

Combinational Logic I

Learning Objectives

1. Generate a POS or SOP Boolean expression from a truth table.
2. Build a logic circuit from a Boolean expression.
3. Create a truth table from a Boolean expression or logic circuit.
4. Build a multiplexor out of primitive logic gates.

Electronics Basics

Short

Draw a closed switch:

_____ at any point on a _____ is the same

Example

Draw a simple switched circuit

Transistors are _____ controlled _____.

Draw the circuit using a transistor

Draw the simplified circuit

There are many types of transistors:

triode tube, BJT: _____, FET: _____

triode tube	BJT	FET
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MOSFET Transistor

M_____ O_____ S_____ F_____ E_____ T_____

3 terminals: _____

Gate voltages are either _____ or _____.

Draw a PMOS	Draw an NMOS
Closes when gate = _____	Closes when gate = _____

TRANSISTOR CIRCUIT	SWITCH REPRESENTATION
IN = 0 OUT = ?	
IN = 1 OUT = ?	

This circuit is a _____

Truth Table

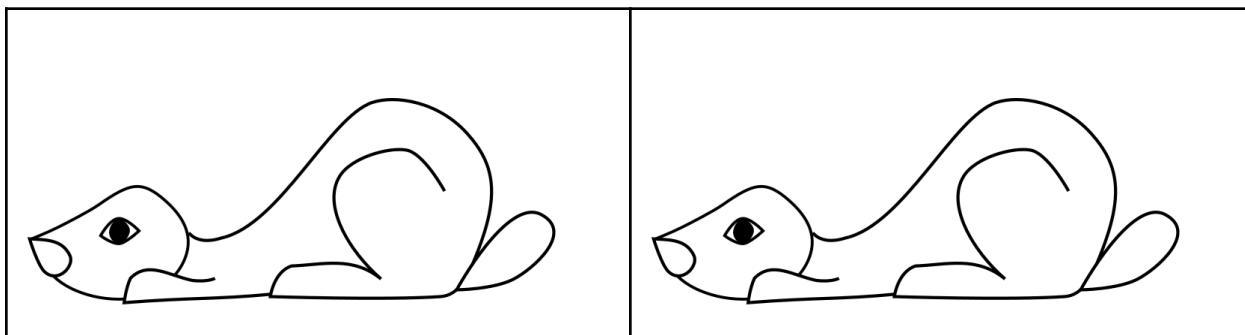
A truth table represents the _____ of a logic circuit. # of inputs: _____ # of outputs: _____ # of columns: _____ # of rows: _____	Draw the truth table for an inverter
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“Not” A can be written as: _____

Logic Operations

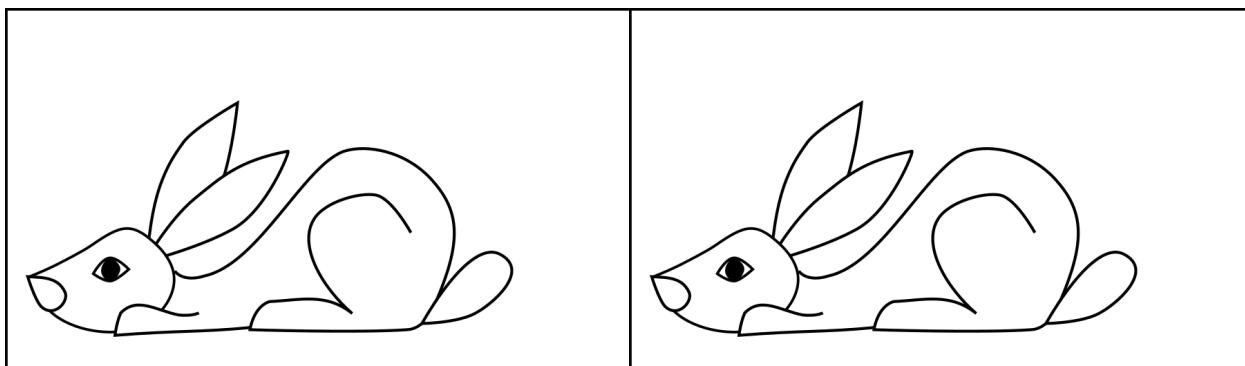
Rabbit Analogy

Say “P” is any statement. E.g. P = “The rabbit has floppy ears”



This sentence is either _____ or _____

Say "Q" is another statement. Q = "The rabbit has patched fur"



Now form the compound sentences:

