❖ Chapter 2: Combinational Logic/Combinational Circuits

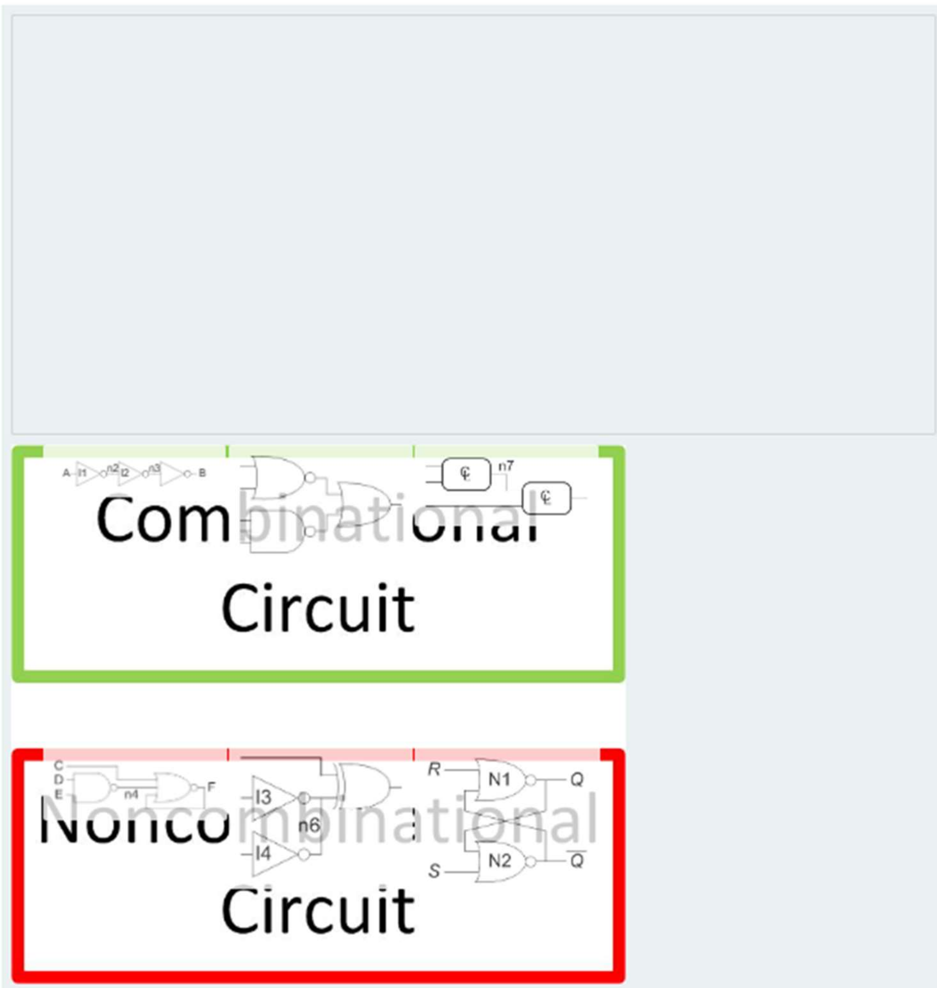
Lecture Practice due Apr 8, 2023 10:37 PDT Completed

Combinational Circuits

1/1 point (graded)

Keyboard Help

Drag the circuits into the boxes to classify them as combinational or non combinational.



Reset

FEEDBACK

ℹ **Good work! You have distinguished combinational circuits.**

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Consider the following truth table.

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

Sum of Products

1/1 point (graded)

Give a sum of products expression for the truth table above. Read ~A as NOT(A) (like A with a bar over the top).

- ○ Y = A
- ◉ Y = (~A)(~B) + AB
- ○ Y = (~A)B + A(~B)
- ○ Y = ~(A ^ B)

✔

Submit Try again (1 attempt remaining) Show answer

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Duality

1/1 point (graded)

What is the dual of 0 * 0 = 0?

- ○ 0 + 0 = 0
- ◉ 1 + 1 = 1
- ○ 1 * 1 = 1

✔

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Duality

1/1 point (graded)

Let (~X) mean NOT X. Propose a "Super Involution" Theorem: (~(~(~B))) =

- 0
- 1
- B
- (~B)

Submit Try again (1 attempt remaining) Show answer

XOR Identity

1/1 point (graded)

The identity element I for XOR such that B XOR I = B is:

- 0
- 1
- There is no identity element for XOR

Submit Try again (1 attempt remaining) Show answer

XOR Null Element

1/1 point (graded)

The null element N for XOR such that B XOR N = N is:

- 0
- 1
- There is no null element for XOR

Submit Try again (1 attempt remaining) Show answer

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Theorems

1/1 point (graded)

The theorem that X+Y = Y+X is known as:

- ( ) Associativity
- ( ) Distributivity
- (•) Commutativity

✔

Submit Try again (1 attempt remaining) Show answer

Duality

1/1 point (graded)

What is the dual of the covering theorem B*(B+C) = B ?

