16.317: Microprocessor Systems Design I

Spring 2013

Homework 2

Due **Friday, 2/15/13**

NOTE: ***The solution to this assignment will be posted Monday, 2/18, making that day the last day to submit late assignments. Note that we do not have class that day—any late submissions will have to come via e-mail.***

UPDATE (2/11): ***Due to Friday's cancellation, I've made the following changes:***

- ***Problem 1 is now worth 60 points***
- ***Problem 3 is worth 10 extra credit points if completed.***
- ***Problems 2 and 3 have been changed slightly—the rotate instructions originally in Problem 2 have been changed to shift instructions, while rotate instructions have been added to Problem 3.***

UPDATE #2 (2/13): ***As you may have noticed, some of the instructions in Problem 3 were not covered during today's class. I've modified the problem again. The original problem is worth 15 extra points, if you want to look up those instructions; the "new" problem is still worth 10.***

1. ***(60 points)*** Assume the state of the 80386DX's registers and memory are:

EAX: 00000010H
EBX: 00000020H
ECX: 00000030H
EDX: 00000040H
CF: 1
ESI: 00000100H
EDI: 00000100H
DS: 2000H

Address				
20100H	10	00	08	00
20104H	10	10	FF	FF
20108H	08	00	19	91
2010CH	20	40	60	80
20110H	02	00	AB	0F
20114H	30	00	11	55
20118H	40	00	7C	EE
2011CH	FF	00	42	D2
20120H	30	00	30	90

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

ADD AX, 00FFH
ADC SI, AX
INC BYTE PTR [0100H]
SUB DL, BL
SBB DL, [0114H]
DEC BYTE PTR [DI+BX]
NEG BYTE PTR [DI+0018H]
MUL DX
IMUL BYTE PTR [SI+FEF7H]
DIV BYTE PTR [SI+FEF9H]
IDIV BYTE PTR[SI+FF01H]

2. *(40 points)* Assume the state of the 80386DX's registers and memory are:

EAX: 00005555H
EBX: 00000010H
ECX: 00000010H
EDX: 0000AAAAH
ESI: 000000F2H
EDI: 00000200H
DS: 4500H

Address				
45100H	0F	F0	00	FF
	…			
45200H	30	00	19	91
	…			
45210H	AA	AA	AB	0F
	…			
45220H	55	55	7C	EE
	…			
45300H	AA	55	30	90

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

AND BYTE PTR [0300H], 0FH
SAR DX, 8
OR [BX+DI], AX
SHL AX, 2
XOR AX, [SI+BX]
NOT BYTE PTR [0300H]
SHR AX, 4

3. ***(Extra credit; 10 or 15 points)*** Assume the state of the 80386DX's registers and memory are:

EAX: 00005555H
EBX: 00000010H
ECX: 00000010H
EDX: 0000AAAAH
ESI: 000000F2H
EDI: 00000200H
DS: ABC0H

Address				
ABD00H	0F	F0	00	FF
	…			
45200H	30	00	19	91
	…			
45210H	AA	AA	AB	0F
	…			
45220H	55	55	7C	EE
	…			
45300H	AA	55	30	90

Also, assume all flags (ZF, CF, SF, PF, OF) are initialized to 0.

For the instruction sequence shown below, list <u>all</u> changed registers and/or memory locations and their new values, as well as all changed flags from the list above. Note that the registers and memory have the same starting values at the beginning of each sequence, but a value changed by one instruction in a sequence can affect the results of all other instructions in the same sequence.

<u>Original problem (15 pts)</u>

```
BT AX, 4
SETC [100H]
BTS AX, 5
SETC [101H]
BTR AX, 6
SETC [102H]
BTC AX, 7
SETC [103H]
ROL AX, 4
RCR AX, 5
```

<u>New problem (10 pts)</u>

```
BT      AX, 4
BTS     AX, 5
BTR     AX, 6
BTC     AX, 7
BSF     CX, BYTE PTR [100H]
BSR     DX, BYTE PTR [101H]
ROL     AX, 4
RCR     AX, 5
ROR     BX, 12
RCL     BX, 3
```