Intro to Binary Logic

Overview

- Two discrete values
  - True or false
  - Yes or no
  - High or low
  - 1 or 0
- Consists of binary variables and a set of logical operations

Overview

- Consists of binary variables and a set of logical operations
- 3 basic logical operations
  - AND
  - OR
  - NOT
- Each of which produces a result *z*

AND

- Denoted by a dot ($\cdot$) or the absence of a symbol.

$$x \cdot y = z = xy$$

- Interpreted to mean that
  - z = 1 if and only if (iff) x = 1 and y = 1
  - otherwise the result is z = 0.

AND

- The results of the operation can be shown by a truth table.

Inputs		Result
x	y	$x \cdot y$
0	0	0
0	1	0
1	0	0
1	1	1

- **All** inputs must be true for the result to be true.

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OR

- Denoted by a plus (+)

$$x + y = z$$

- Interpreted to mean that
  - z = 1 if x = 1 or y = 1
  - otherwise the result is z = 0.

OR

- The truth table

x	y	$x + y$
0	0	0
0	1	1
1	0	1
1	1	1

- **At least 1** input must be true for the result to be true.

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NOT

- This operation is represented by a prime (‘)

$$x' = z$$

- Referred to as the complement operation.

x	x'
0	1
1	0

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Pitfall

- Binary logic should not be confused with binary arithmetic.

  + implies OR

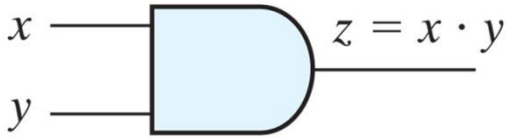
    NOT addition

  · implies AND

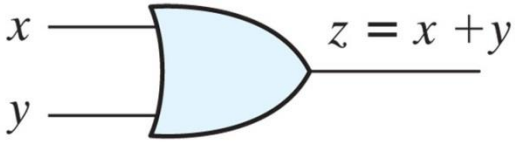
    NOT multiplication

Logic Gates

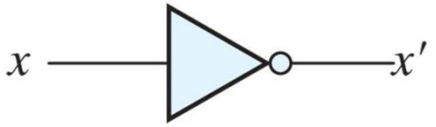
- Electronic circuits that operate on one or more input signals to produce an output.



(a) Two-input AND gate



(b) Two-input OR gate



(c) NOT gate or inverter

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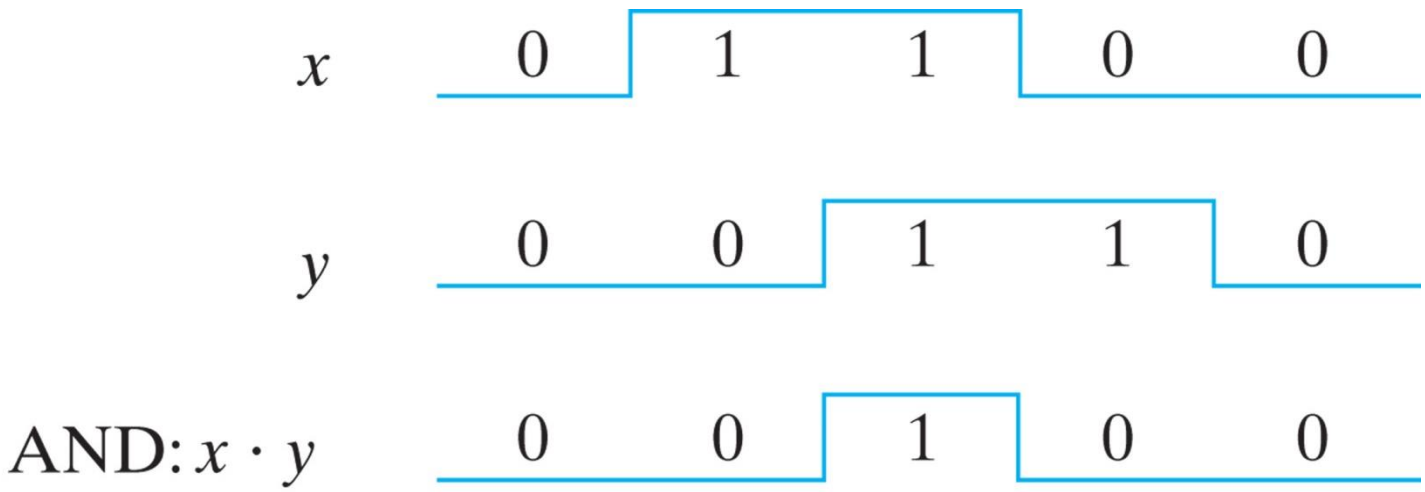
Timing Diagram



