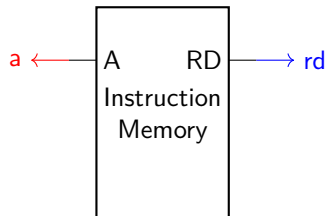


RISC-V Processor CircuiTikZ Library

March 12, 2025

1 Components

1.1 Instruction Memory

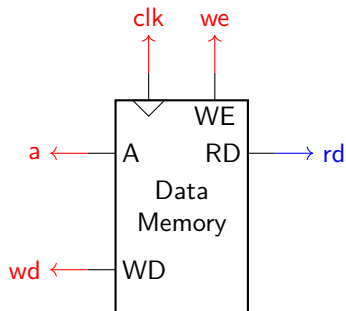


```

1 \begin{circuitikz}
2   \node[instrmem, align=center] (comp) {Instruction
3     \Memory};
4   \draw[->, red] (comp.a) -- ++(-.5, 0) node[left] {
5     a};
6   \draw[->, blue] (comp.rd) -- ++(.5, 0) node[right]
7     {rd};
8 \end{circuitikz}

```

1.2 Data Memory

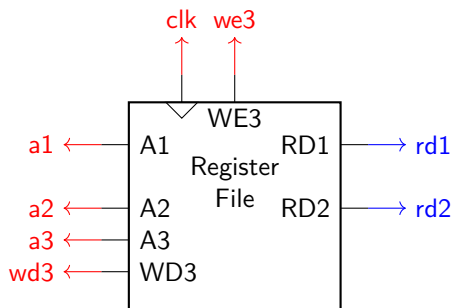


```

1 \begin{circuitikz}[]
2   \node[datamem, align=center] (comp) {Data\Memory
3     };
4   \draw[->, red] (comp.a) -- ++(-.5, 0) node[left]
5     {a};
6   \draw[->, red] (comp.wd) -- ++(-.5, 0) node[left]
7     {wd};
8   \draw[->, red] (comp.clk) -- ++(0, .5) node[above]
9     {clk};
10  \draw[->, red] (comp.we) -- ++(0, .5) node[above]
11    {we};
12  \draw[->, blue] (comp.rd) -- ++(.5, 0) node[right]
13    {rd};
14 \end{circuitikz}

```

1.3 Register File

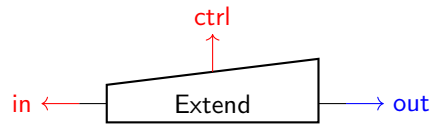


```

1 \begin{circuitikz}[]
2   \node[regfile, align=center] (comp) {
3     Register\
4     File};
5   \draw[->, red] (comp.a1) -- ++(-.5, 0)
6     node[left] {a1};
7   \draw[->, red] (comp.a2) -- ++(-.5, 0)
8     node[left] {a2};
9   \draw[->, red] (comp.a3) -- ++(-.5, 0)
10    node[left] {a3};
11  \draw[->, red] (comp.wd3) -- ++(-.5, 0)
12    node[left] {wd3};
13  \draw[->, red] (comp.clk) -- ++(0, .5)
14    node[above] {clk};
15  \draw[->, red] (comp.we3) -- ++(0, .5)
16    node[above] {we3};
17  \draw[->, blue] (comp.rd1) -- ++(.5, 0)
18    node[right] {rd1};
19  \draw[->, blue] (comp.rd2) -- ++(.5, 0)
20    node[right] {rd2};
21 \end{circuitikz}

```

1.4 Extend Unit

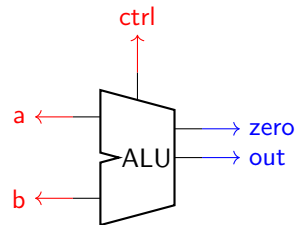


```

1 \begin{circuitikz}[]
2 \node[extend, align=center] (comp) {Extend
3 \draw[->, red] (comp.in) -- ++(-.5, 0)
  node[left] {in};
4 \draw[->, red] (comp.ctrl) -- ++(0, .5)
  node[above] {ctrl};
5 \draw[->, blue] (comp.out) -- ++(.5, 0)
  node[right] {out};
6 \end{circuitikz}

