

# EECE.3170: Microprocessor Systems Design I

Fall 2016

## Homework 2 Solution

Assume the state of an x86 processor's registers and memory are:

	<b>Address</b>	<b>Lo</b>		<b>Hi</b>	
EAX: 0xEECE3170	0x20100	10	00	08	00
EBX: 0x00000001	0x20104	10	10	FF	FF
ECX: 0x00000002	0x20108	08	00	19	91
EDX: 0x00000004	0x2010C	20	40	60	80
ESI: 0x00020100	0x20110	02	00	AB	0F
EDI: 0x00020110	0x20114	30	99	11	55
	0x20118	40	AA	7C	EE
	0x2011C	FF	BB	42	D2
	0x20120	30	CC	30	90

What is the result of each of the instructions listed below? Assume that the instructions execute in sequence—in other words, the result of each instruction may depend on the results of earlier instructions. Correctly evaluating each instruction will earn you **10 points**.

Note that you may assume any constant values shown using less than 32 bits are zero-extended to 32 bits if necessary (for example, 0x000F = 0x0000000F).

*MOV DL, 0xFE*

**Solution:** DL = 0xFE

*MOV DH, AL*

**Solution:** DH = AL = 0x70 (EDX now = 0x000070FE)

*MOVSX BX, BYTE PTR [ESI+0x000F]*

**Solution:** BX = sign-extended byte at address ESI+0x000F = 0x00020100 + 0x000F = 0x0002010F

→ BX = 0x80 sign-extended = 0xFF80

*MOV [EDI+ECX], EBX*

**Solution:** Double-word at address EDI+ECX = EBX

EDI+ECX = 0x00020110 + 0x00000002 = 0x00020112

→ (0x20112) = EBX = 0x0000FF80 (bytes ordered as 0x80, 0xFF, 0x00, 0x00)

*MOV [ESI+4\*ECX], AX*

**Solution:** Word at address  $ESI+4*ECX = AX$

$$ESI + 4*ECX = 0x20100 + 4 * 2 = 0x20108$$

→  $(0x20108) = \mathbf{0x3170}$  (bytes ordered as 0x70, 0x31)

*XCHG CL, [ESI]*

**Solution:** Swap byte values in CL, address 0x20110 →  $CL = \mathbf{0x10}$ ,  $(0x20110) = \mathbf{0x02}$

*MOVZX EAX, WORD PTR [EDI+ECX]*

**Solution:**  $EAX = \text{zero-extended word at address } EDI+ECX = 0x20110 + 0x00000010 = 0x20120$

→  $EAX = \mathbf{0x0000CC30}$  (original word underlined)

*MOV DX, [EDI+0xFFFFFFFF]*

**Solution:**  $DX = \text{word at address } EDI+0xFFFFFFFF = 0x20110 + (-6) = 0x2010A$

→  $DX = \mathbf{0x9119}$

*LEA ECX, [ESI+EBX+0x0017]*

**Solution:**  $ECX = ESI + EBX + 0x0017h = 0x20100 + 0x0000FF80 + 0x0017h = \mathbf{0x30097}$

*MOVSX EBX, BYTE PTR [ESI+4]*

**Solution:**  $EBX = \text{sign-extended byte at address } 0x20104h = \mathbf{0x00000010}$  (original byte underlined)