Lab13 Answer Sheet

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**

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?

- <<< 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 >>>