# 16.317: Microprocessor Systems Design I

Spring 2012

Homework 3

Due **Monday, 3/26/12**

Most problems in this assignment are based on problems in the textbook, although they have been modified in some cases—do not assume that simply doing the problem directly from the text will be sufficient.

1. *(Chapter 5, #34)* Assume the state of the 80386DX's registers and memory are::

   - (EAX) = 00000000H
   - (EBX) = 00000010H
   - (ECX) = 00000105H
   - (EDX) = 00001111H
   - (ESI) = 00000100H
   - (EDI) = 00000200H
   - (CF) = 0
   - (DS:100H) = 0FH
   - (DS:200H) = 22H
   - (DS:201H) = 44H
   - (DS:202H) = 00H
   - (DS:203H) = 00H
   - (DS:210H) = 55H
   - (DS:211H) = AAH
   - (DS:220H) = AAH
   - (DS:221H) = 55H
   - (DS:400H) = AAH
   - (DS:401H) = 55H

   What is the result produced in the destination operand by each of the instructions listed below? Assume that each instruction executes independently—your answer to part (b), for example, does not depend on your answer to part (a).

   a. SHL DX, CL
   b. SHL EDX, 7
   c. SHL BYTE PTR [0400H], CL
   d. SHR BYTE PTR [DI], 1
   e. SHR DWORD PTR [DI], 3
   f. SHR BYTE PTR [DI+BX], CL
   g. SAR WORD PTR [BX+DI], 1
   h. SAR WORD PTR [BX][DI]+10H, CL

2. *(Chapter 5, #44)* Assume the state of the 80386DX's registers and memory are::

- (EAX) = 00000000H
- (EBX) = 00000010H
- (ECX) = 00000105H
- (EDX) = 00001111H
- (ESI) = 00000100H
- (EDI) = 00000200H
- (CF) = 1
- (DS:100H) = 0FH
- (DS:200H) = 22H
- (DS:201H) = 44H
- (DS:210H) = 55H
- (DS:211H) = AAH
- (DS:220H) = AAH
- (DS:221H) = 55H
- (DS:400H) = AAH
- (DS:401H) = 55H

What is the result produced in the destination operand by each of the instructions listed below? Assume that each instruction executes independently—your answer to part (b), for example, does not depend on your answer to part (a).

a. ROL DX, CL
b. RCL BYTE PTR [0400H], CL
c. ROR BYTE PTR [DI], 1
d. ROR BYTE PTR [DI+BX], CL
e. RCR WORD PTR [BX+DI], 1
f. RCR WORD PTR [BX][DI]+10H, CL

3. (*Chapter 6, #8)* Assume the state of the 80386DX's registers and memory are::

- (EAX) = 00008001H
- (ESI) = 00000200H
- (EDI) = 00000300H
- (DS:100H) = F0H
- (DS:200H) = F0H
- (DS:201H) = 01H
- (DS:300H) = 34H
- (DS:301H) = 12H
- (DS:302H) = 00H
- (DS:303H) = 00H

What is the state of the 80386DX's flags after executing each of the following instructions?

a. CMP [0100H], AL
b. CMP AX, [SI]
c. CMP DWORD PTR [DI], 1234H

4. *(Chapter 6, #26)* The program that follows implements what is known as a *delay loop.*

```
     MOV  CX, 1000H
DLY: DEC  CX
     NOP            ; NOP instruction does nothing
     JNZ  DLY
NXT: ---  ---
```

a. How many times does the JNZ DLY instruction get executed?
b. Change the program so that JNZ DLY is executed just 17 times.
c. Change the program so that JNZ DLY is executed $2^{32}$ times.

5. *(Chapter 6, #28)* Write a program that compares the elements of two arrays, A(I) and B(I). Each array contains 100 16-bit signed numbers. The comparison is to be done by comparing the corresponding elements of the two arrays until either two elements are found to be unequal or all elements of the arrays have been compared and found to be equal. Assume that the arrays start in the current data segment at offset addresses $A000_{16}$ and $B000_{16}$, respectively. If the two arrays are found to be unequal, save the offset of the first unequal element of A(I) in the memory location with offset $C000_{16}$; otherwise, write all 0s into this location.

6. *(Chapter 6, #36)* Assume the state of the 80386DX's registers and memory are::

- (CS) = 1075H
- (IP) = 0300H
- (EBX) = 00000100H
- (EDX) = 10101000H
- (ESI) = 00000100H
- (DS:100H) = 00H
- (DS:101H) = 10H
- (DS:200H) = 00H
- (DS:201H) = 01H
- (DS:202H) = 00H
- (DS:203H) = 10H

To what address is program control passed after executing each instruction below?

a. CALL 1000H
b. CALL WORD PTR [100H]
c. CALL DWORD PTR [BX+SI]
d. CALL EDX