Truth Tables

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These slides introduce truth tables

Truth Tables

- Truth Table
  - Visual tool to express and analyze Boolean functions

NOT

A	Not A
F	T
T	F

NOT

A	Not A
0	1
1	0

OR

A	B	A or B
F	F	F
F	T	T
T	F	T
T	T	T

OR

A	B	A or B
0	0	0
0	1	1
1	0	1
1	1	1

Truth Tables

- Components
  - 1 column for each input
  - 1 column for the output (furthest to the right)
  - 1 column for each intermediate signal analyzed (middle)
  - 1 row for each enumerated input combination
    - For n inputs → 2^n rows
    - Enumerate the inputs in a binary count process

A	B	C
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

Truth Tables

- Example

Enumerated Inputs

a	b	c	Intermediate 1	Intermediate 2	Output
0	0	0	1	0	0
0	0	1	0	0	0
0	1	0	1	1	1
0	1	1	0	0	0
1	0	0	1	0	1
1	0	1	0	0	1
1	1	0	1	1	1
1	1	1	0	0	1

Truth Tables

- Input Don't Cares
  - There are instances in Boolean/digital logic where we may not care what the value of a specific input is
  - In those cases, we use an X in the truth table to indicate a don't care and combine the symmetric rows into a single row in the table

a	b	c	Intermediate 1	Intermediate 2	Output
0	0	0	1	0	0
0	0	1	0	0	0
0	1	X	1	1	1
0	1	X	0	0	1
1	X	0	1	0	1
1	0	1	0	0	1
1	X	0	1	1	1
1	1	1	0	0	1

a	b	c	Intermediate 1	Intermediate 2	Output
0	0	0	1	0	0
0	0	1	0	0	0
0	1	X	1	1	1
1	X	0	1	0	1
1	0	1	0	0	1
1	1	1	0	0	1

Truth Tables

- Output Don't Cares
  - There are instances in Boolean/digital logic where:
    - We may consider specific input combinations to be impossible and
    - We don't care what the logic output value is
  - In those cases, we use an X in the truth table output

not possible and don't care →

a	b	c	Intermediate 1	Intermediate 2	Output
0	0	0	1	0	0
0	0	1	0	0	0
0	1	0	1	1	1
0	1	1	0	0	X
1	0	0	1	0	1
1	0	1	0	0	1
1	1	0	1	1	X
1	1	1	0	0	1