

## Computer Architecture HW4 Report

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OS: Windows

PC: PC module reads clock signals, reset bit, start bit, and next cycle PC as input, and outputs the PC of current cycle. This module changes its internal register “pc\_o” at positive edge of clock signal. When reset signal is set, PC is reset to 0. And PC will only be updated by next PC when start bit is on. PC will receive the next instruction as the input and sends PC\_o to Instruction Memory and Adder.

Adder: The adder receives PC\_o and increments it by 4 to update the next instruction.

Instruction Memory: The instruction is then decoded into 32 bits and sent to Control, Registers, Sign\_Extend and ALU\_Control partially (dependent on the type of instruction received, either I-type or R-type)

Control: Control module receives the instruction [6:0] (0<sup>th</sup> to 6<sup>th</sup> bit) as input to control the input/control signal of ALU\_Control, Multiplexor, and Register.

Registers: Instruction [19:15] is read into the 1<sup>st</sup> register and instruction [24:20] is read into the 2<sup>nd</sup> register. If the control signal of RegWrite (from Control to Registers) is on, the output (alu\_result) from the ALU will be written back to the register.

Sign\_Extend: Instruction [31:20] is sent to Sign\_Extend module as input for certain instructions like srai and addi to extend the bits of the instructions according to the most significant bit of the output (before sign extension)

MUX32: The MUX32 module reads control signal from Control module, data 2 from register and data\_ext from Sign\_Extend module as inputs. If control signal is 0, data 2 is chosen to be sent to ALU, data\_ext otherwise.

ALU\_Control: It receives control signal from Control module and instruction [31:25] and instruction [14:12] to determine how the ALU should execute the current instruction.

ALU: Receives data1 from registers, output from ALU\_Control and output from MUX32. The instructions are executed in this module and sent to ALU\_result as output. If there is any branching situations, then the output is sent to Zero.