

Chapter 3

Logics

Computer Application

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Logic Variables

- Logical variable may assume one or other of only **two** possible values {False, True}.
- The values are expressed by declarative statements, for example:
 - “the light is blue”.
 - “the value of x is 7”.
- The two possible values expressed by the declarative statements must be such that, on the basic of human reason, i.e., on the basic of logic, they are **mutually exclusive**.

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Logic Functions

- Logical function defined by **truth tables**.
- The number of variable can be 1, 2, ...
- For single logical variable there has 4 possible function:

x F(x)	x F(x)	x F(x)	x F(x)
F F	F T	F F	F T
T T	T F	T F	T T

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Possible Logic Function

- There are 16 possible functions of 2 input variables:
 - in general, there are $2^{(2*n)}$ functions of n inputs
 - 8 inputs = $2^{2^8} = 2^{256} = \text{about a google}$

Where do we start?

Diagram showing a box with inputs X and Y and output F.

X	Y	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
0	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	1	1
1	0	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	1	1
1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

16 possible functions (F0-F15)

Labels for functions:

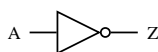
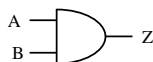
- X and Y
- X
- Y
- X xor Y
- X or Y
- X nor Y
- X = Y
- Xnor
- not Y
- not X
- X nand Y
- not (X and Y)

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Basic Logic Gates

- AND gate
 - Output Z = T only when inputs A **and** B are both T
- OR gate
 - Output Z = T only when inputs A **or** B **or** both are T
- NOT gate or inverter
 - Output Z = T only when input A is F
- Simple alone, but combine a few million gates properly and you have a computer!

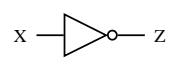
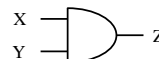


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Basic logic Gates

- AND Gate
- OR Gate
- NOT Gate



X	Y	Z
F	F	F
F	T	F
T	F	F
T	T	T

X	Y	Z
F	F	F
F	T	T
T	F	T
T	T	T

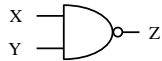
X	Z
F	T
T	F

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Not Basic logic Gates

• NAND Gate



X	Y	Z
F	F	T
F	T	T
T	F	T
T	T	F

NOR Gate



X	Y	Z
F	F	T
F	T	F
T	F	F
T	T	F

Not Basic logic Gates

• XOR Gate



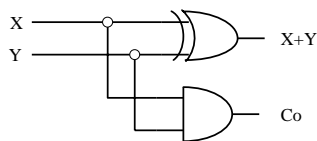
X	Y	Z
F	F	F
F	T	T
T	F	T
T	T	F

NXOR Gate



X	Y	Z
F	F	T
F	T	F
T	F	F
T	T	T

Example: Full Adder



Symbolic Logic

"את עצובה," אמר הפרש בקול מודאג: "תני לי לשיר לך שיר כדי לנחם אותך."
 "הוא ארוך מאוד?" שאלה אליס, כי כבר שמעה די והותר שירה באותו יום.
 "הוא ארוך," אמר הפרש, "אבל מאוד, מאוד יפה. כל מי ששומע אותי שר אותו - או שעניו מתמלאות דמעות, או -"
 "או מה?" אמרה אליס, כי הפרש השתק פתאום.
 "או שלא, את מבינה?" קוראים לשיר הזה בשם 'עניי תורים'."

