Lab03 CPU测试及汇编程序设计

基础RISC-V指令执行过程

- `sw`

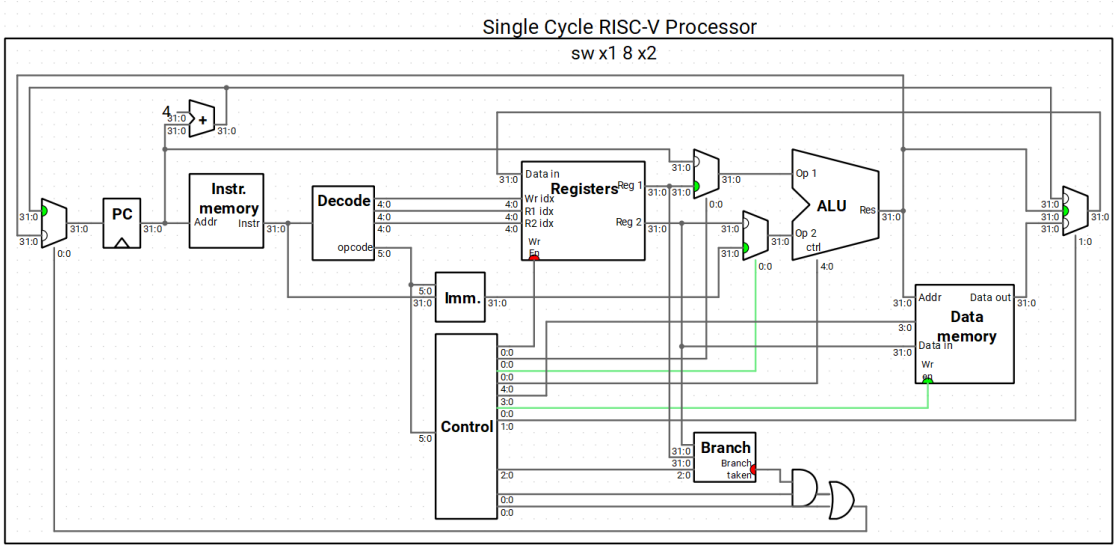
  `sw rs2, imm(rs1)`

  - `rs1`: 寄存器堆的`Reg1`端口

    `imm`: 将指令中立即数signed extend为32bit

    二者由ALU计算作为Data Memory的地址。

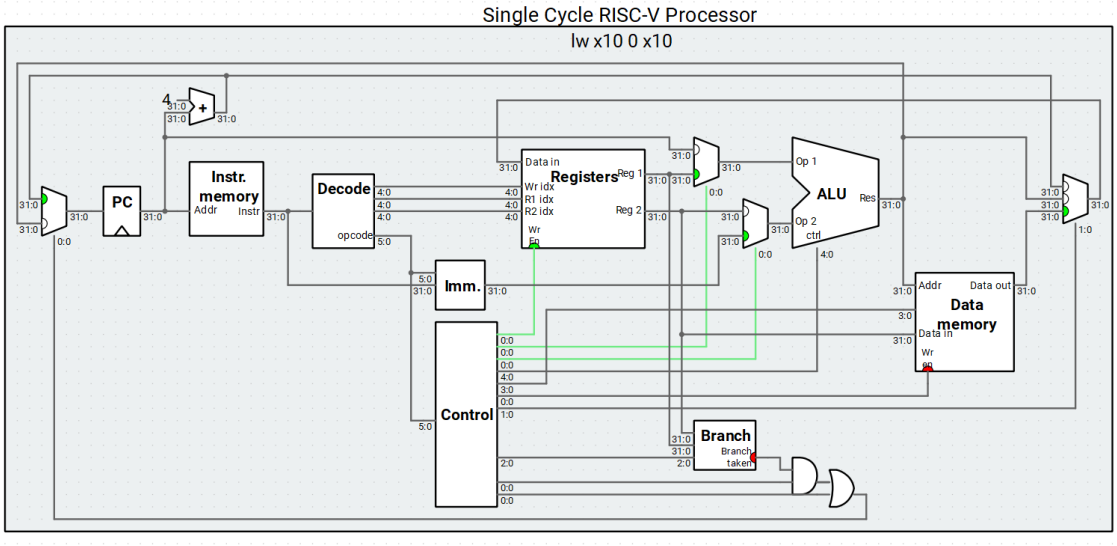
  - `rs2`: 寄存器堆的`Reg2`端口，通往Data Memory的Data in。



