

# Computer Organization and Structure

Homework #4  
Due: 2006/12/26

1. Describe the effect that a single stuck-at- $n$  fault (i.e., regardless of what it should be, the signal is always  $n$ , where  $n = 0$  or  $1$ ) would have for the signals in the following sub-questions:
  - a. For single stuck-at-0 fault, which instructions, if any, will not work correctly in the *single-cycle* datapath as shown in Figure 1? Explain why. Consider each of the following faults separately:
    - a) RegWrite = 0
    - b) ALUop0 = 0
    - c) ALUop1 = 0
    - d) Branch = 0
    - e) MemRead = 0
    - f) MemWrite = 0

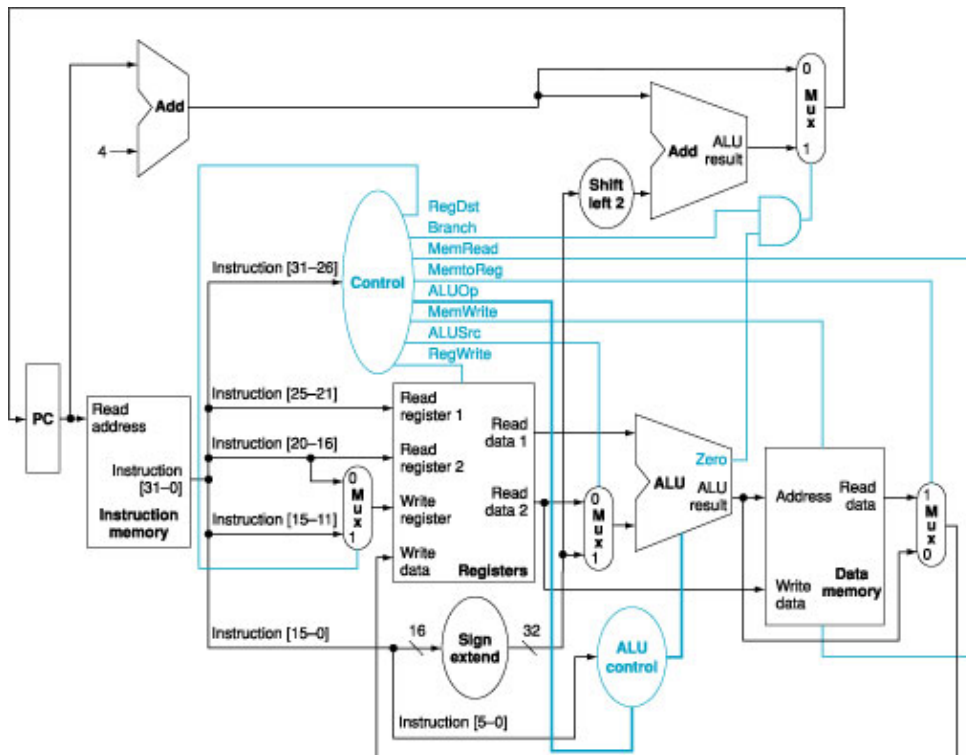


Figure 1: The simple datapath with the control unit.

- b. For single stuck-at-1 fault, which instructions, if any, will not work correctly in the *single-cycle* datapath? Explain why.
- c. For single stuck-at-0 fault, which instructions, if any, will not work correctly in the *multiple-cycle* datapath as shown in Figure 2? Explain why. Consider each of the following faults separately:



Find out which of the machines is fastest. Are there instruction mixes that would make another machine faster, and if so, what are they?

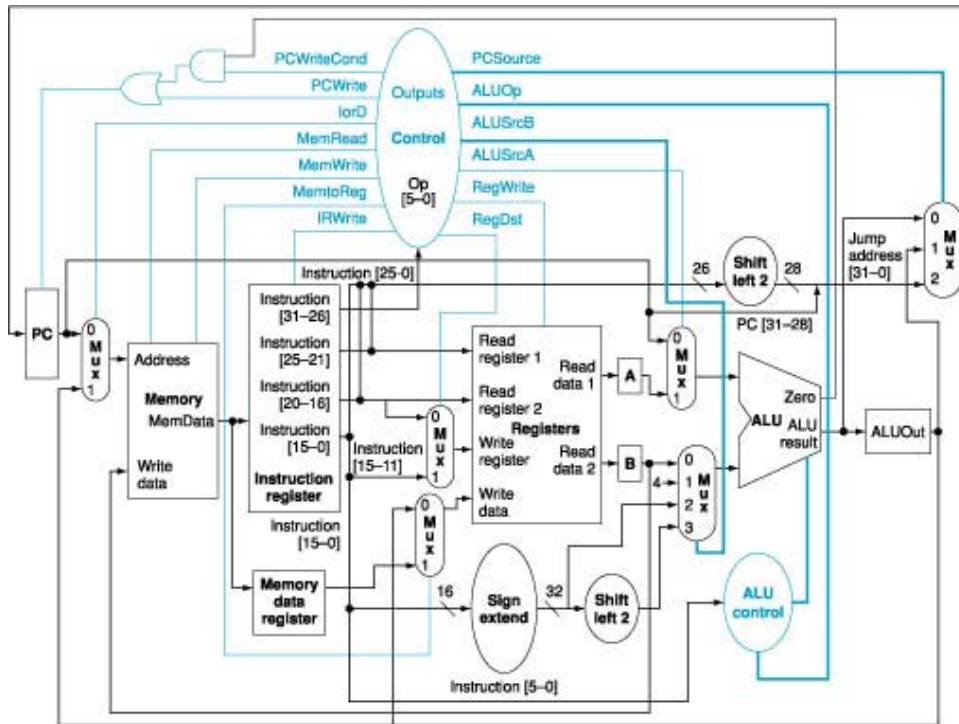


Figure 3: The complete datapath for the multicycle implementation together with the necessary control lines.

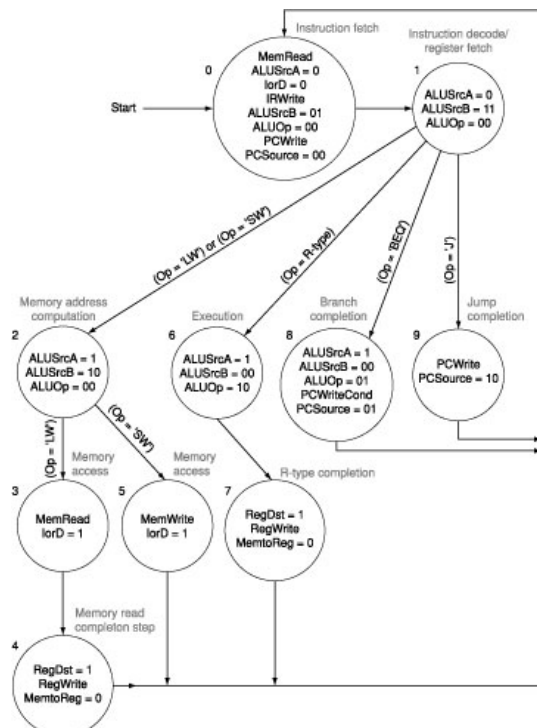


Figure 4: The complete finite state machine control for the datapath shown in Figure 3.