Name: _____

Directions: **Work only on this sheet** (on both sides, if needed); do not turn in any supplementary sheets of paper. There is actually plenty of room for your answers, as long as you organize yourself BEFORE starting writing.

1. (10) Fill the blank: The sign (+, -, 0) of the result of executing a CMPL instruction is recorded in the _____.

2. Answer the following questions as to what occurs during the execution (not the fetch) of the instruction

```
addl %eax, (%ebx)
```

(a) (10) How many times will a number be placed onto the address bus?

(b) (10) Which control lines will be used?

3. Consider the example of counting lower-case letters, pp.93ff, but modified so that line 2 is

```
x:  .string "c29jem"
```

(a) (15) For each of the line numbers and operands listed below, state what addressing mode is being used.

line	operand	addressing mode
11	`$x`	
16	`(%eax)`	
16	`%bl`	

(b) (30) Suppose **x** is at address 0x500c, and consider the situation that will exist when we reach **done**. Show (in hex) the contents at each of these addresses:

address	contents
0x500c	
0x500d	
0x500e	
0x500f	
0x5010	
0x5011	
0x5012	
0x5013	
0x5014	
0x5015	
0x5016	
0x5017	
0x5018	

4. (25) Consider the code at the top of p.93, at the line

```
andl $-16,%esp
```

Suppose that before this instruction was executed, ESP contained 0x88888168. What will it contain afterwards?

Solutions:

1. EFLAGS register

2.a 2: once to read the location pointed to by EBX and once to write to it

2.b MEMR, MEMW

3.a

line	operand	addressing mode
11	`$x`	immediate
16	`(%eax)`	indirect
16	`%bl`	register

3.b

address	contents
0x500c	63
0x500d	32
0x500e	39
0x500f	6a
0x5010	65
0x5011	6d
0x5012	0
0x5013	0
0x5014	0
0x5015	1
0x5016	0
0x5017	1
0x5018	0

4. First, -16 is -0x10, i.e. 0xfffffff0. That last 0 is four 0 bits, while the fs are each 1111. So, the mask will set the last four bits of ESP to 0s, while leaving the other bits intact. So, the 0x88888168 in ESP will change to 0x88888160.