Question 1. (30 points)

Recall our discussions about the design of a MIPS processor from Chapter 5 of your textbook. Fig. 5.19 shows the datapath as well as the control signals of a version of MIPS that supports the instructions \texttt{lw, sw, a few R-type instructions, beq, and j.}

Part 1.
Simplify the datapath of MIPS so that it supports the \texttt{add} and \texttt{subtract} instructions only (and not the remaining instructions). Show only those control signals that are required in this design.

Part 2.
Derive logical expressions for each of these control signals as a function of the opcode and the function field variables. Explain your derivation.

Question 2. (20 points)

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

Alice and Bob argue about the implementation of the \texttt{swap} instruction \textit{using the datapath of Fig. 5.19}. Alice believes, it can be done using Fig. 5.19, but Bob believes this is impossible. Whom do you support? If you support Alice, then explain how \texttt{swap} can be implemented using the datapath of Fig. 5.19. If you agree with Bob, then explain why \texttt{swap} cannot be implemented using the datapath of Fig 5.19.