Combinational Logic II

Boolean Equations

Order of Operations

1) _____ 2) _____ 3) _____

Circuit Examples

Bubble

A bubble denotes inversion as shown below

Logic Circuits

Draw the circuit for: A' + (A'·B) + C

Draw the circuit for: (A' + (A' · B)) ⊕ (C+A) = D

Draw the logic circuit for: D = ABC + A'(B+C) + A(B') + C

Draw the logic circuit for: D = (A' + B + C) + A(B + C) + B(C') + AC
What boolean equation does this logic circuit represent?
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What boolean equation does this logic circuit represent?

Logical Completeness

You can create a circuit for ANY truth table with only _____

In addition, you can complete any truth table with only _____

You can also complete any truth table with only _____

XOR Gate

Complete the truth table:

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

There are 2 ways for the output of a 2-input xor gate to be 1:

If:

1 - A is _____ AND B is _____ OR 2 - A is _____ AND B is _____

_____

Schematics

Draw a logic circuit that corresponds with the truth table of an xor gate

Sum of Products (SOP)

How do we get from a truth table to a logic expression?

Procedure

1) Identify rows with an output equal to _____

2) Write product terms - AND the inputs together where the ____ inputs are _____

3) _____ the product terms together to form a _____

Examples

Write the SOP for Out

S	A	B	Out
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Product terms (aka _____):

_____

_____

Sum of products:

_____

This is the truth table of a:

_____

Write the SOP for Out

S	A	B	Out
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

Product terms:

_____

_____

Sum of products:

_____

_____

Product of Sums (POS)

How do we get from a truth table to a logic expression?

Procedure

1) Identify rows with an output equal to _____

2) Write sum terms - OR the inputs together where the ____ inputs are _____

3) _____ the sum terms together to form a _____

Examples

Write the POS for Out

S	A	B	Out
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Sum terms (aka _____):

_____

_____

Product of sums:

_____

_____

Write the POS for Out

S	A	B	Out
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

Sum terms:

_____

_____

Product of sums:

_____

_____

PLA: P_____ L_____ A_____

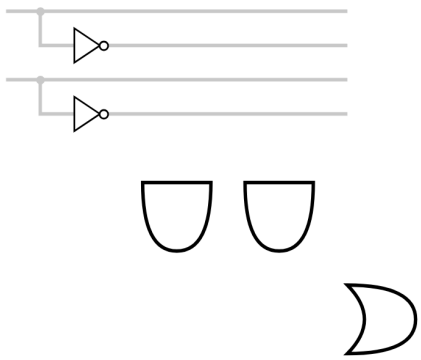
A structured logic element that takes a set of _____

and _____ of logic.

Draw the basic form of a PLA

Example

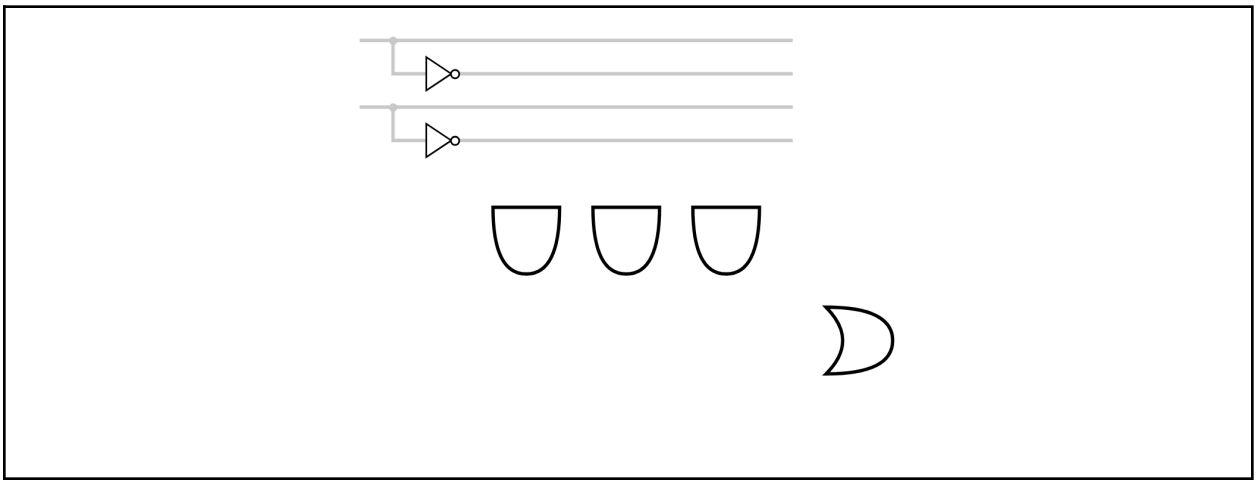
Implement the logic for an XOR gate as a PLA