- ( ) B + C = C + B
- ( ) (C+B)*B = B
- (•) B+(B*C)=B

✔

Submit Try again (1 attempt remaining) Show answer

Proof

1/1 point (graded)

How can you prove Boolean theorems?

- [x] Perfect induction: try all the finite number of possibilities.
- [ ] Using the Method of Frobenius
- [x] By applying axioms and other theorems
- [ ] Theorems can't be proven; they just have to be accepted as true

✔

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Consider the following truth table:

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

Sum of Products

1/1 point (graded)

Write a sum of products equation corresponding to the truth table above

- (selected) Y = (~A)(~B) + A(~B)
- Y = (~A)(~B) + B
- Y = A^B

✔

Submit Try again (1 attempt remaining) Show answer

Simplifying

1/1 point (graded)

Apply Boolean Algebra to your equation above to find a minimal sum-of-products equation

- Y = (~A)(~B) + A(~B)
- Y = (~A + A)(~B)
- Y = ~A
- Y = A
- (selected) Y = ~B

✔

Submit Try again (1 attempt remaining) Show answer

Consider the following truth table. Note that we could write it in short hand as 00001110 by just considering the output column, ordered with the first row in the least significant bit.

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

Sum of Products

1/1 point (graded)

Write a sum of products expression from the truth table:

- (selected) Y = (~A)(~B)C + (~A)B(~C) + (~A)BC
- Y = (~A)(B+C)
- Y = ~(A)(~((~B)(~C)))

✔

Submit Try again (1 attempt remaining) Show answer

Simplification

1/1 point (graded)

Apply Boolean Algebra to find a minimal sum of products equation.

- Y = (~A)(B+C)
- (selected) Y = (~A)(B) + (~A)C
- Y = (~A)(~B)C + (~A)B(~C) + (~A)BC

✔

Submit Try again (1 attempt remaining) Show answer

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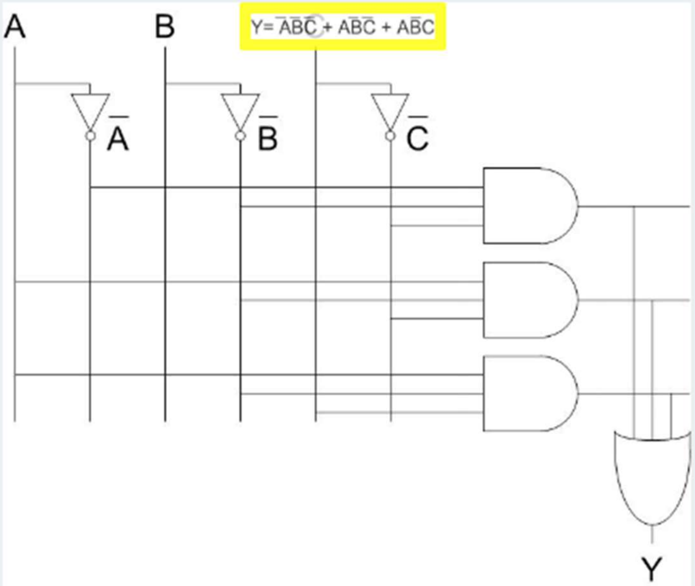
Logic to Gates

1/1 point (graded)

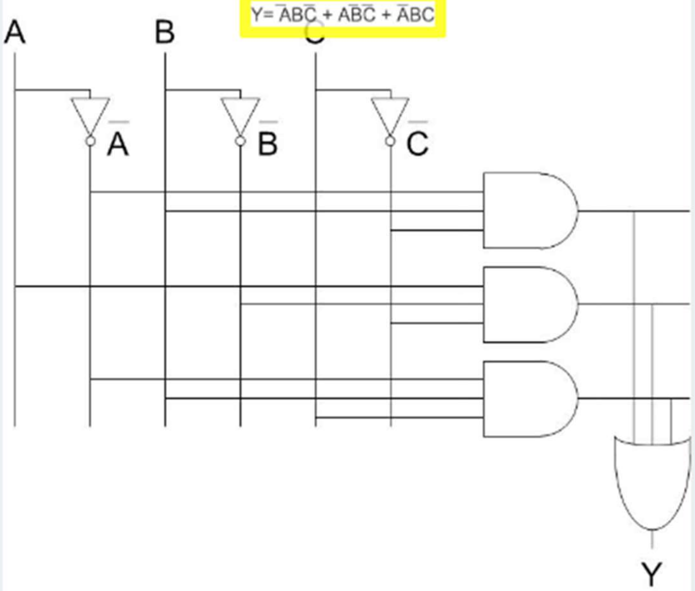
Keyboard Help

Drag the Boolean equations to the corresponding schematics.

$Y = \overline{A}\,\overline{B}\,\overline{C} + A\overline{B}\,\overline{C} + A\overline{B}C$



$Y = \overline{A}B\overline{C} + A\overline{B}\,\overline{C} + \overline{A}BC$



Reset

FEEDBACK

Good work! You can relate equations and schematics.

