location address.

* Prefetched bytes in a FIFO called Queue.
* EU is ready then call instruction from queue.

Pipelining

* pipelining is kind of parallel processing.

Memory Segmentation

→ 20 bit address bus → can address 2^{20}

* OFFSET size 16 bit

*** Imtruction এর physical address কীভাবে calculate করা যায় ?

Starting address 10000 (code segment) ← hardware 0
offset 0029 (IP)
10029

Example:

If DS=7FA2H and the offset is 438EH

ⓐ physical addres

7FA20
438E
83DAE

ⓑ Lower Range: → starting

7FA20 + 0000 = 7FA20

ⓒ Upper Range of DS: → Ending

7FA20 + FFFF = 8FA1F

ⓓ Show the logical address:

7FA2:438E

Lecture- 5

Wednesday

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Programming languages

* Machine language → Binary (0,1)
* Assembly "
* High-level "

Machine language:

⇒ Deals with machine directly ⇒ No need for translation

⇒ Fast ⇒ No extra space needed.

Assembly language:

⇒ Uses Memonies (MUL, ADD, MOV, DIV)

⇒ Faster than high level language.

4 Parts:

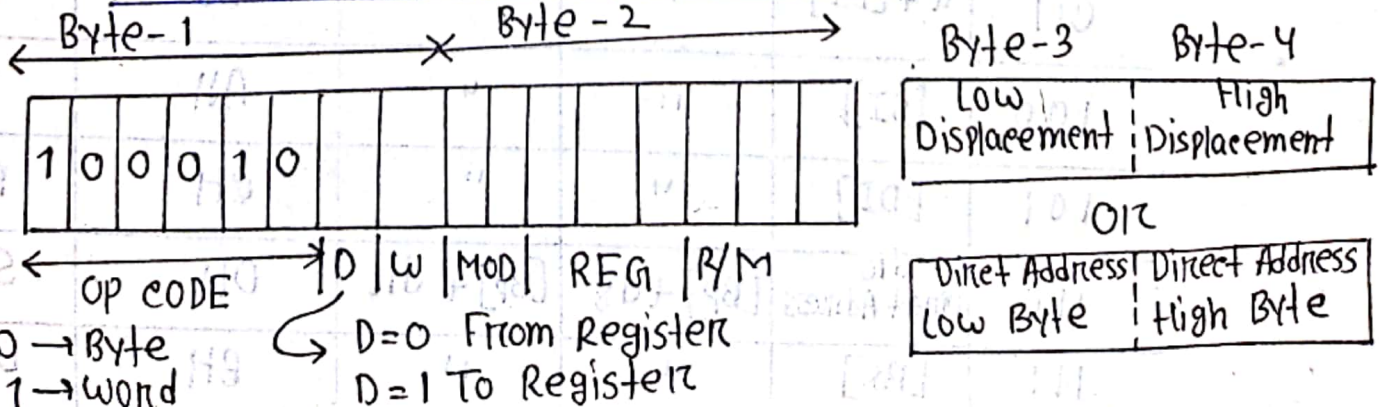
① level ② Opcode ③ Operand ④ comments

② Opcode ↓ tells the Processor what to do.

③ Operand ↓ কার উপর operation করবে।

High-level language: More closer to human.

MOVE Instruction Coding Format and Examples



Register		CODE
W=0	W=1	
AL	AX	000
BL	BX	011
CL	CX	001
DL	DX	010
AH	SP	100
BH	DI	111
CH	BP	101
DH	SI	110

Register Transfer

Memory Transfer

MOD / R/M	00	01	10	11	
				W=0	W=1
000	[Bx]+[SI]	---+d8	---+d16	AL	AX
001	" + [DI]	"	"	CL	CX
010	[BP]+[SI]	"	"	DL	DX
011	" +[DI]	"	"	BL	BX
100	[SI]	"	"	AH	SP
101	[DI]	"	"	CH	BP
110	d16 Direct Address	[BP] +d8	[Bp] + d16	DH	SI
111	[Bx]	"	"	BH	DI

MOV SP, BX

OPCODE = 100010
D = 0, ω = 1
MOD = 11
REG = 011
R/M = 100

MOV SP, BX

OPCODE = 100010
D = 1, ω = 1
MOD = 11
REG = 100
R/M = 011

MOV CL, [BX]

