**CS219 Assignment #5**

Purpose: Become familiar with the MIPS architecture instruction formats, control signals, Datapath elements.

Points: 110

**Reading/References:** Chapter 4, Class Lecture / Lecture Notes, Textbook

1. What are the steps to be followed to execute an instruction? [10 pts]
2. Define the following: [10 pts, 2.5 pts each]
3. Clock signal
4. Control signal
5. Data
6. How an edge-triggered methodology allows a state element to be read and written in the same clock cycle
7. Define combinational elements and give few examples [5 pts]
8. Define sequential (storage) elements and give few examples [5 pts]
9. Explain the Datapath elements that are needed by every instruction. Include the diagrams of each Datapath element and explain what is the role of that element to execute an instruction? (Note: You can copy and paste the diagrams from the textbook/PPT as needed in this assignment. No need of hand drawing) [20 pts]

[Hint: Refer the PPTs and/or textbook. Explaining (purpose, what it takes as input and what it gives as output, etc.) each element in the following diagram addresses Question 5]

Diagram

Description automatically generated

1. Build a datapath that can support a R-format instruction, for example, a datapath to execute an *add rd, rs, rt* instruction. You no need to draw/copy each block individually, but just draw/copy the final datapath for a R-format instruction. List all the steps in executing the instruction, starting from PC. [Hint: Refer Ch4 PPT] [20 pts]
2. Build a datapath that can support an I-format instruction, for example, a datapath to execute a *lw rt, imm(rs)* instruction. You no need to draw/copy each block individually, but just draw/copy the final datapath for an I-format instruction. List all the steps in executing the instruction, starting from PC. [Hint: Refer Ch4 PPT] [20 pts]
3. Build a datapath that can support a J-format instruction, for example, a datapath to execute a *j targetAddress* instruction. You no need to draw/copy each block individually, but just draw/copy the final datapath for a J-format instruction. List all the steps in executing the instruction, starting from PC. [Hint: Refer Ch4 PPT] [20 pts]