

## **Introduction:**

Our team was tasked with building a 16-bit processor using a 2-address format for register addressing in Logisim. During the design process, we faced several challenges that required careful planning and collaboration to overcome. In this report, we will discuss the design challenges we faced and how we overcame them.

## **Design Challenges:**

1. **Register Organization:** The first challenge we faced was deciding on the organization of the registers. We needed to determine the number of registers we would need, the size of each register, and how we would address them.  
→ To overcome this challenge, we decided to use eight 16-bit registers. Each register would be able to store two 8-bit values or one 16-bit value. We also decided to use a 2-address format for register addressing, which allowed us to perform operations on two registers simultaneously.
2. **Instruction Set:** The next challenge was designing an instruction set that would allow us to perform a wide range of operations while keeping the instruction set small enough to fit within our 16-bit processor.  
→ To overcome this challenge, we created an instruction set that included basic arithmetic and logical operations, as well as conditional and unconditional jumps. We also included instructions for loading and storing values in memory.
3. **Timing and Clocking:** The third challenge we faced was designing the timing and clocking of our processor. We needed to ensure that our processor could execute instructions accurately and reliably.

➔ To overcome this challenge, we designed a clocking system that synchronized the execution of instructions. We also added delay elements to ensure that each instruction had enough time to complete before the next instruction was executed.

4. Testing and Debugging: The final challenge we faced was testing and debugging our processor. We needed to ensure that our processor was functioning correctly and that it could handle a variety of inputs and outputs.

➔ To overcome this challenge, we used simulation tools in Logisim to test our processor. We also used logic analyzers to monitor the signals within our processor and identify any errors or issues.

## **Conclusion:**

➔ In conclusion, building a 16-bit processor using a 2-address format for register addressing in Logisim presented several design challenges. Through careful planning, collaboration, and testing, we were able to overcome these challenges and create a functional processor. We learned valuable lessons about design and collaboration during this project, and we look forward to applying these lessons to future projects.