Name and Student ID:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Lab Section:\_\_\_

Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**PRELAB:**

**Part 1:** CPU Scavenger Hunt

**Q1.** Find the **adder** inside the ALU and answer the following:

* What is the name of this component?
* Is it a ripple-carry or carry lookahead adder?
* Can it also do subtraction?
* What is the size of its two operands in bits?

**Q2.** Find a 4-to-16 **decoder** and answer the following:

* What is the name of this component?
* Does it have an enable input?
* What are the names of its outputs 4 and 6?
* Can you guess what is its function in this CPU?

**Q3.** Find a **shifter circuit** and answer the following:

* What is the name of this component?
* What is the size of the input in bits?
* What happens to the most significant bit on shift left?
* What happens to the least significant bit on shift right?

**Q4.** Find the **program counter** and answer the following:

* What is the name of this component?
* What is the size of the output bus in bits?
* How many control lines does it have?
* What type of high-level circuit does it implement?

**Q5.** Find a **register file** with exactly 4 registers and answer the following:

* What is the name of this component?
* What is the size of each register in bits?
* What type of Flip-Flops are used to construct each register?
* The contents of how many registers can be read at the same time?

**Q6.** Find two **clock dividers** and answer the following:

* How are they implemented?
* They slow down the clock by a factor of X and Y. What are X and Y?

**Q7.** Find the **multiplexor** that sits after the ALU and takes the output of the ALU as one of its inputs. Then, answer the following:

* What is the name of this component?
* Where does the other input come from?
* What is the size of each input in bits?
* How many select lines does it have in bits?

**Q8.** Find the circuit that outputs the signal **DMEM\_WRITE\_ENABLE** and then answer the following:

* In which block is this circuit located?
* What is the Boolean expression for this signal?

**Q9.** Examine the **DMEM** box and answer the following:

* What are the names of the control lines for this box?
* What high-level component is used to implement the data memory?
* What is the size of the data memory in bytes?

**Q10.** Find the **flags register** and answer the following:

* How many flags does it store?
* What are the names of these flags?

TA Initials: \_\_\_\_\_\_\_\_\_

**Part 2:** Play a game of PONG!

Draw the output shown on the four 7-semgment indicators when the game is over.

TA Initials: \_\_\_\_\_\_\_\_\_

**LAB:**

**Can you Play the Game well?**

Demonstrate to the TA that you can play the game. TA Initials: \_\_\_\_\_\_\_\_\_