

EE 3724 Test #1 SOLUTIONS- Spring '01 – Reese

1. (10 pts) Assume we have microprocessor that has an 8-bit wide INSTRUCTION POINTER register (or program counter register). The microprocessor has an instruction format that is **OPCODE|DATA**, where the OPCODE field is 5 bits, and the DATA FIELD is 8 bits.
 - a. What is the maximum number of different types of instructions that this processor could support? *OPCODE field = 5 bits, $2^5 = 32$ maximum different instruction types*
 - b. What is the largest program (number of instructions in the program) that this processor could have? *Instruction pointer width = 8bits, $2^8 = 256$ instructions in program*
2. (6 pts) What are the three parts of ANY computer system?
control, input/output, memory

3. 15 pts.

Assume the following memory contents:

Address	Contents															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
09A0:0000	C5	67	A5	00	12	BC	34	BB	F4	72	09	A3	29	01	D4	CE
09A0:0010	FE	89	02	D8	A4	8A	7C	DD	90	3C	9B	83	65	19	F6	8A
09A0:0020	A7	CC	9A	BD	8E	90	2C	00	1C	90	0E	13	8C	39	58	C6
09A0:0030	76	D7	CA	FF	D8	71	18	24	40	A8	2C	76	93	C5	0F	9E
09A0:0040	82	A6	54	2E	9A	20	0A	98	E4	A0	0E	25	38	29	2C	86

Assume the following register contents:
DS: 09A3, SS: 09A1, BX= 000C, BP:0004

Give the final value of the affected register:

- a) `mov al, [BX]` DS:BX = 09A3:000C = 09A0:003C, AL = 93
- b) `mov ax, [BX-5]` DS:BX-5 = 09A3:(00C-5) = 09A3:0007 = 09A0:0037, AX = 4024
- c) `mov eax, [BP+8]`
SS:BP+8 = 09A1: (0004+8) = 09A1:000C = 09A0:001C, EAX= 8AF61965

4. (5 pts) Assume the following register contents:

AX = 01FA BX = FF03

What is the NEW value of AX if the instruction "imul bl" is executed?

*AX = signed AL * signed BL = FA * 03 = -6 * +3 = -18, AX = FFEh*

5. (5 pts) Assume the following register contents:

AX = 001A BX = FF0C

What is the new value of AX if the instruction "idiv bl" is executed? Remember that AL gets the quotient, and that AH gets the remainder.

Signed 001A / signed FC = 26 / -4, quotient(AL) = -6 = FA h, rmdr (AH) = +2 = 02 h

6. 10 pts. Assume the following register contents:

Assume the following register contents:

DS: 09A4, SS: 09A1, BX= 0005, BP:001B, EAX = AA2387E4

Address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
09A0:0000																
09A0:0010																
09A0:0020																
09A0:0030	87	23	AA													
09A0:0040		E4	87													

Show how memory is modified for the following instructions:

a) mov [bp+4], eax SS:BP+4 = 09A1:001B+4 = 09A1:001F = 09A0:002F

b) mov [bx-4], ax DS:BX-4 = 09A4:(0005-4) = 09A4:0001 = 009A0:0041

7. 15 pts. For each of the following sums, indicate if unsigned overflow (carry flag), signed overflow (two's complement) occur (neither, one or the other, or both)

Circle ONE answer

a. F0h + FFh NEITHER **Only Unsigned overflow** Only Signed Overflow Both
F0 + FF = FDh, sets carry flag. As signed: Negative + Negative = Negative, no signed overflow.

b. 90h + A0h NEITHER Only Unsigned overflow Only Signed Overflow **Both**
90h + A0h = 30h, sets carry flag, As signed: negative + negative = positive, so signed overflow.

c. 10h + A0h **NEITHER** Only Unsigned overflow Only Signed Overflow Both
10h + A0h = B0h, carry flag not set, as signed: positive + negative cannot overflow.

d. 50h + 40h NEITHER Only Unsigned overflow **Only Signed Overflow** Both
50h + 40h = 90h. carry flag not set, as signed: positive + positive = negative, so signed overflow.

e. 20h + 30h **NEITHER** Only Unsigned overflow Only Signed Overflow Both
20h + 30h = 50h. Carry flag not set, as signed: positive + positive = positive, so no signed overflow.

8. (8 pts) The instruction "add ax, bx" will do a 16 bit add of $AX = AX + BX$. How could I do a 16 bit add if I only have 8 bit registers? Write a two instruction sequence that will do a 16 add of $AX = AX + BX$ but you can ONLY use registers AH, AL, BH, BL in your instructions.

```
add  al,bl
adc  ah,bh      ADD with CARRY (AH + BH + Carry Flag)
```

9. (10 pts) We talked about the MASM assembler in class.

- What does the "DB" assembler instruction stand for and what does it do?
Define Byte, reserves 1 byte of memory storage
- What the "DW" assembler instruction stand for and what does it do?
Define Word, reserves 1 word of memory storage
- I mentioned that the first two instructions of ANY program should be something like:

```
START:  mov  ax, @data
        mov  ds, ax
```

WHY IS THIS NECESSARY?

The DATA SEGMENT must be initialized to point to your data - this is not done automatically. Most instructions that reference memory will use the data segment as the default segment register and you must initialize this to point to your data segment -- it is NOT done automatically by DOS.

10. (4 pts) Give the 8 bit binary code for the decimal number 83 encoded as a Binary Coded Decimal (BCD number)

$83 = 1000\ 0011$ (BCD), each decimal digital is a group of 4 bits.

11. (4 pts) The ASCII codes 4Dh, 53h, 55h represent what? M S U

12. (8 pts) Explain the difference between the following two instructions:

- mov bx, 0200h Will move the value 0200h into BX
- mov bx, [0200h] Moves the word stored at memory location 0200h into BX.