CS315-02 Processor Components 2025-10-28

Project05 - incremental development

C Coding
Data Representation → IEEE 754 FP
Memory
RISC-V Assembly
RISC-V Machine Code
RISC-V Emulator
Cache Design
Digital Design

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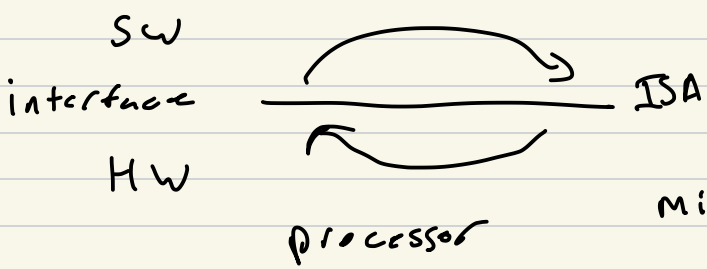
Processor Design

Instruction Set Architecture



microarchitecture

digital logic implementation

Computer Architecture

Instruction Set Architecture specification

machine code

registers
memory

assemblers
compilers

micro architecture

Digital Design

Schematic entry (visual)

HDL
Hardware Description Language

Verilog

IEEE VHDL

Moore's Law

The number of transistors in a processor will double every 1.5 years.

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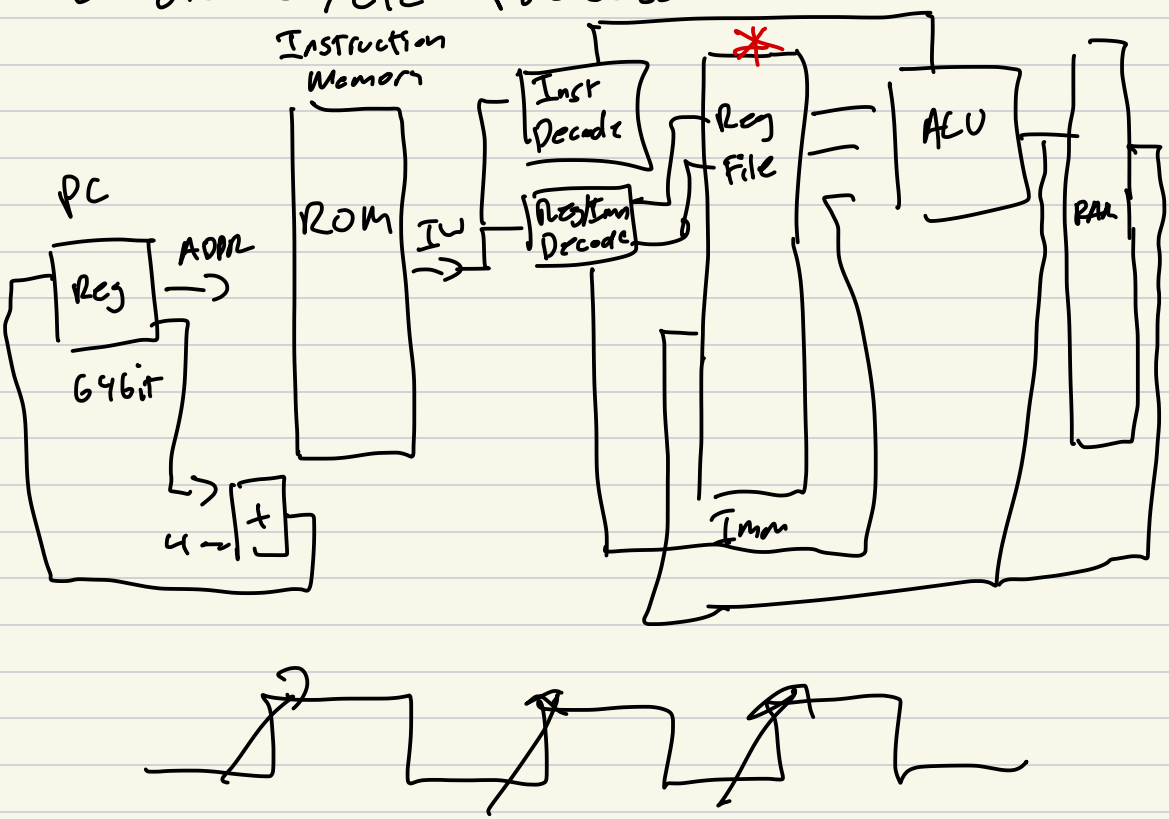
* single-cycle processor
  Multi-cycle processor
* pipelined processor