OPCODE = 100010
D = 1, ω = 0
MOD = 00
REG = 001
R/M = 111

MOV 43H[SI], DH

OPCODE = 100010
D = 10, ω = 0
MOD = 01, REG = 110
R/M = 100

*** Assignment → Move instruction all exercise + example. } 18/9/23 → সোমবার Submission.

বাংলা → Language ঠিক হবে।

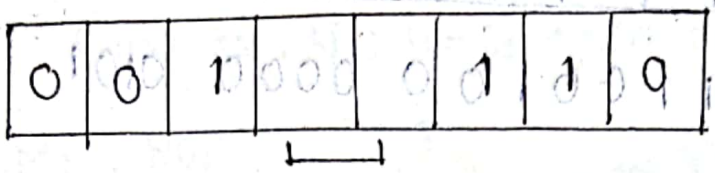
Lecture-6

18/9/23

Monday

MOV CS:[BX], DL

SEGMENT OVERRIDE PREFIX

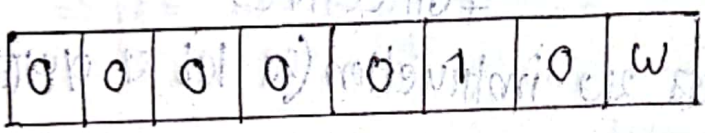


Segment Register

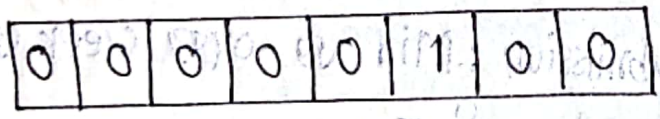
Segreg	code
CS	01
DS	11
ES	00
SS	10

ADD AL, 01H

The format is-

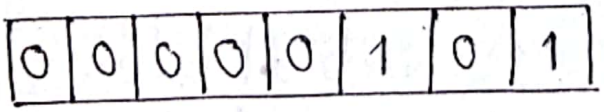


, data byte, data byte



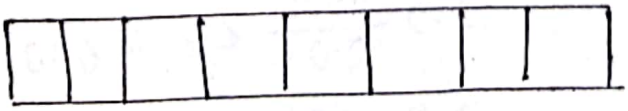
, 0000, 0001

ADD AX, 3201H



,

ADD AL, 05H



IN AL, 05H → Appendix A তে এগুলি instruction এর format দেখা।

*** MOV, ADD, IN

এর Formate for IN -

1	1	1	0	0	1	0	ω

, data byte, data byte

1 1 1 0 0 1 0 0 0000 0101

IN AX, 3205 H

1	1	1	0	0	1	0	1

E5H, 05H, 32H

+ directives

*** Chapter-6 এর সব instruction (যা lab এ পড়ানো হয়েছে) syntax, Explanation, example Assignment.

↳ Submission : Mid এর পরের week এর বুধবার।

Lecture-7
Wednesday
4/10/23

Instruction Timing and Delay loops

clock cycles

Mov cx, N ; 4 = C_0 → clock cycle overhead

KILL TIME : NOP ; 3
NOP ; 3 ↗ Jump করলে
LOOP KILL TIME ; 17 or 5 → Jump না করে পরের line এ গেলে

$\therefore C_T = C_0 + N(C_L) - 12$

$\Rightarrow N = \frac{C_T - C_0 + 12}{C_L} = \frac{5000 - 4 + 12}{23} = 218 = 0DAH$

1ms delay = 1000 μs delay

8086 μP, clock Speed = 5MHz = 5×10^6 Hz

$n = \frac{1}{T}$

$\Rightarrow T = \frac{1}{n} = \frac{1}{5 \times 10^6} = 0.2 \mu S$

0.2 μS → 1 c.c

$\therefore$ 1 " → $\frac{1}{0.2}$ "

$\therefore$ 1000 " → $\frac{1000}{0.2}$ c.c

= 5000 c.c

2.5 ms Delay

2.5 ms delay $= 2.5 \times 10^3$ μs

0.2 μs → 1 cc

$\therefore 1$ μs → $\frac{1}{0.2}$ cc

$\therefore 2.5 \times 10^3 \rightarrow \frac{2.5 \times 10^3}{0.2} = 12,500$

$\therefore N = \frac{12,500 - 4 + 12}{23} = 544D = 220H$

Nested LOOP: → অনেক বড় time দরকার হলে

```
MOV BX, COUNT1 ; 4
CNTD1: MOV CX, COUNT2 ; 4 (COUNT 1)
CNTD2: LOOP CNTDN 2 ; ((17 x COUNT 2) - 12)
                                    COUNT1
       DEC BX ; 2 (COUNT 1)
       JN2 CNTDN1 ; 16 (COUNT 1) - 12
```

30 s delay

Lecture-8

5/10/23
Thursday

8086 Addressing Modes

→ Slide

Some important topics:

① Editor
② Assemblerz
③ Linker
④ Locator
⑤ Debugger → Assignment
⑥ Emulatorz

CT syllabus: lecture 1-8

Lecture-9

9/10/23
Monday

- সব instruction detail এ আমি আসতে with example.
- " directives " " " " " " .

=> DB, DW, DD,

=> CMP instruction এর কাজ কী?

CMP Destination, Source

CMP Bx, CX