P and Q

The rabbit has _____

The rabbit has _____

P or Q

The rabbit has _____

The rabbit has _____

Truth Tables

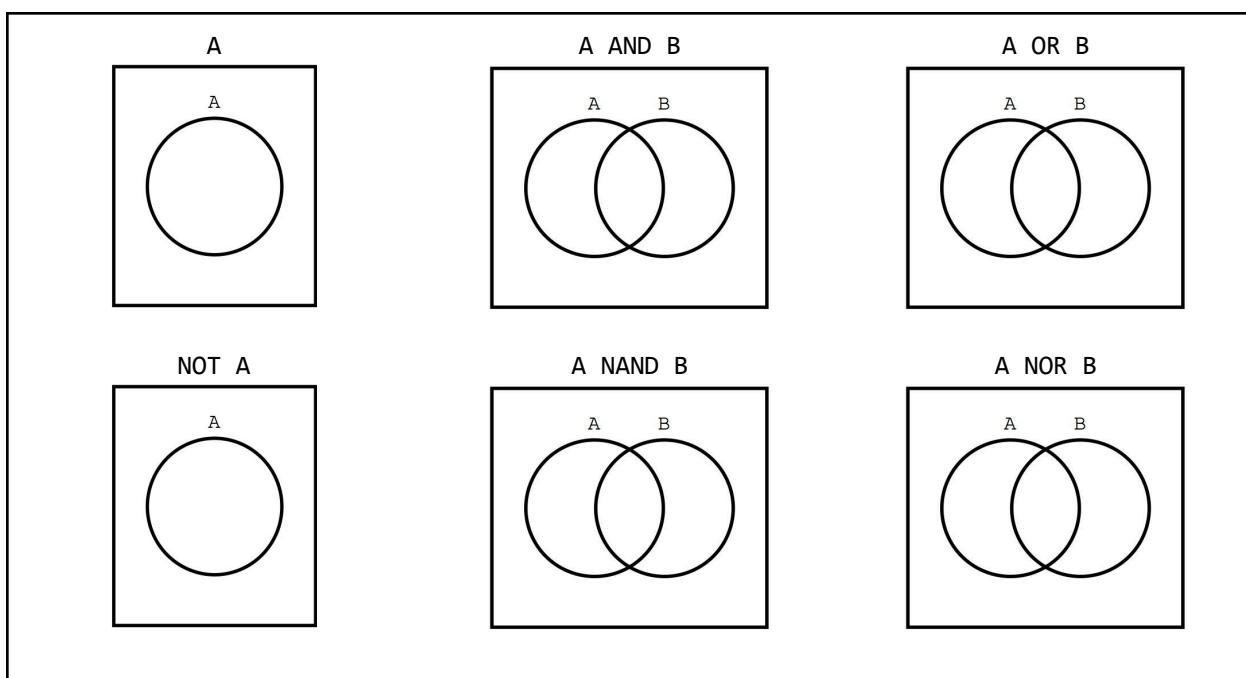
	Has floppy ears? (P)	Has patched fur? (Q)	Has floppy ears AND patched fur? (P AND Q)
A line drawing of a rabbit lying down, facing left, with large, floppy ears and a long, curved tail.			
A line drawing of a rabbit lying down, facing left, with large, floppy ears and a long, curved tail.			
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A line drawing of a rabbit lying down, facing left, with large, floppy ears and a long, curved tail.			

	Has floppy ears? (P)	Has patched fur? (Q)	Has floppy ears OR patched fur? (P OR Q)
			
			
			
			

The rabbit analogy was adapted from a lesson in the Cartoon Guide for Computer Science, 1st Ed. © 1983 p 102-104

Venn Diagrams

Shade the appropriate areas on the Venn diagrams



Logic Gates

BUFFER

Draw the schematic here:

Complete the truth table:

A	Out = A
0	0
1	1

NOT (Inverter)

Draw the schematic here:

Complete the truth table:

A	Out = A'

(the _____ indicates inversion)

AND

Draw the schematic here:

Complete the truth table:

A	B	Out =
0	0	
0	1	
1	0	
1	1	

NAND

Draw the schematic here:

Complete the truth table:

A	B	Out =

OR

Draw the schematic here:

Complete the truth table:

A	B	Out =

NOR

Draw the schematic here:

Complete the truth table:

A	B	Out =

XOR

Draw the schematic here:

Complete the truth table:

A	B	Out =

XNOR

Draw the schematic here:

Complete the truth table:

A	B	Out =