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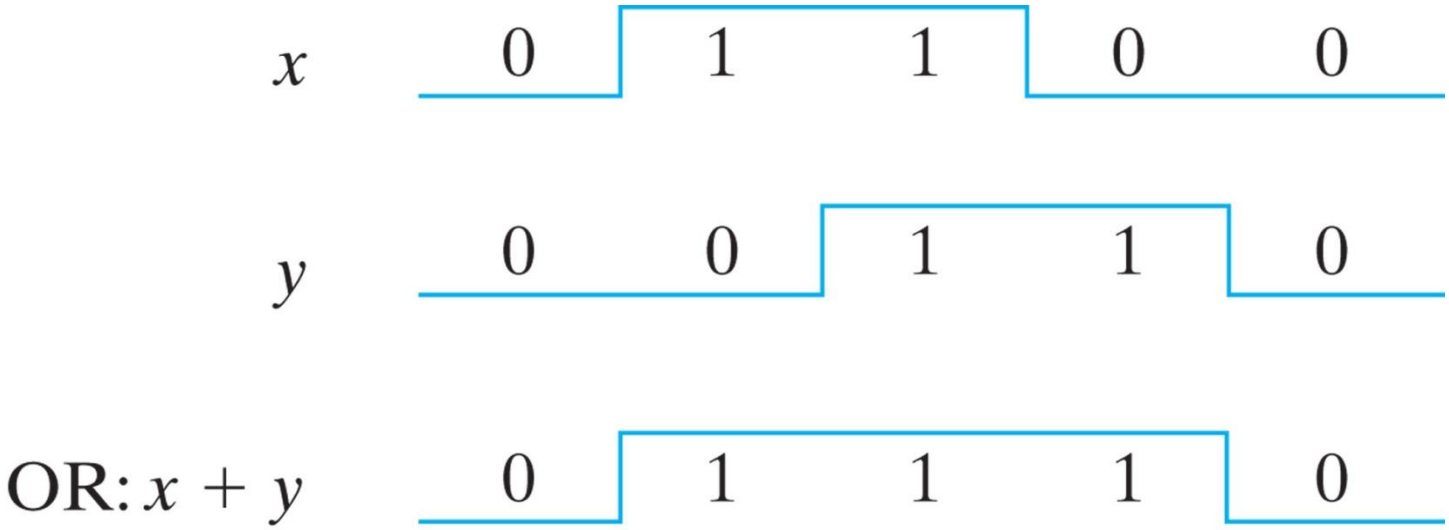
Timing Diagram



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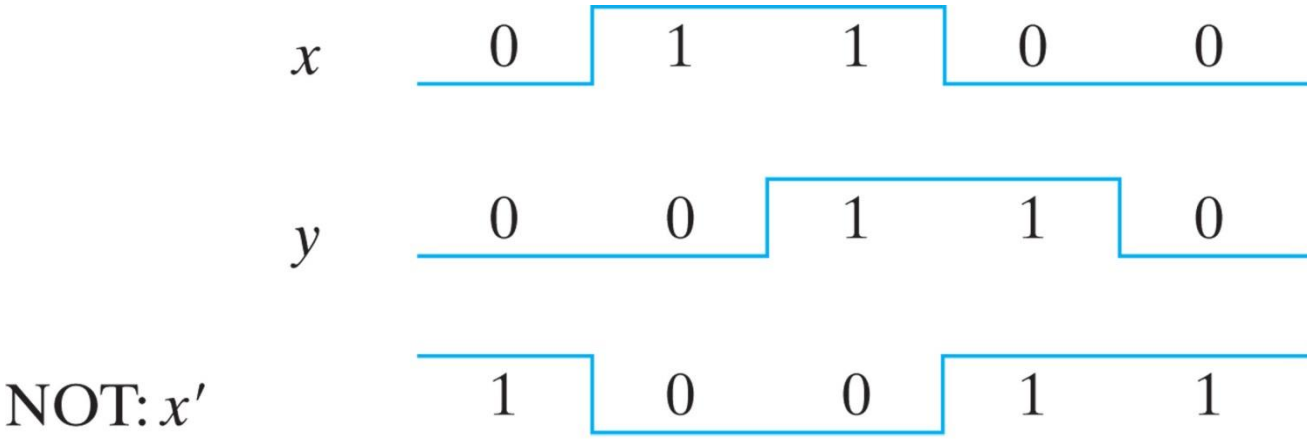
Timing Diagram



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Summary

- Binary logic is comprised of 3 basic operations.
  - AND, NOT, OR
- Be wary of the pitfall
  - Binary logic is not binary arithmetic

- Will tie directly to Boolean Algebra in Chapter 2