EECE.3170: Microprocessor Systems Design I

Fall 2019

Homework 2 Solution

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

EAX: 0xEECE3170
EBX: 0x00000001
ECX: 0x00000002
EDX: 0x00000004
ESI: 0x00020100
EDI: 0x00020110

Address	***Lo***			***Hi***
0x20100	*10*	*00*	*08*	*00*
0x20104	*10*	*10*	*FF*	*FF*
0x20108	*08*	*00*	*19*	*91*
0x2010C	*20*	*40*	*60*	*80*
0x20110	*02*	*00*	*AB*	*0F*
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

à BX = 0x80 sign-extended = **0xFF80**

MOV [EDI+ECX], EBX

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

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

à (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

à (0x20108) = **0x3170** (bytes ordered as 0x70, 0x31)

XCHG CL, [ESI]

Solution: Swap byte values in CL, address 0x20110 à CL = **0x10**, (0x20110) = **0x02**

MOVZX EAX, WORD PTR [EDI+ECX]

Solution: EAX = zero-extended word at address EDI+ECX = 0x20110 + 0x00000010 = 0x20120

à EAX = **0x0000CC30** (original word underlined)

MOV DX, [EDI+0xFFFFFFFA]

Solution: DX = word at address EDI+0xFFFFFFFA = 0x20110 + (-6) = 0x2010A

à DX = **0x9119**

LEA ECX, [ESI+EBX+0x0017]

Solution: ECX = ESI + EBX + 0x0017h = 0x20100 + 0x0000FF80 + 0x0017h = **0x30097**

MOVSX EBX, BYTE PTR [ESI+4]

Solution: EBX = sign-extended byte at address 0x20104h = **0x00000010** (original byte underlined)