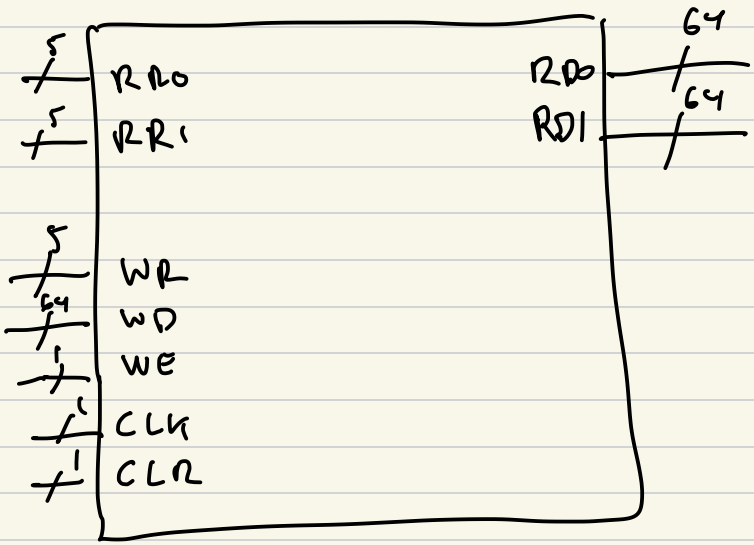
Lab 09 → Lab 10 → project 06

Single-Cycle Processor



Register File

- 32 64-bit registers: x0, x1, ..., x31
- Read up to two registers in the same clock cycle
- Write to one register in a clock cycle.
- x0 (zero) is always zero(0).



