

# **Operations on Binary Data**

1's complement operation.

Conversion to/from unsigned binary/2's complement/IEEE floating-point representation from/to decimal representation.

Modular arithmetics.

Addition and subtraction in unsigned binary and 2's complement representations.

Carry out and Overflow.

#### Boolean Algebra

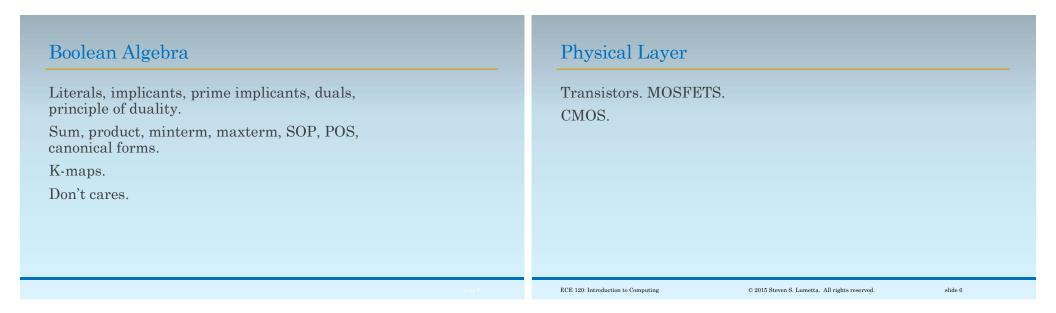
Logic functions: NOT, OR, AND, XOR, XNOR, NOR, NAND.

Truth table.

Logical completeness.

Proof approaches: by construction, by induction.

Boolean algebra properties.



# **Combinational Logic Circuits**

2-level networks: AND-OR, OR-AND, NANO-NAND, NOR-NOR.

Design metrics: optimality, heuristics, constraints (area, speed, power).

Multiplexer, decoder.

Full adder, ripple-carry adder.

Comparator.

Bit-slicing.

# Sequential Logic Circuits

R-S latch, S-R latch, gated D-latch. Positive-edge triggered D flip-flop. Register, shift register, resister with parallel load. Active-low, active-high. Set, reset. Clock, clock edge, clock gating.

### Finite State Machine (FSM)

Clock synchronous sequential circuit.

 $Mealy \ and \ Moore \ models.$ 

Synchronous counters, ripple counters.

Serialization.

FSM design: state and state representation, transition rules, list of abstract states, next-state table, state transition diagram.

#### Memory

Address space, addressability. Abstract memory model. RAM, ROM, SRAM, DRAM. SRAM cell, DRAM cell. SRAM slice. Address selection. Coincident selection. Building larger memories from smaller memories.

# Von Neumann model

Model elements: processing unit, control unit, memory, input/output.

PC, IR, MAR, MDR.

Processor datapath, bus, control signals.

Instruction processing, instruction cycle.

Instruction Set Architecture (ISA), instruction encoding, instruction fields, opcodes.

# LC-3 Computer Architecture

Datapath, control unit. LC-3 instructions. LC-3 binary coding. LC-3 assembly language. Assembly process.

Error Detection and Correction	C language and Programming Concepts
Codewords, codes. Bit error. Odd/even parity. Hamming distance. Hamming code. SEC-DEC.	<ul> <li>High-level language concepts: syntax, variables, operators, expressions, statements.</li> <li>Functions in C: main, printf, scanf,</li> <li>Transforming tasks into program, flowchart.</li> <li>Systematic Decomposition: sequential, conditional, and iterative constructs.</li> <li>C statements: if, if-else, for, while.</li> </ul>
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