Instruction Format
8086

By,

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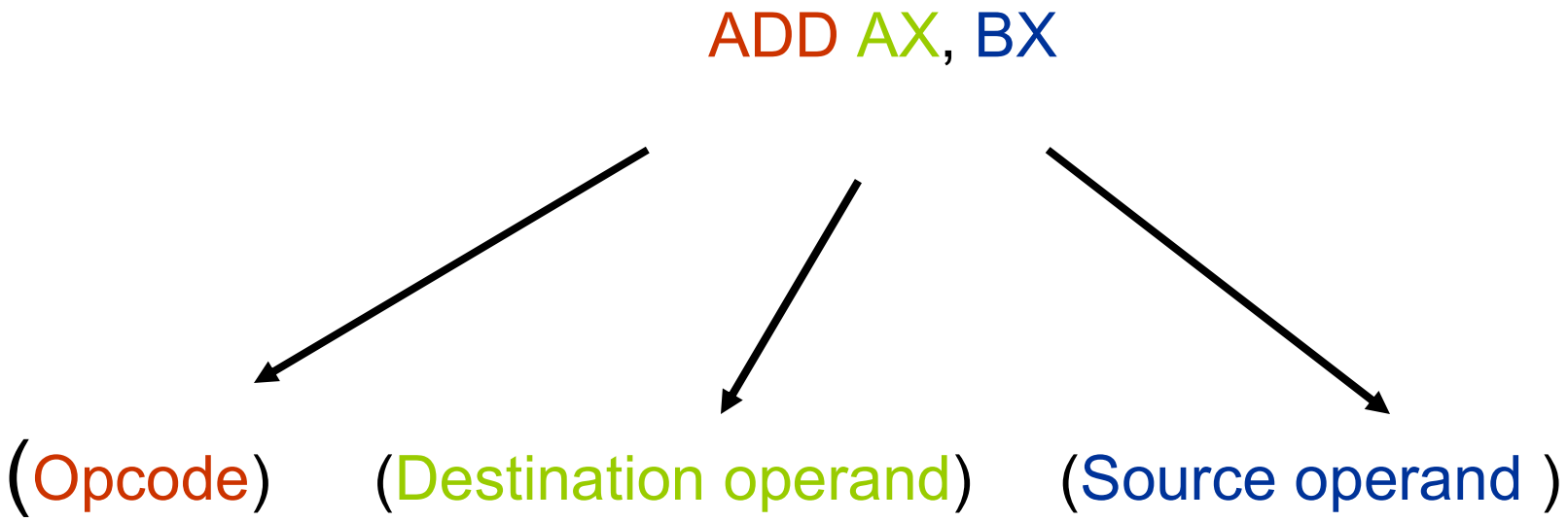
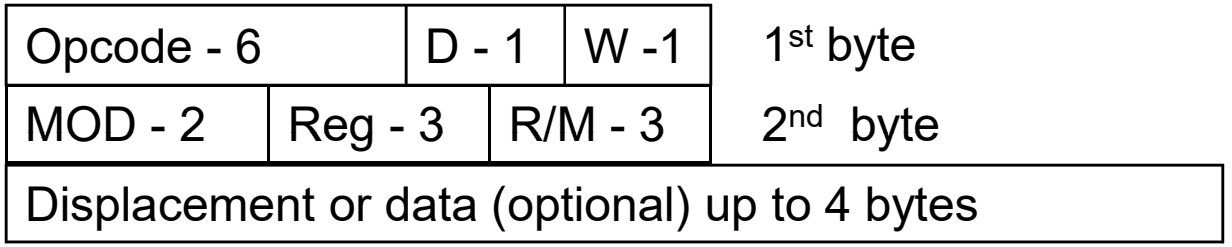

ADD AX, BX
(Opcode)
(Destination operand)
(Source operand)

general instruction form for the 8086

- An instruction can be coded with 1 to 6 bytes



Converting Assembly Language Instructions to Machine Code

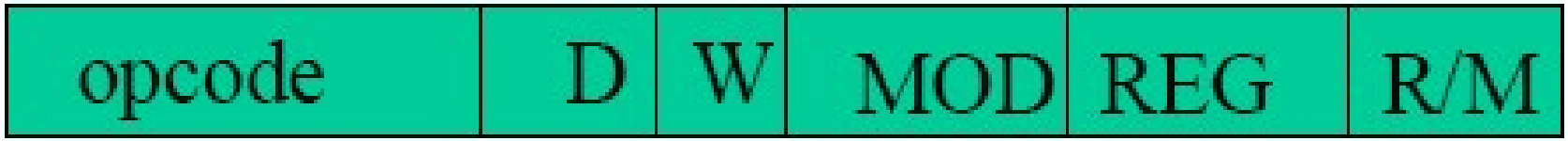
- Byte 1 contains three kinds of information
  - Opcode field (6 bits) specifies the operation (add, subtract, move)

- Register Direction Bit (D bit) Tells the register operand in REG field in byte 2 is source or destination operand

