Kameron Mace

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Chapter 2 Summary

Chapter two essentially covers the basics of digital logic, the basics of what computers are built on. It covers voltage, current, transistors, logic gates, Boolean functions, TTL (transistor-transistor logic), combinatorial circuits, flip flops, binary counters, clocks, sequences, demultiplexer (demux), the concept of feedback, iteration, replication, power distribution, heat dissipation, actual physical size, and the different layers of abstraction. All of these topics help the reader to understand exactly what computers are.

The transistor is the most basic part of a computer, it has three paths, one path controls the flow, and the other two paths allow for flow to passthrough the transistor. Transistors make up logic gates, they are the physcial version of boolean functions. Specifically, the nor gate uses 6 transistors, 5 resistors, and 3 diodes. For a not gate, you only need a transistor and a resistor. Rather than the engineer or user have to build gates from transistors everytime they need one, companies manufacture small logic gates thatcan be connected to circuits. One such example is the 7400 family, each number stands for a different type of gate component. The 7400 has 4 nand gates, the 7402 has 4 nor gates, and the 7404 has 6 inverters. These are combinatorial circuits.

Engineers need more than combinatorial circuits to solve more complex problems. Combinatorial circuits are for changing the input that the user puts in, sometimes this is not required. This is where clocks, binary counters, and more sophisticated circuits come into play. The flip flop is an electronic part that can maintain it’s state. The flip flop once activated for the first time will become boolean 1 and turn on, the second time the input is received it will turn off. The flip flop is basically a computer on/off button. A good visual representation of a flip flop is shown in a transition diagram. In a transition diagram the leading edge of an input change is where an output change occurs, the falling edge shows when input changes from one to zero.

Binary counters are similar to flip flops, however, binary counters accumulate total rather than just turn on and off. Clocks are very helpful tools that work by alternating values of 0 and 1 at a regular rate measured in Hertz(Hz). A demultiplexor (demux) is a single integrated circuit that uses a binary value and a set of outputs. The demux will be given an i^th value to run, and it will turn all other values off. One way these three tools are used is by running a clock, feeding the clock’s output to a binary counter, and then feeding the output of the binary counter to the demux to run whatever task.

In coding software, replication is an improper way to do things, and iteration is used to avoid errors. However, in physical hardware, replication over iteration as it is more efficient and the hardware is much simpler when replicating.

Building circuits requires the engineer to think critically about how to correctly assemble everything, as well as consider some issues like power distribution, clock skew, and heat dissipation.

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