CSE341: Microprocessors

Assignment 01

1. Suppose the physical address of a memory location is **33330** H and the offset is **1111** H. What is the base address (segment number) of the segment? What is the highest address in that segment (assume non overlapping segmentation) ? (1+1 = 2 mark)

2. Find out the physical address when
   a. **234D h** is the offset and base address of segment is **91AB h** (1 mark)
   b. **1863 h** is the offset and base address of segment is **AA10 h** (1 mark)
   c. Give an example of a physical address which can have 3 different logical address (do not use the example that is given in the slide) (1 mark)

3.
   a. Suppose AX contains **EEEEh** and BX contains **BBBBh**. Suppose the instruction **"ADD AX, BX"** is executed. What is the status of **SF, PF, ZF, CF** and **OF** ? **You have to explain your answer.** (2.5 mark)

   b. Suppose AX contains **8000h** and BX contains **1234h**. Suppose the instruction "**ADD AX, BX**" is executed. What is the status of **SF, PF, ZF, CF** and **OF** ? **You have to explain your answer.** (2.5 mark)

4. You are given the following instruction:

   ADD AX , [10h]

   You are provided the following data: **DS = AB12h ; SS = 2567h ; CS= 29C1h**
   Find the effective address location for the given instruction. (1 mark)

5. Find the smallest and the second largest segment address for each of the following physical addresses. Also, mention the logical addresses (**segment:offset pair**) for each case: (1 + 1 = 2 mark)

   a. **FFFEFh**
   b. **2h**

6. Explain in detail why 8086 supports a maximum of **1MB** physical memory? (2 mark)

7. What will be the capacity in **megabytes** of the physical memory of a microprocessor with a **28 bit address bus**? What are the initial and last physical addresses in hexadecimal numbers? (1 + 1 = 2 mark)

8. Use the following charts to answer the questions **(a)** and **(b)**

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	

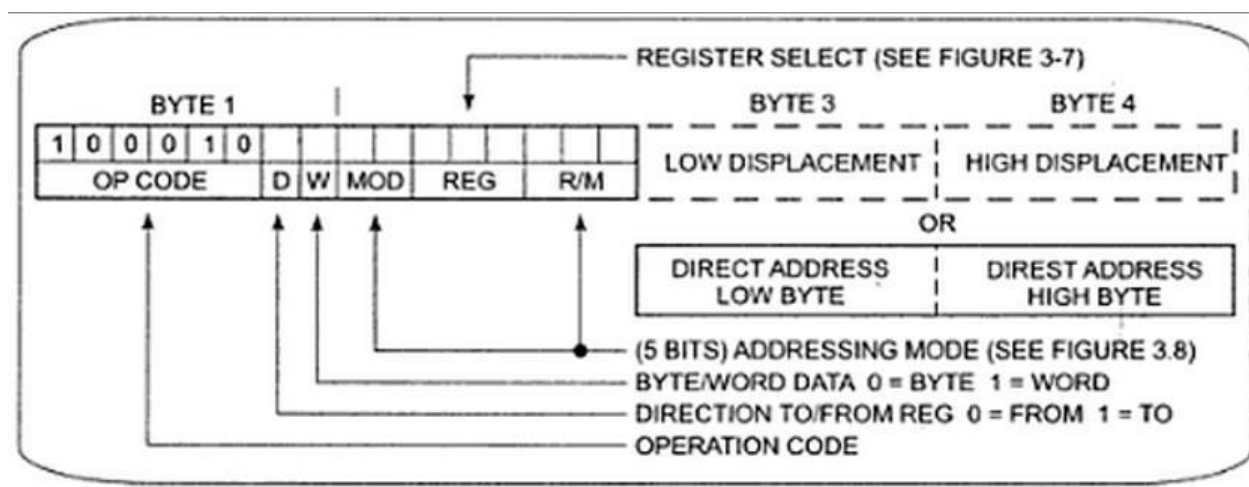**Figure: R/M vs MOD Chart for MOV: 100010 instruction**

Figure: MOV: 100010 instruction template

(a) Convert **89806910h** from machine language to its corresponding assembly language. Show all of your workings. (1.5 mark)

The bytes are: 89 80 69 10

First byte (opcode): 89h = 1000 1001

- opcode = 100010 (MOV)
- d = 0 (register is the source)
- w = 1 (16-bit operand)

Second byte (ModRM): 80h = 10 000 000

- mod = 10 → memory operand with 16-bit displacement
- reg = 000 → AX (since w = 1)
- r/m = 000 → [BX+SI] + disp16

Displacement (next two bytes, low then high): 69 10 → 1069h

Since d = 0, reg (AX) is the source and r/m is the destination.

Assembly: MOV [BX+SI+1069h], AX

(b) Suppose the instruction **MOV DI, [BP+42h]**, appears in a program. What is its machine language for the given instruction? (1.5 mark)

Opcode byte:
- opcode = 100010 (MOV)
- d = 1 (register DI is the destination)
- w = 1 (16-bit operand)
- → 1000 1011 = **8Bh**

ModRM byte:
- mod = 01 → memory operand with 8-bit displacement
- reg = 111 → DI
- r/m = 110 → [BP] + disp8
- → 01 111 110 = **7Eh**

Displacement byte: 42h

Machine language: 8B 7E 42h