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.

Name: _____

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

1. **[12 Points]** Do exercise 2.33 from page 89 of the text. Namely, we're trying to find a program that runs in 100 seconds on an old machine and three times faster on a new machine. The new machine executes floating point instructions five times faster than the old machine, but other instructions at the same speed. Of the original 100 seconds, what fraction must be spent on floating point instructions?

2. [**12 Points**] Write in binary the single-precision floating point representation for 2.75.

3. [**12 Points**] Instead of using a special hardware multiplier, it is possible to multiply using shift and add instructions. This is particularly attractive when multiplying by small constants. Suppose we want to put 5 times the value in `$8` into `$9`, ignoring any overflow that may occur. Show a minimal sequence of MIPS instructions for doing this; don't use a multiply instruction.

4. **[12 Points]** A sequential logic circuit is to be designed that has two inputs, A and B, and a single output, OK. If the A and B inputs ever are asserted simultaneously, the A input takes priority. Initially the OK output is asserted. It stays asserted so long as the A and B inputs are asserted in a strictly alternating fashion. The alternation can start with either of them, and there can be arbitrarily long pauses where neither is asserted. Remember also that if both A and B are simultaneously asserted, it is as though just A were. As soon as either input is asserted twice in a row, without the other input asserted in between, the OK output is deasserted. Once this happens, the OK output remains deasserted from then on no matter what is done to the inputs.

   (a) Draw a state machine diagram; indicate the states in which the OK output would be asserted, and indicate fully all the transitions between states including those that loop back from a state to itself.

   (b) Give three example rows from the next-state function's truth table, at least one of which uses one or more don't care (X) symbols.