ECE 450/451: Digital System Design/Lab

IN

Number Systems and Boolean Algebra
• Understand fundamentals of number systems and Boolean algebra

Logic
• Know truth tables and canonical expansions
• Has introduction to K-maps

Gates and Logic
• Understands representation of logic as gate-level schematics

Energy and Radiation
• Has knowledge of sequential building blocks
• Has exposure to FSMs

Pre-requisites
• ECE102 with a C or higher; ECE202 with a C or higher

Concepts:
• Basic implementation of logic gates
• Design representation (gate schematics, HDL)
• Logic families and digital circuit behavior
• Boolean algebra, switching theory, logic minimization (algebra, cubes, Quine-McCluskey, CAD tools)
• Logic synthesis (multi-level gates, function blocks, programmable logic)
• Advanced finite state machine synthesis (state enumeration, minimization, encoding, partitioning)
• Synchronous design (clocking methods, timing parameters, metastability)
• Computer system design fundamentals (ALU, data path, control)
• Design trade-offs (area, speed, power)
• Design methodology and design flow for complex logic circuit

Applications:
• Complex combinational circuits
• Complex sequential circuits: counters, FIFOs, sequence generators
• Systems and subsystems: CPU, I/O controller, memory management

Tools:
• Design tools: schematic capture, digital simulation, HDL compilation and synthesis, debugging and validation of hardware

OUT

CMOS Logic
• Understand how CMOS logic circuits are composed to perform arbitrary logic functions

Hardware Description Language
• Use schematic and HDL representation of combinational and sequential logic

Logic Minimization
• Understand complex logic minimization through Quine-McCluskey and CAD methods

Arithmetic Logic Design
• Understand the techniques for common arithmetic logic design

Finite State Machine Design
• Design and optimize a complex finite state machine from design specifications

Programmed Logic
• Understand complex logic implementation in programmable devices: PLA/PLD, FPGA

Micro-Architecture
• Has knowledge of aspects of computer system micro-architecture and design

Knowledge of Design Methodology and Design Flow
• Use a variety of design and simulation tools to design and validate complex logic circuits

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