22C: 060 Computer Organization
Spring 2011
Assignment 6
Total points = 50
Assigned May 26, due May 3, 2011

Submit your work to the ICON drop box

Question 1. (Background)

Fig. 4.17 in your textbook shows the datapath as well as the control signals of a single-cycle version of MIPS that supports the instructions lw, sw, a few R-type instructions, and beq.

Part 1. (15 points)

Simplify the datapath of Fig. 4.17 by removing unnecessary units and redundant signals so that it supports only **add** and **subtract** instructions (and not the remaining instructions). Show only those control signals that are required in this design. Assume that ALUop is a 1-bit signal in the residual datapath (AlUop = 0 means "add" and ALU = 1 means "subtract").

Part 2. (15 points)

Derive logical expressions for each of these control signals as a function of the opcode bits and the function field bits. Explain your derivation.

(Hint: Tables 4.12, 4.13, 4.22 may be useful)

Question 2. (20 points)

Let us try to add the instruction **swap (rs, rt)** to the MIPS instruction set, and use the I-type format to represent that instruction (with the immediate field = 0).

Alice and Bob argue about the implementation of the swap instruction using the datapath of Fig. 4.17. Alice believes, it can be implemented using Fig. 4.17, but Bob believes this is impossible. Whom do you support? If you support Alice, then explain how swap can be implemented using the datapath of Fig. 4.17. If you agree with Bob, then explain why swap cannot be implemented using the datapath of Fig 4.17.