```

1.5 Arithmetic Logic Unit

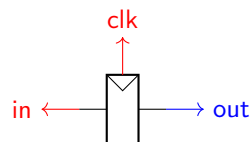


```

1 \begin{circuitikz}[]
2 \node[alu, align=center] (comp) {ALU};
3 \draw[->, red] (comp.a) -- ++(-.5, 0) node[left] {a};
4 \draw[->, red] (comp.b) -- ++(-.5, 0) node[left] {b};
5 \draw[->, red] (comp.ctrl) -- ++(0, .5) node[above] {
  ctrl};
6 \draw[->, blue] (comp.out) -- ++(.5, 0) node[right] {
  out};
7 \draw[->, blue] (comp.zero) -- ++(.5, 0) node[right] {
  zero};
8 \end{circuitikz}

```

1.6 Register

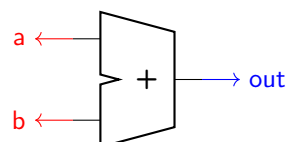


```

1 \begin{circuitikz}[]
2 \node[reg, align=center] (comp) {};
3 \draw[->, red] (comp.in) -- ++(-.5, 0) node[left] {in};
4 \draw[->, red] (comp.clk) -- ++(0, .5) node[above] {clk};
5 %\draw[->, red] (comp.en) -- ++(0, -.5) node[below] {en};
6 \draw[->, blue] (comp.out) -- ++(.5, 0) node[right] {out
  };
7 \end{circuitikz}

```

1.7 Adder

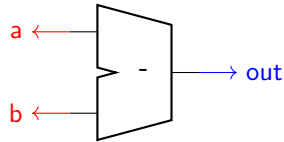


```

1 \begin{circuitikz}[]
2 \node[adder, align=center] (comp) {};
3 \draw[->, red] (comp.a) -- ++(-.5, 0) node[left] {a};
4 \draw[->, red] (comp.b) -- ++(-.5, 0) node[left] {b};
5 \draw[->, blue] (comp.out) -- ++(.5, 0) node[right] {
  out};
6 \end{circuitikz}

```

1.8 Subtractor

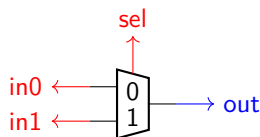


```

1 \begin{circuitikz}[]
2   \node[sub, align=center] (comp) {};
3   \draw[->, red] (comp.a) -- ++(-.5, 0) node[left] {a};
4   \draw[->, red] (comp.b) -- ++(-.5, 0) node[left] {b};
5   \draw[->, blue] (comp.out) -- ++(.5, 0) node[right] {
6     out};
7 \end{circuitikz}

```

1.9 Multiplexer

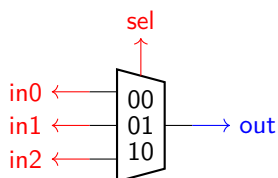


```

1 \begin{circuitikz}[]
2   \node[mux, align=center] (comp) {};
3   \draw[->, red] (comp.in0) -- ++(-.5, 0) node[left] {in
4     0};
5   \draw[->, red] (comp.in1) -- ++(-.5, 0) node[left] {in
6     1};
7   \draw[->, red] (comp.sel) -- ++(0, .5) node[above] {sel
8     };
9   \draw[->, blue] (comp.out) -- ++(.5, 0) node[right] {out
10    };
11 \end{circuitikz}

```

1.10 Multiplexer with 3 inputs

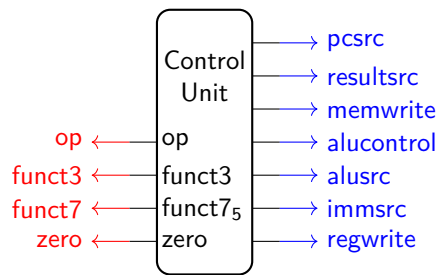


```

1 \begin{circuitikz}[]
2   \node[3mux, align=center] (comp) {};
3   \draw[->, red] (comp.in0) -- ++(-.5, 0) node[left] {in
4     0};
5   \draw[->, red] (comp.in1) -- ++(-.5, 0) node[left] {in
6     1};
7   \draw[->, red] (comp.in2) -- ++(-.5, 0) node[left] {in
8     2};
9   \draw[->, red] (comp.sel) -- ++(0, .5) node[above] {
10    sel};
11   \draw[->, blue] (comp.out) -- ++(.5, 0) node[right] {
12    out};
13 \end{circuitikz}

