

Processor Datapaths

3-17-2003

Opening Discussion

- Do you have any questions about the quiz or the midterms?
- What did we talk about before the midterm?
- Have you seen anything interesting in the news dealing with processors?

You mean we aren't done yet?

- In the last two chapters we have covered pretty much all of the machine and assembly languages of the MIPS processor as well as how the digital logic is laid out to do those instructions.
- In that discussion we just assumed that the input wires had the right values on them and that the output wires would send signals to the right places. We still have to resolve what really happens there.

The Datapath

- The datapath is the part of the processor responsible for making sure that the ALU operates on the correct pieces of data and that the calculations that it performs are utilized in the right way.
- If the ALU was the brawn of the chip, the datapath is the brain. It doesn't really do anything in and of itself, it just makes sure that other parts do the right things.

Elements with State

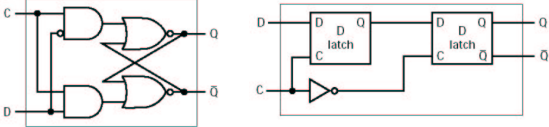
- To this point we have talked about combinatorial elements. Given the same inputs, they always produce the same outputs. They have no state associated with them.
- Obviously some elements in our computer need to have a state. These include the registers and memory and they are part of the control path. More on them in two slides.

Clocking

- A critical part of making the computer work is the clocking of it. We don't want to be setting and reading data elements at the same time.
- Our book assumes an edge-triggered clocking methodology. The clock signal is a square wave and each computation starts with a read on the rising edge of the wave.

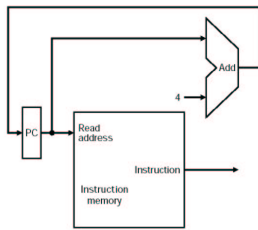
D Locks and Flip-Flops

- State elements can be built from D flip-flops that are made with D locks as shown below.
- D is the input and C is the clock signal.



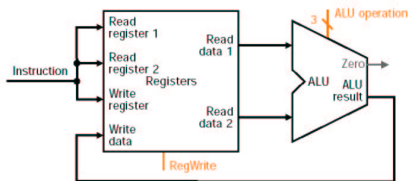
Instruction Fetching Datapath

- Without branches or jumps, this simple setup can control a sequential program.

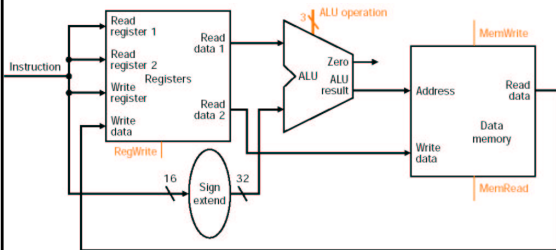


R-type Datapath

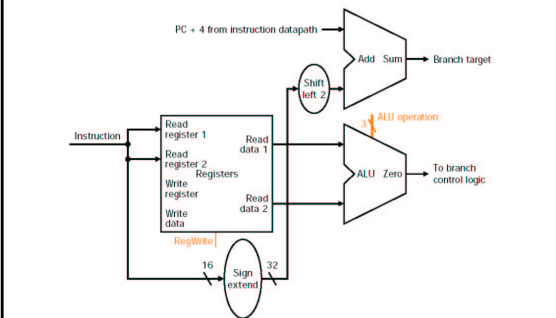
- This datapath with a register file and an ALU can be used to execute the R-type instructions.



Load/Store Datapath



Branch Datapath



Minute Essay

- In the class we will be putting all of these pieces together into a more complete control path that can actually do some of the MIPS instruction set. Do you have any questions about the material from today you'd like to have answered before we dive into that?
- Assignment #4 is up, but I have pushed the due date back to next Monday.
