

Logic

Digital electronics

9/6/2023

1 Binary Codes

Binary Code is how information is represented with binary digits, multiple exist. Codes provide further implementation methods of binary into a digital system.

Binary Coded Decimal is code to represent decimal in binary. Each digit is represented by its binary 4-bit equivalent.

Application include numeric LED displays. (BCD is translated digit by digit and the appropriate number is shown)



Logic

Logic math (**Boolean Algebra**) existed before digital computers. It explained logic, by the means of math, utilizing 2 values (*True or False*).

- As a transistor is a binary output, logic can be implemented
- Basic functions are AND, OR, NOT

- **AND** → All inputs must be true for the expression to be true. $z = xy, z = x * y$
- **OR** → Any 1 input can be true for the expression to be true. $z = x + y$
- **NOT** → Reverse the expression/scoped output from true to false and vice versa. $z = x' = \bar{x}$

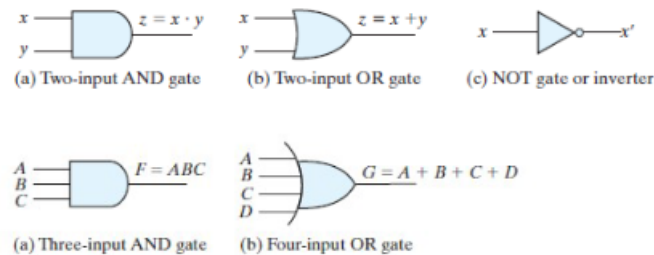
Truth Tables of Logical Operations

AND			OR			NOT	
x	y	$x \cdot y$	x	y	$x + y$	x	x'
0	0	0	0	0	0	0	1
0	1	0	0	1	1	1	0
1	0	0	1	0	1		
1	1	1	1	1	1		

Logic gates

These functions are implemented with logic gates, Electronic device to implement Boolean function.

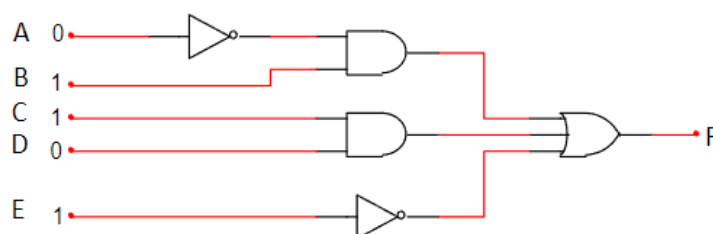
- These gates have multiple inputs and one output.
- They use specific symbols in their schematic representation



Boolean Functions

Variables are used to represent inputs and outputs. In a Boolean function, ANDs appear as a product and ORs appear as a sum. NOT is represented with a ' or a bar above the variable.

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1. The output of the circuit, F : 1
2. Circuit as a Boolean expression: $F = \bar{A}B + CD + \bar{E}$

Cascading Logic Gates

Logic gates can be cascaded together to create more inputs, for physical logic gates only have a finite amount of inputs.

Timing Diagram

Shows inputs and outputs of a logic circuit over time. Output of a logic circuit is assumed to change "instantly".

- Inputs are on the top, outputs are at the bottom, for the sake of readability.