  1: destination 0: source

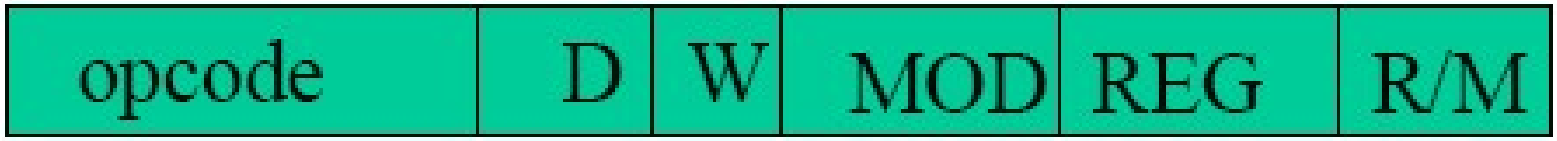
- Data Size Bit (W bit) Specifies whether the operation will be performed on 8-bit or 16-bit data

0: 8 bits 1: 16 bits



- Byte 2 has three fields
  - Mode field (MOD)
  - Register field (REG) *used to identify the register for the first operand*
  - Register/memory field (R/M field)

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



2-bit MOD field and 3-bit R/M field together specify the second operand

CODE	EXPLANATION
00	Memory Mode, no displacement follows*
01	Memory Mode, 8-bit displacement follows
10	Memory Mode, 16-bit displacement follows
11	Register Mode (no displacement)

*Except when R/M = 110, then 16-bit displacement follows

(a)

Mode Field encoding

MOD = 11			EFFECTIVE ADDRESS CALCULATION			
R/M	W = 0	W = 1	R/M	MOD = 00	MOD = 01	MOD = 10
000	AL	AX	000	(BX) + (SI)	(BX) + (SI) + D8	(BX) + (SI) + D16
001	CL	CX	001	(BX) + (DI)	(BX) + (DI) + D8	(BX) + (DI) + D16
010	DL	DX	010	(BP) + (SI)	(BP) + (SI) + D8	(BP) + (SI) + D16
011	BL	BX	011	(BP) + (DI)	(BP) + (DI) + D8	(BP) + (DI) + D16
100	AH	SP	100	(SI)	(SI) + D8	(SI) + D16
101	CH	BP	101	(DI)	(DI) + D8	(DI) + D16
110	DH	SI	110	DIRECT ADDRESS	(BP) + D8	(BP) + D16
111	BH	DI	111	(BX)	(BX) + D8	(BX) + D16

(b)

Register/memory (R/M) Field Encoding

Examples

MOV BL,AL **($88C3_{16}$)**

Opcode for MOV = 100010

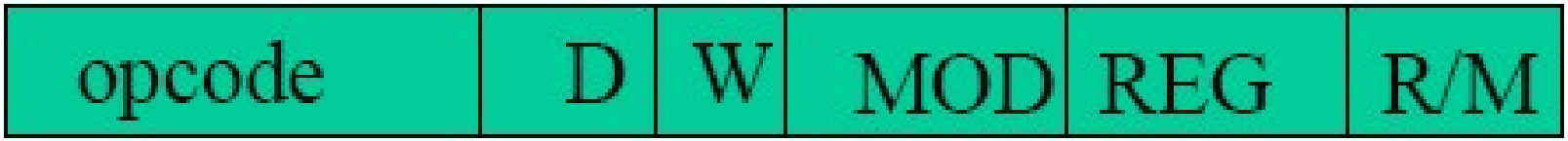
D = 0 (AL source operand)

W bit = 0 (8-bits)

Therefore byte 1 is $10001000_2=88_{16}$

- MOD = 11 (register mode)
- REG = 000 (code for AL)
- R/M = 011 (destination is BL)

Therefore Byte 2 is $11000011_2=C3_{16}$



- MOV CL,[BX]
- MOV CH,[1050]h

General format of 8086 instructions

general formats

- One byte instruction
  - May have implied data or register operands
  - Eg: CLC, clear carry (11111000)

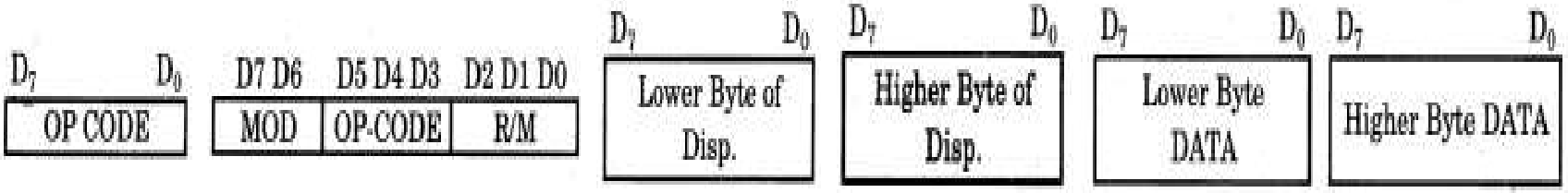
- Register to Register (2 bytes)

- Register to /from memory with no displacement (2 bytes)

- Register to /from memory with displacement (3 or 4 bytes)

- Immediate Operand to Register

- Immediate Operand to Memory with 16 bit displacement



Single bit indicators

- **W – bit:** word or byte
- **D- bit:** if double operand is present, indicate which is source and which is destination. D=1, REG destination operand.
- **S – bit :** sign extension bit
- **V – bit:** for shift rotate instructions, if 1 CL contains count, else count is one.
- **Z – bit:** used by REP instruction.