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

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

**Submission Instructions:**

**Prelab:**

1. **No prelab**

**Lab:**

1. **Complete the scavenger hunt according to the instructions**
2. **Take screenshots of each component and include them in the document below (note: to receive points your NetID has to be visible in the screenshot, say in a command window that is in the background).**
3. **Complete this document and upload it to Canvas**

**LAB: 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?
* <<< screenshot of the adder symbol >>>

**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?
* <<< screenshot of the decoder symbol >>>

**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?
* <<< screenshot of the shifter symbol >>>

**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?

* <<< screenshot of the program counter symbol >>>

**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?
* <<< screenshot of the register file symbol >>>

**Q6.** Find the two **clock dividers** for the **VideoGame\_Clock** 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?
* <<< screenshot of the two clock dividers >>>

**Q7.** Find the **multiplexer** 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?
* <<< screenshot of the multiplexer symbol >>>

**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?
* <<< screenshot of the block in which the circuit is located >>>

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

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

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

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

**Part 2: PONG. Take a cellphone picture of the board as you are playing the game. Selfies are OK too as long as the game is visible in the background ☺**

* <<< picture >>>