Example

Implement this truth table as a PLA

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

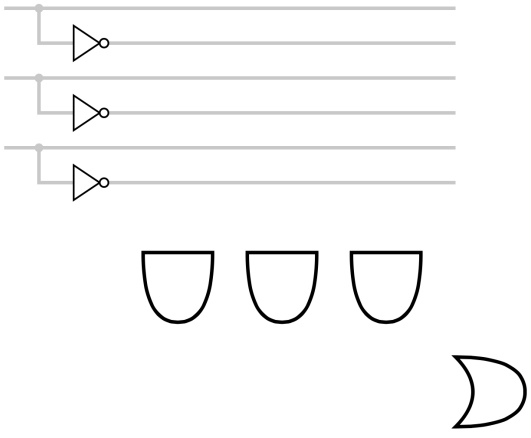


This PLA implements logic as a _____

Examples

Given: Truth table
(fill in values for D in the truth table)

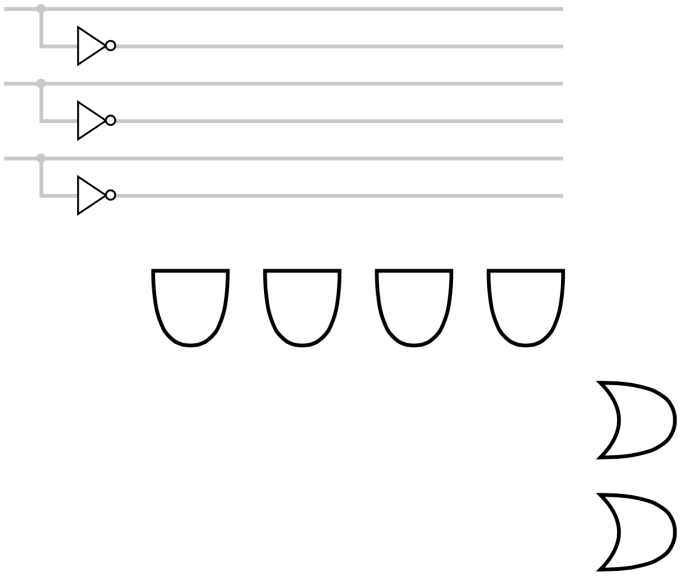
Solve: 1) Draw the circuit 2) Write the corresponding Boolean expression for the output



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

Given: Truth table
(fill in values for D and E in the truth table)

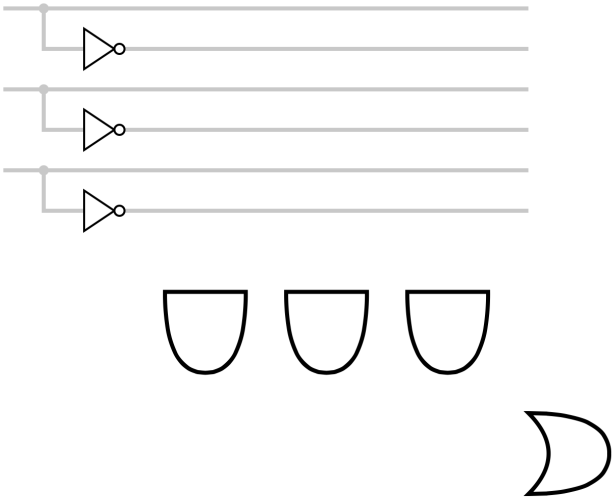
Solve: 1) Draw the circuit 2) Write the corresponding Boolean expressions for the outputs



A	B	C	D	E
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

Given: Circuit
(finish drawing this circuit)

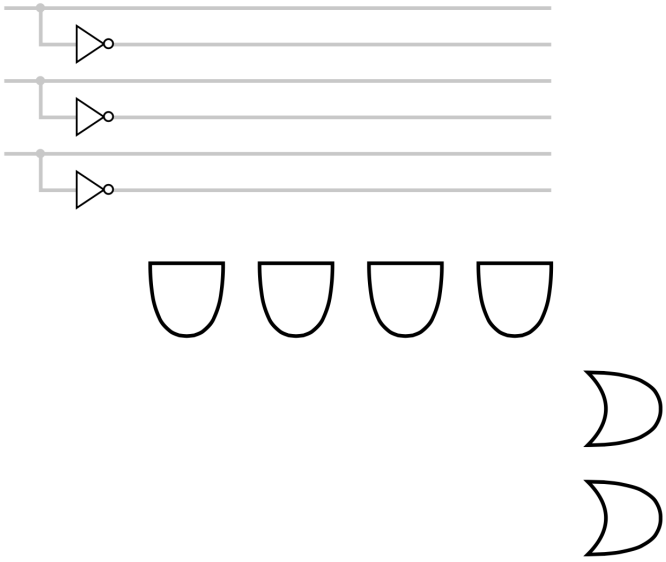
Solve: 1) Complete the truth table 2) Write the corresponding Boolean expression for the output