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DeMorgan's Law

1/1 point (graded)

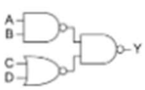
Simplify Y=~((~A)(B+C)) to sum-of-products form:

- ( ) (~A)B + (~A)C
- ( ) A(~B)(~C)
- (•) A + (~B)(~C)
- ( ) (~A)BC
- ( ) ~(A + (~B) + (~C)

✔

Submit | Try again (1 attempt remaining) | Show answer

Use bubble pushing to determine the function performed by the following circuit:



Multiple Choice

1/1 point (graded)

Boolean equation for circuit above:

- ( ) Y = ABCD
- ( ) Y = (A+B)CD
- ( ) Y = AB(~C)(~D)
- (•) Y = AB + C + D
- ( ) Y = AB(C+D)

✔

Submit | Try again (1 attempt remaining) | Show answer

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X

1/1 point (graded)

In digital design, an X may mean (check all that apply):

- [ ] floating value
- [x] uninitialized value
- [x] contention
- [x] don't care

Submit Try again (1 attempt remaining) Show answer

Z

1/1 point (graded)

In digital design, an Z may mean (check all that apply):

- [x] floating value
- [ ] uninitialized value
- [ ] contention
- [ ] don't care

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Truth Tables and Karnaugh Maps

1/1 point (graded)

Keyboard Help

PROBLEM

Drag the truth tables to their corresponding Karnaugh Maps.

Y: C \ AB	00	01	11	10
0	1	0	1	0
1	1	1	0	1

Y: C \ AB	00	01	11	10
0	1	0	0	1
1	1	1	0	1

Reset

FEEDBACK

Good work! You can relate truth tables and Karnaugh maps.

Karnaugh Maps and Boolean Equations

1/1 point (graded)

Keyboard Help

Drag the minimal sum-of-products equations to its corresponding Karnaugh map.

Y = (~A)(~B) + (~A)C + (~B)C + AB(~C)

Y: C \ AB	00	01	11	10
0	1		1	0
1	1	1	0	1

~B + (~A)C

Y: C \ AB	00	01	11	10
0	1	0	0	1
1	1	1	0	1

Reset

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Consider the following Karnaugh map:

Y: C \ AB	00	01	11	10
0	1	x	1	0
1	1	x	0	x

Minimal SOP Expression

1/1 point (graded)

Determine a minimal sum-of-products expression from the K-map.

- ( ) Y = (~A)(~B)(~C) + (~A)(~B)C + AB(~C)
- ( ) Y = (~A)(~B) + AB(~C) + A(~B)C
- ( ) Y = (~A)(~B) + AB(~C)
- ( ) Y = (~A) + AB(~C)
- ( ) Y = (~A) + B(~C) + (~B)C
- (•) Y = (~A) + B(~C)

✔

Submit Try again (1 attempt remaining) Show answer

Consider the following Karnaugh map:

Y: CD \ AB	00	01	11	10
00	1	0	1	1
01	1	x	x	x
11	1	0	0	0
10	1	1	0	x

Minimal SOP Expression

1/1 point (graded)

Determine a minimal sum-of-products expression from the K-map.

- ( ) Y = (~A)(~B) + (~A)C(~D) + A(~C)(~D)
- ( ) Y = (~A)(~B) + (~B)(~D) + A(~C)
- (•) Y = (~A)(~B) + (~A)C(~D) + A(~C)

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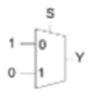
Consider the following circuit:



Multiple Choice

1/1 point (graded)

If S = 1, what is Y in the circuit above?

- (•) 0
- ( ) 1
- ( ) X
- ( ) Z
- ( ) Not enough information to say

✔

Submit Try again (1 attempt remaining) Show answer

Multiple Choice

1/1 point (graded)

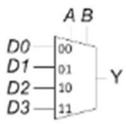
The mux circuit above is equivalent to the following logic function:

- (•) Y = ~S
- ( ) Y = 0
- ( ) Y = 1
- ( ) Y = (~S)D0 + SD1

✔

Submit Try again (1 attempt remaining) Show answer

Consider the following 4:1 multiplexer.



Multiple Choice

1/1 point (graded)

What values could you provide to {D3, D2, D1, D0} to make this mux compute Y = A NAND B?

- ○ {0, 0, 0, 0}
- ◉ {0, 1, 1, 1}
- ○ {1, 1, 1, 0}
- ○ {0, 0, 0, 1}
- ○ {1, 0, 0, 0}

✔

Submit Try again (1 attempt remaining) Show answer

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Numerical Input

1/1 point (graded)

Consider a decoder taking a 7-bit address input. How many outputs does it produce?

128 ✔

128

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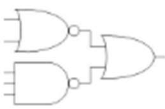
Consider the following component delays

Cell	Propagation Delay (ps)	Contamination Delay (ps)
NOT	6	4
NAND2	8	6
NOR2	10	8
NAND3	10	8
NOR3	12	10

and the circuit below. The OR gate is composed of a NOR followed by an inverter.



Propagation Delay

1/1 point (graded)

What is the propagation delay of this circuit (in ps)?

26

26

Submit Try again (1 attempt remaining) Show answer

Contamination Delay

1/1 point (graded)

What is the contamination delay of this circuit (in ps)?

20

20

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