```

1.11 Single-Cycle Control Unit

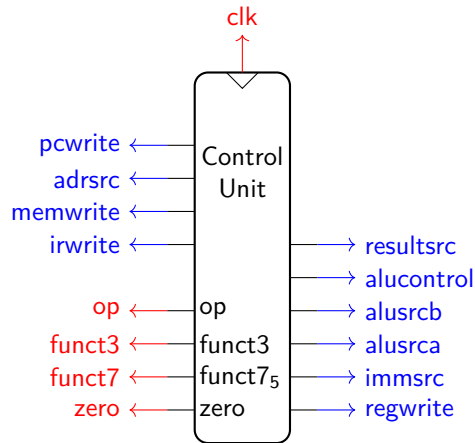


```

1 \begin{circuitikz}[]
2   \node[ctrlunitsc, align=center] (comp) {
3     Control\\Unit};
4   \draw[->, red] (comp.op) -- ++(-.5, 0)
5     node[left] {op};
6   \draw[->, red] (comp.funct3) -- ++(-.5, 0)
7     node[left] {funct3};
8   \draw[->, red] (comp.funct7) -- ++(-.5, 0)
9     node[left] {funct7};
10  \draw[->, red] (comp.zero) -- ++(-.5, 0)
11    node[left] {zero};
12
13  \draw[->, blue] (comp.pcsrc) -- ++(.5, 0)
14    node[right] {pcsrc};
15  \draw[->, blue] (comp.resultsrc) -- ++(.5, 0)
16    node[right] {resultsrc};
17  \draw[->, blue] (comp.memwrite) -- ++(.5, 0)
18    node[right] {memwrite};
19  \draw[->, blue] (comp.alucontrol) -- ++(.5, 0)
20    node[right] {alucontrol};
21  \draw[->, blue] (comp.alusrc) -- ++(.5, 0)
22    node[right] {alusrc};
23  \draw[->, blue] (comp.immsrc) -- ++(.5, 0)
24    node[right] {immsrc};
25  \draw[->, blue] (comp.regwrite) -- ++(.5, 0)
26    node[right] {regwrite};
27 \end{circuitikz}

