16.317: Microprocessor Systems Design I

Fall 2013

Homework 2

Due **Monday, 9/23/13**

Notes:

- While typed solutions are preferred, handwritten solutions to these problems are acceptable.
- Any handwritten solutions that are scanned and submitted electronically must be clearly legible and combined into a single file—simply sending a picture of each scanned page is not an acceptable form of submission.
- This assignment is worth a total of 50 points.

1. (15 points) Assume the state of an x86 processor's registers are as follows:

   - (DS) = 1631h
   - (ES) = F0F0h
   - (SS) = 3170h
   - (ESI) = 10102020h
   - (EDI) = 617CFE11h
   - (EBX) = 001AC2B8h
   - (EBP) = FAAF1F2Fh

   Given each of the logical addresses listed below, answer the following questions:

   - What linear address corresponds to the given logical address?
   - If the processor accesses a word at that address, is the access aligned?
   - If the processor accesses a double word at that address, is the access aligned?

   a. DS:SI
   b. ES:DI
   c. SS:BP
   d. DS:BX
   e. ES:B026h

2. (15 points) Assume the state of the x86 registers are as follows:

- (DS) = C02Eh
- (ES) = 9170h
- (ESI) = 0000E11Ch
- (EDI) = 3AA51273h
- (EBX) = D0B0F12Fh
- (EDX) = 00000003h

For each of the instructions below, determine the linear address for the memory operand in each instruction. Recall that memory operands are indicated by square brackets [ ], and that either the source or destination may be a memory operand.

Note also that the initial state is the same for each instruction—you should not assume that all instructions execute in sequence.

a. MOV ES:[DI], AX

b. MOV [B18Dh], BX

c. MOV CX, ES:[SI+1EE7h]

d. MOV AX, [BX+4*DX]

e. MOV [55h+DX+DI], AX

3. (20 points) Assume the state of the x86 registers and memory are as shown below. Note that all values shown in memory are in hexadecimal:

Initial state:
EAX: 00000000h
EBX: 00000008h
ECX: 0000021Eh
EDX: 0000FFFEh
ESI: 0000F000h
EDI: 00000101h
DS: 2201h
ES: 2000h

Address	Lo			Hi
22000h	20	13	80	40
22004h	FF	AF	BC	13
22008h	99	88	77	66
2200Ch	A8	B1	F0	43
22010h	78	D6	32	33
22014h	34	35	12	16
22018h	93	03	7C	EF

What is the result produced in the destination operand by each of the instructions listed below? Assume that the instructions execute in sequence.

```
MOV     AX, [BX+01H]
MOV     [000Ah], CX
MOVSX   EBX, BYTE PTR [0001H]
MOVZX   DWORD PTR ES:[SI+3000h], DX
LEA     DI, [SI+1A2BH]
LDS     EDX, ES:[2006H]
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