RR read register

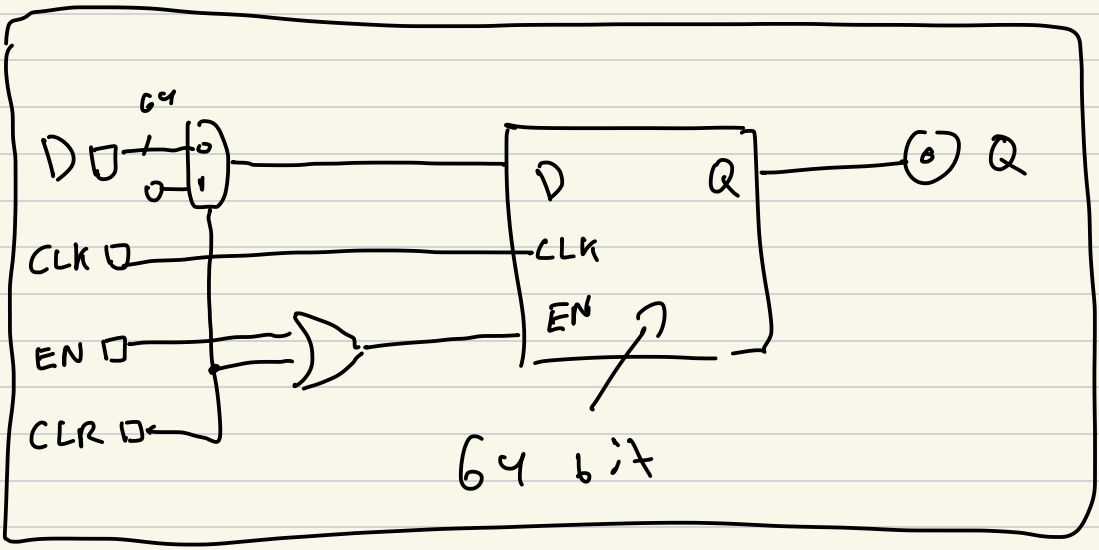
RD read data

WR write register

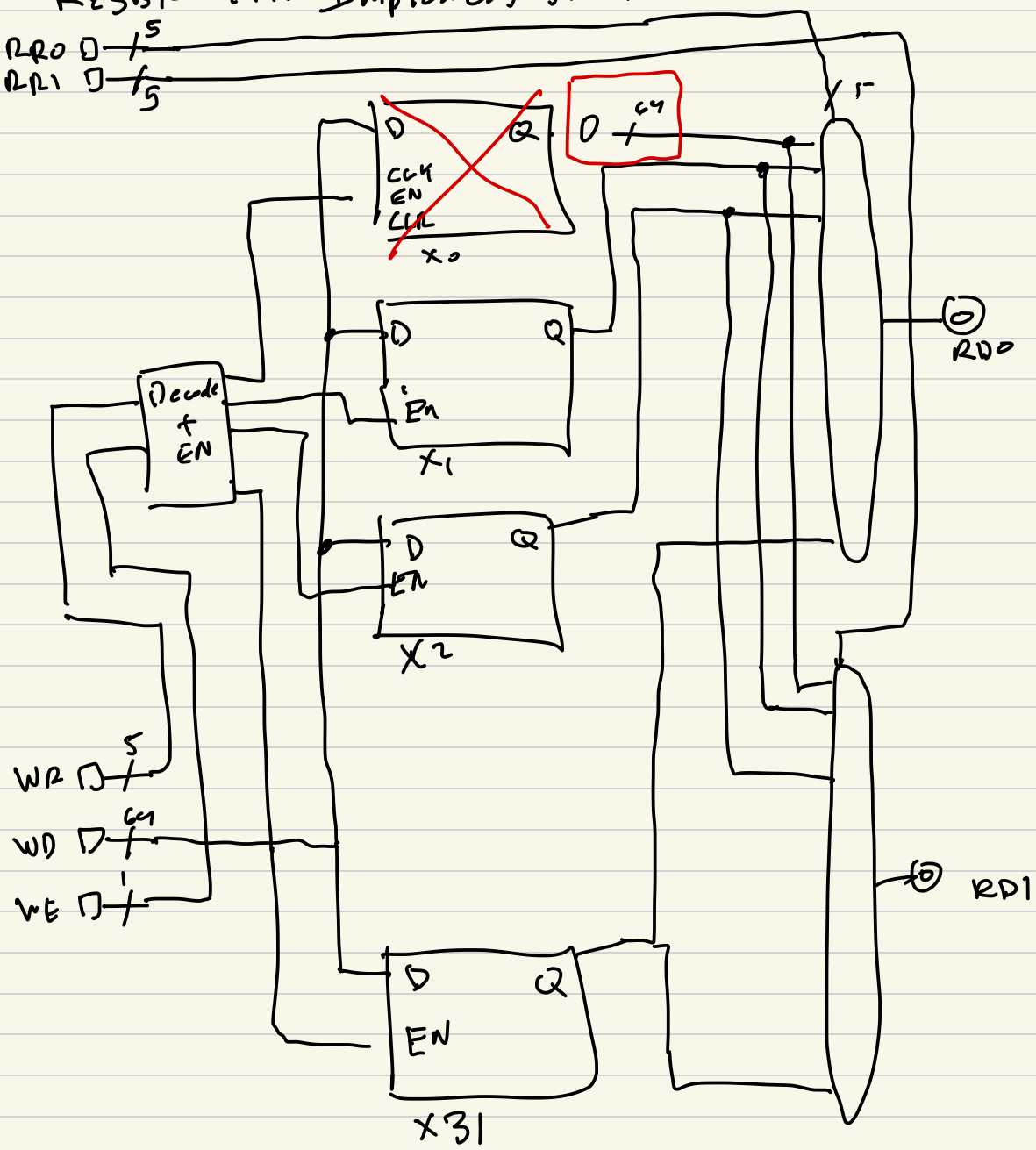
WD write data

WE write enable

Adding CLR to the Digital Register



Register File Implementation



ALU Arithmetic Logic Unit