- `lw`

  `lw rd, imm(rs1)`

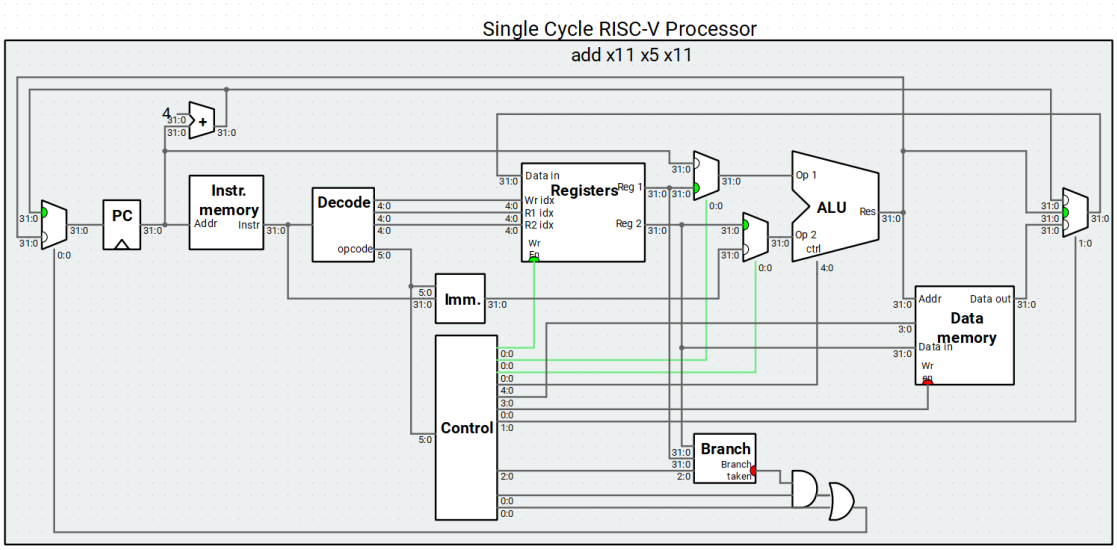
  - `rd`: 寄存器堆的Wr idx指定的目标寄存器。由Data Memory的Data out端口经mux后向`rd`赋值
  - 由ALU计算`imm + rs1`获得数据内存的读地址



- `add`

`add rd, rs1, rs2`

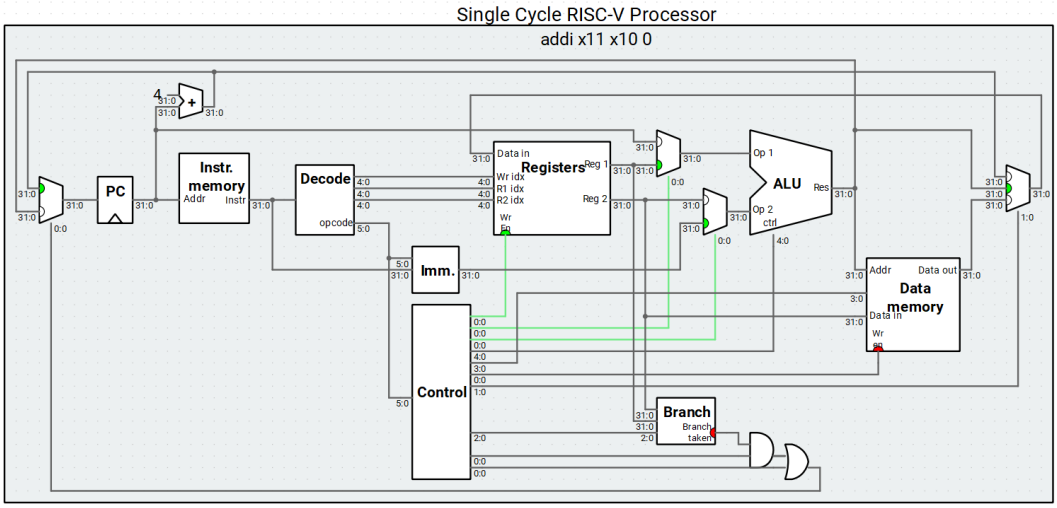
`rs1`, `rs2` 分别由register的 `Reg1`, `Reg2` 提供，由ALU计算后结果经mux存入Register `rd` 位置



