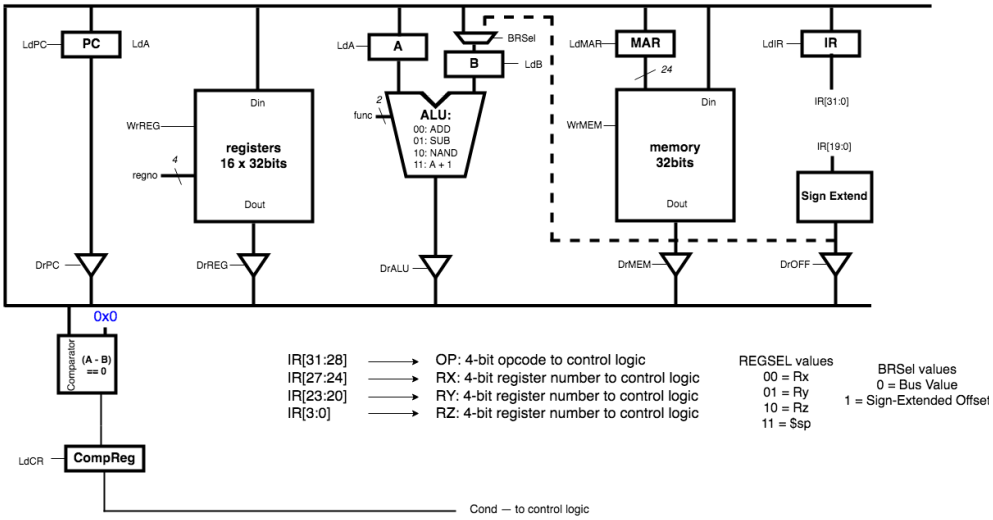
CS 2200 Homework 3
Fall 2019

Rules:

- Please print a copy of the assignment and hand write your answers. No electronic submissions are allowed. **Please print as one double-sided page. Do NOT staple multiple sheets together.** There will be a **30** point penalty if you do not.
- This is an individual assignment. You may discuss concepts but not the answers.
- Due Date: **18th September 2019 – 6:05 PM**. Bring your BuzzCard. Show up on time.

Name:_____ **GT Username:**_____ **Section:**_____

LC-5000 Datapath



The above is the datapath of the **LC-5000**, a modified version of LC-2200. **Notice the extra MUX in front of the ALU "B" register.**

1. Write out the microstates for a more efficient **ADDI** and **LW** using the modifications on the LC-5000 datapath. For each microstate, give the control signals used (see the example). Signals irrelevant to the state can be omitted and will be assumed to be zero. **You will lose points for an inefficient answer!**

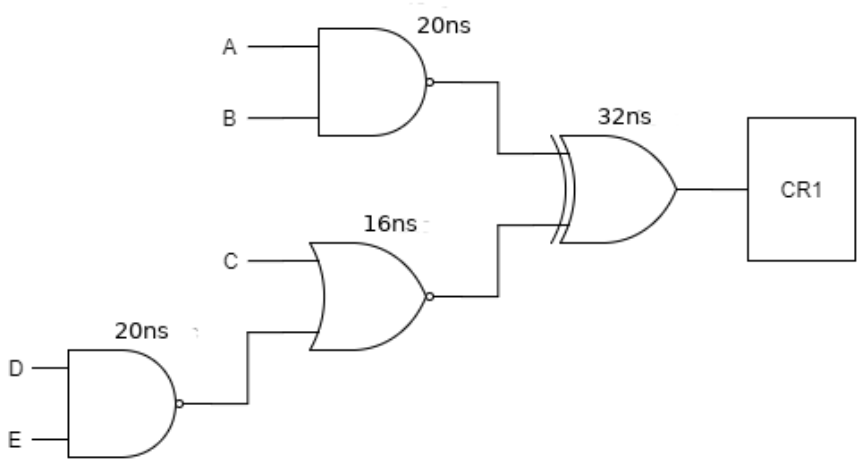
ADD (example)	**ADDI**	**LW**
ADD0: DrREG, LdA, RegSel=01 **ADD1:** DrREG, LdB, RegSel=10 **ADD2:** DrALU, WrReg, func=00, RegSel=00		

2. Briefly describe what the FETCH, DECODE, & EXECUTE phases of the FSM are used for.

   During the DECODE phase, how exactly does the processor transition from the end of the fetch macrostate to the appropriate ISA instruction? (Hint: Talk about the signals and sequencer ROM in the context of Project 1)

3. The following circuit consists of combinational logic with its output going to a register (CR1). The delay of each gate is shown next to it in nanoseconds. The setup and hold time of the register are shown in the table below. The propagation delay of the wires is negligible.

   Assuming that inputs to the system change synchronously on the same clock as the register, what is the maximum clock frequency allowed that does not cause undefined behavior? Provide your answer in units of **MHz** rounded to the **nearest hundredth.**



Register Characteristics	
Setup Time	22ns
Hold Time	22ns

Show your work for partial credit.

Maximum Frequency (MHz): _____