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

Given: Circuit
(finish drawing this circuit)

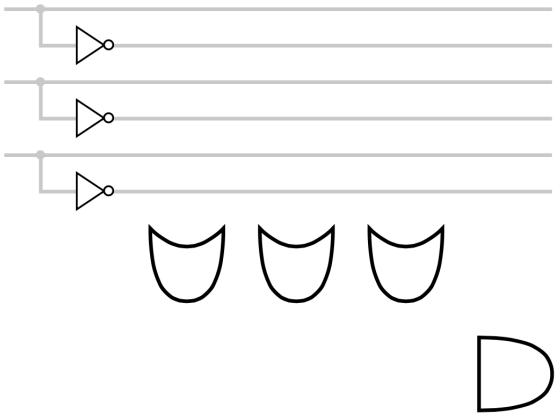
Solve: 1) Complete the truth table 2) Write the corresponding Boolean expression for the outputs



A	B	C	D	E
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

Given: Truth table
(fill in values for D in the truth table)

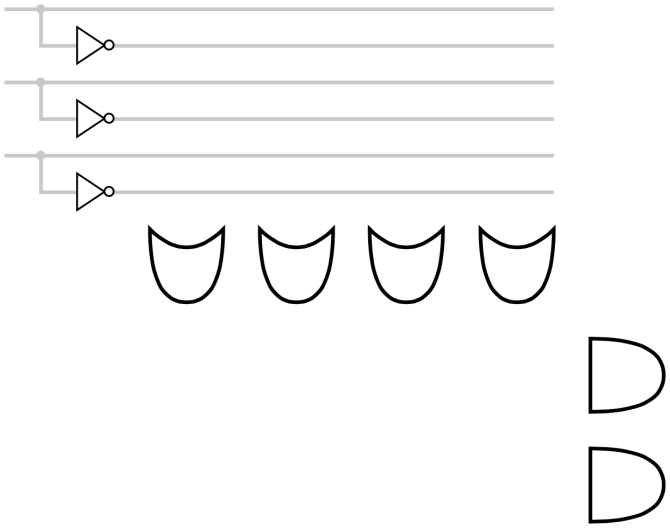
Solve: 1) Draw the circuit 2) Write the corresponding Boolean expression for the output



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

Given: Truth table
(fill in values for D and E in the truth table)

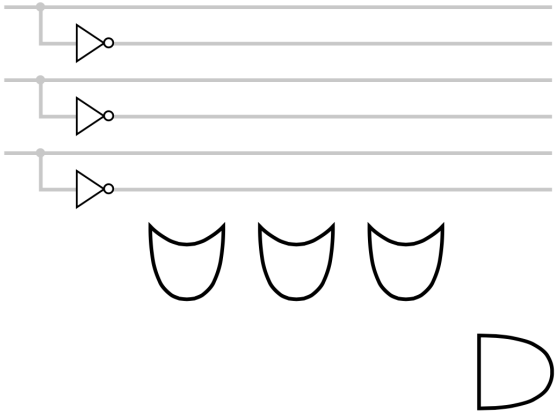
Solve: 1) Draw the circuit 2) Write the corresponding Boolean expressions for the outputs



A	B	C	D	E
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

Given: Circuit
(finish drawing this circuit)

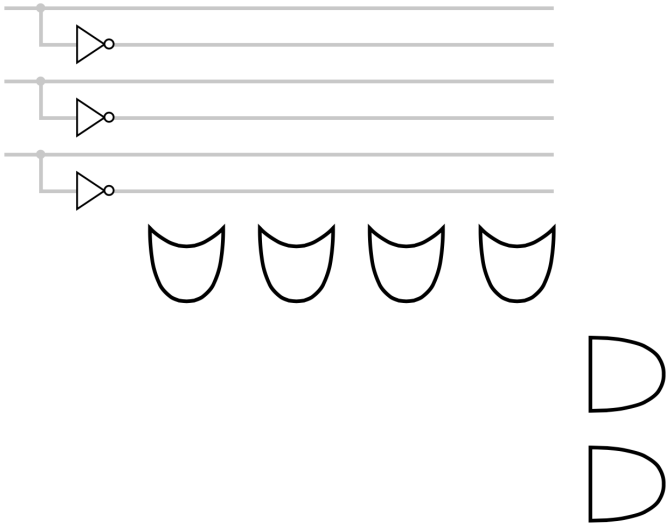
Solve: 1) Complete the truth table 2) Write the corresponding Boolean expression for the output



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

Given: Circuit
(finish drawing this circuit)

Solve: 1) Complete the truth table 2) Write the corresponding Boolean expressions for the outputs



A	B	C	D	E
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		