- `addi`

  `addi rd, rs1, imm`

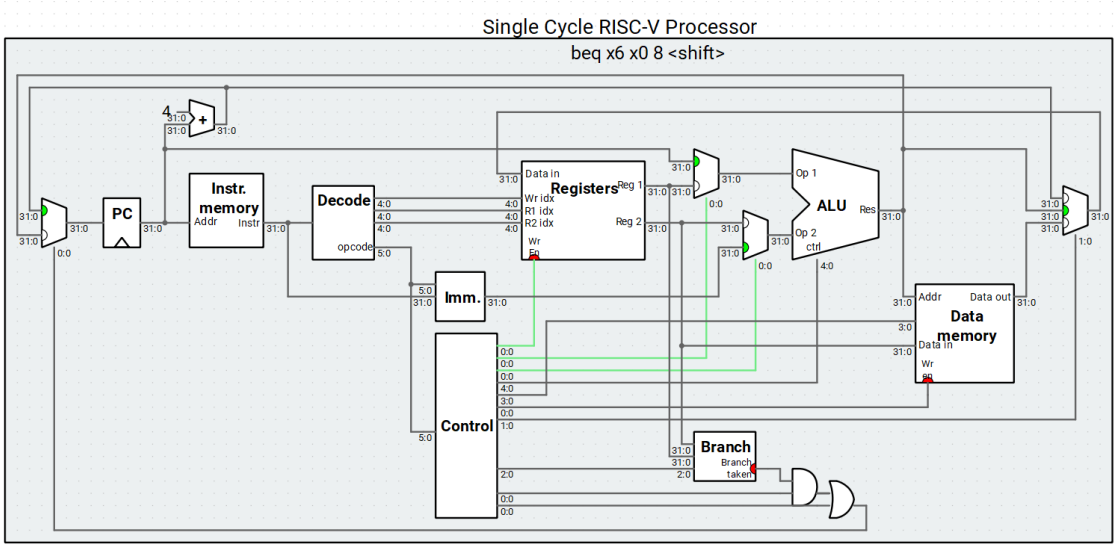
  - `rs1`: 寄存器堆的 `Reg1` 端口
  - `imm`: 将指令中立即数signed extend为32bit
  - `rd`: ALU计算结果经mux后存入register中 `rd`



- `beq`

  `beq rs1, rs2, imm`

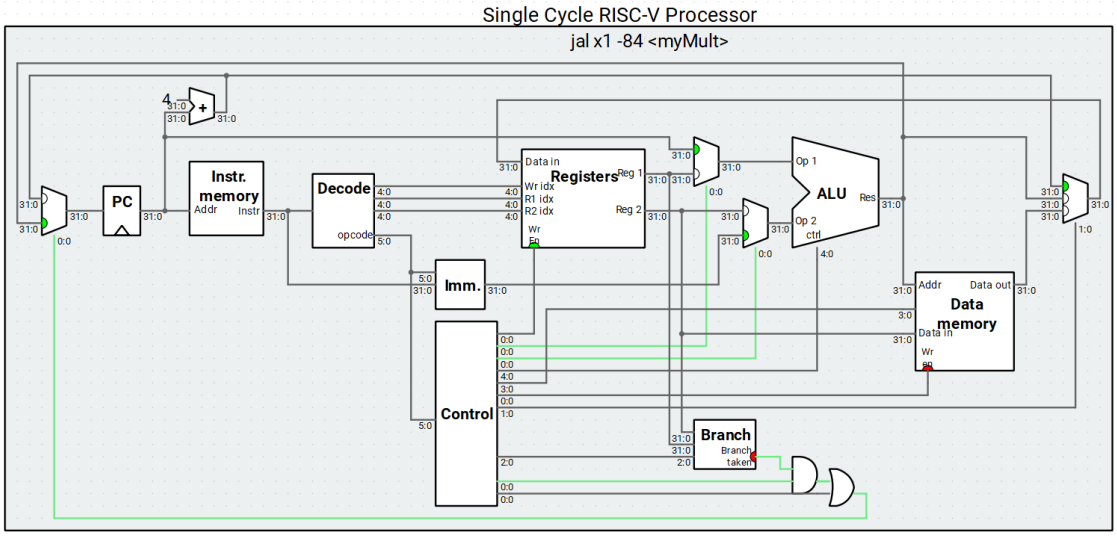
  - `PC + Offset` 的值由ALU计算
  - `rs1`, `rs2` 的比较由Branch Unit进行
  - `PCSrc = (Branch Taken && Branch)|| Jal`



- `jal`

  `jal imm`

  - `PC + Offset` 的值由ALU计算
  - ALU 计算结果经mux后存入Register中 `x0`



Fibonacci

```
.data
    prompt1: .string "Input f1: \n"
    prompt2: .string "Input f0: \n"
    msg1: .string "Fibonacci "
    msg2: .string ": "

.text

# get f1 and f2

    li a7, 4
    la a0, prompt1
    ecall

    li a7, 5
    ecall
    mv t0, a0

    li a7, 4
    la a0, prompt2
    ecall

    li a7, 5
    ecall
    mv t1, a0

# t4 is the index of current number
    li t4, 3

calculate:

# output 'Fibonacci n: '
    li a7, 4
    la a0, msg1
    ecall

    li a7, 1
    mv a0, t4
    ecall

    li a7, 4
```

```
42      la a0, msg2
43      ecall
44
45  # output next item
46      li a7, 1
47      add a0, t0, t1
48      ecall
49
50      mv t0, t1
51      mv t1, a0
52
53  # wait for keyboard input to continue
54      li a7, 12
55      ecall
56      addi t4, t4, 1
57      j calculate
58
```