Notes for ECE 29595PD - Principles of Digital System Design

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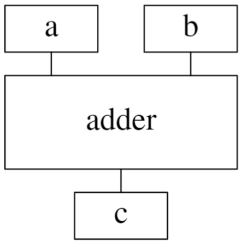
Course Introduction

This course serves as an introduction to digital system design, with an emphasis on principles of digital hardware and embedded system design. It is an alternate class to ECE 27000.
Learning Outcomes:

1. Ability to analyze and design combinational logic circuits.
2. Ability to analyze and design sequential logic circuits.
3. Ability to analyze and design computer logic circuits.
4. Ability to realize, test, and debug practical digital circuits.

Introduction

Digital design entails creating hardware that can conduct an operation or set of operations within a computer system. For example, adding two numbers.



This hardware can add two numbers, that is, conduct the operation $c = a + b$. It could also perform $f = d + e$ or $i = g - h = g + (-h)$ as it is not restricted to the sole values of a and b as inputs. This process fits into the logic design and switching algebra portions of chip manufacturing.
The creation of systems like these is based on the fact that voltage and current are time-varying and can assume any value in a continuous range of real numbers, but are mapped to only two values.

Digital Logic Signals

A digital signal is modeled as assuming, at anytime, only one of two discrete values, which represent:

0	1
LOW	HIGH
FALSE	TRUE

This is called positive logic. This maps the infinite values of voltage and current to the two values. An example of this is CMOS 2-Volt logic:

0	1
0-0.5V	1.5-2.0V

These completely separated ranges of values allow for 0 and 1 to be completely separate, with noise and other possible errors being ignored.