MC48 Intra-term Exam 1

Serial #:

This exam is an open-book, open-notes, individual-work exam. Please write your name only on this page. Do not turn the page until instructed, in order that everyone may have the same time. Then, be sure to look at all problems before deciding which one to do first. Some problems are easier than others, so plan your time accordingly. You have 50 minutes to work.

Write the answer to each problem on the page on which that problem appears. You may use the back of that same sheet if you need additional space. You may also request additional paper, which should be labeled with your test number and the problem number.

Name: ______________________________

Problem	Page	Possible	Score
1	2	12	
2	3	12	
3	4	12	
4	5	12	
Total		48	

1. [**12 Points**] For each of the following six sequences of instructions, indicate whether chapter 6's pipelined processor would use forwarding, stalling, both, or neither.

(a)
```
add $1, $2, $3
lw $4, 5($6)
add $7, $4, $8
add $9, $10, $11
```

(b)
```
lw $4, 5($6)
add $9, $10, $11
add $1, $2, $3
add $7, $4, $8
```

(c)
```
lw $4, 5($6)
add $9, $10, $11
add $7, $4, $8
add $1, $2, $3
```

(d)
```
add $1, $2, $3
lw $4, 5($6)
add $7, $6, $8
add $9, $10, $11
```

(e)
```
add $1, $2, $3
add $4, $1, $5
lw $6, 7($8)
add $9, $10, $6
```

(f)
```
lw $4, 5($6)
add $9, $10, $11
add $7, $8, $9
add $1, $2, $3
```

2. [**12 Points**] A new instruction is to be added to the multi-cycle processor. The instruction is "skip-if-equal." It compares the contents of two registers, specified using the rs and rt fields of the instruction. If the two registers' contents are equal, the instruction after the skip-if-equal is skipped, and execution proceeds with the next instruction (the second one after the skip-if-equal). If the two registers' contents are unequal, instruction continues as normal with the instruction after the skip-if-equal. To implement this instruction you don't need to change the datapath (shown on page 383) at all. You just need to modify the state diagram (figure 5.42 from page 396). A copy of that state diagram is reproduced below.

3. [**12 Points**] Figure 5.42 from page 396 is reproduced below. Suppose it is changed as follows. In state 0, we eliminate PCWrite and PCSource=00. In state 1, we add PCWrite and PCSource=01. Of the five kinds of instructions (lw, sw, R-type, beq, and j), which ones still will work correctly? Which won't? For any that don't, specify how the instruction's behavior will be affected. (You may also find the figures on pages 383 and 384 useful as reference.)

4. [**12 Points**] David Wolfe teaches MC28 on Mondays, Wednesdays and Fridays; MC27L on Tuesdays and Thursdays; MC57 all five days a week; and MC60 only on Wednesdays. You are to design a PLA with a three-bit input specifying the day of the week, and four outputs, one per course, indicating whether David teaches that course on the day that has be input. The three bit input is 001 for Monday, 010 for Tuesday, 011 for Wednesday, 100 for Thursday, and 101 for Friday. Your PLA will only ever be used on weekdays, so all four outputs are don't-cares when the input isn't one of the above five possibilities. You can call the inputs D_2, D_1, and D_0, where D_2 is the most significant bit and D_0 is the least. You can name the four outputs with the course numbers. Draw a diagram of the PLA.