```

1.12 Multi-Cycle Control Unit

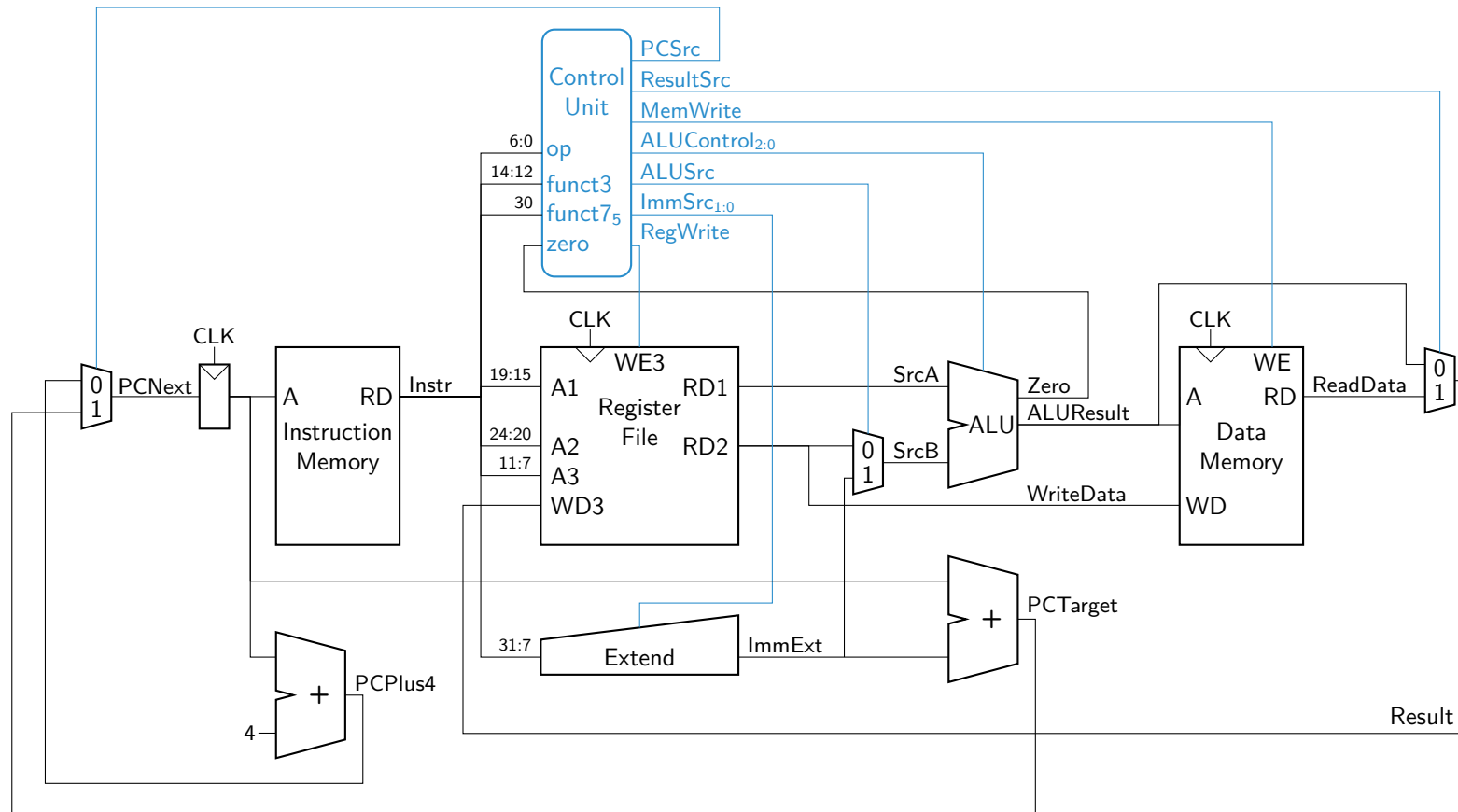


```

1  \begin{circuitikz}[]
2      \node[ctrlunitmc, align=center] (comp)
3          {Control\\Unit};
4      \draw[->, red] (comp.op) -- ++(-.5, 0)
5          node[left] {op};
6      \draw[->, red] (comp.funct3) -- ++(-.5,
7          0) node[left] {funct3};
8      \draw[->, red] (comp.funct7) -- ++(-.5,
9          0) node[left] {funct7};
10     \draw[->, red] (comp.zero) -- ++(-.5,
11         0) node[left] {zero};
12     \draw[->, red] (comp.clk) -- ++(0,.5)
13         node[above] {clk};
14
15     \draw[->, blue] (comp.resultsrc) --
16         ++(.5, 0) node[right] {resultsrc};
17     \draw[->, blue] (comp.memwrite) --
18         ++(-.5, 0) node[left] {memwrite};
19     \draw[->, blue] (comp.alucontrol) --
20         ++(.5, 0) node[right] {alucontrol};
21     \draw[->, blue] (comp.alusrcb) --
22         ++(.5, 0) node[right] {alusrcb};
23     \draw[->, blue] (comp.alusrcb) --
24         ++(.5, 0) node[right] {alusrcb};
25     \draw[->, blue] (comp.immsrc) -- ++(.5,
26         0) node[right] {immsrc};
27     \draw[->, blue] (comp.regwrite) --
28         ++(.5, 0) node[right] {regwrite};
29     \draw[->, blue] (comp.irwrite) --
30         ++(-.5, 0) node[left] {irwrite};
31     \draw[->, blue] (comp.adrsrc) --
32         ++(-.5, 0) node[left] {adrsrc};
33     \draw[->, blue] (comp.pcwrite) --
34         ++(-.5, 0) node[left] {pcwrite};
35 \end{circuitikz}

```

2 Single-Cycle RISC-V Processor



3 Multi-Cycle RISC-V Processor

