

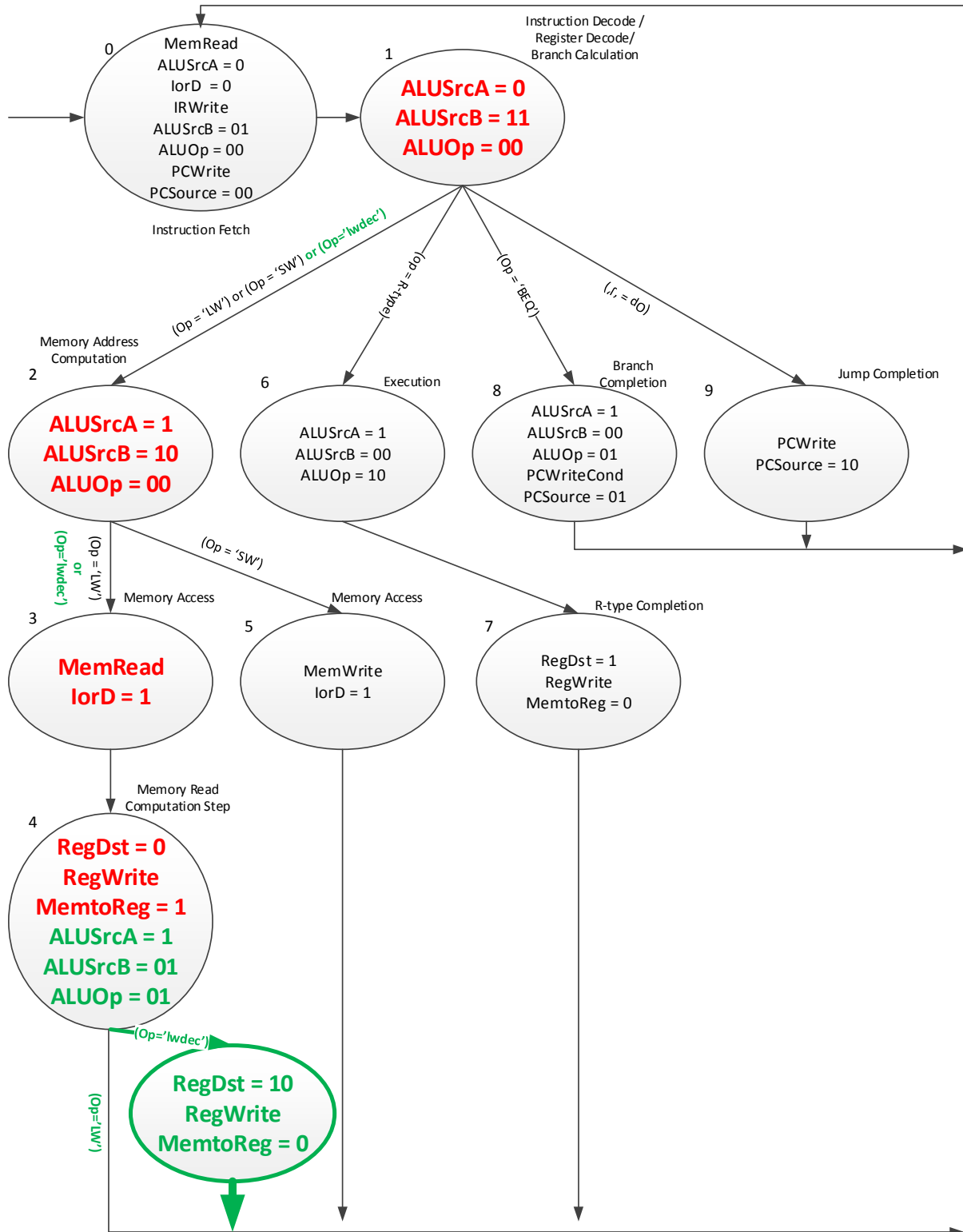
Name: \_\_\_\_\_

ID: \_\_\_\_\_

No calculators, notes, or textbooks allowed. Show all your work for full credit.

Time limit: 20 mins

1. Fill in the missing Control Signals for the multi-cycle datapath control (Multi-cycle datapath on next page)

**Red is Question #1 Green is Question #2**

Orange  $\neq$  Blue are in state 4  
 (Reg[rs]-4) (orig lw)  
 Green (lwdec) in state 10 (new state)

2. Modify the finite state machine in problem #1 to add the 'lwdec' instruction based on the datapath changes shown in this figure. The instruction lwdec rs, offset(rt), loads a value and decrements the value in Reg[rt] by one memory word.  
 $\text{Reg[rt]} \leftarrow \text{Mem}[\text{Reg[rs]} + \text{sign-extended offset}]$   
 $\text{Reg[rs]} \leftarrow \text{Reg[rs]} - 4$

