T02 Tutorial Slides for Week 5

ENEL 353: Digital Circuits — Fall 2019 Term

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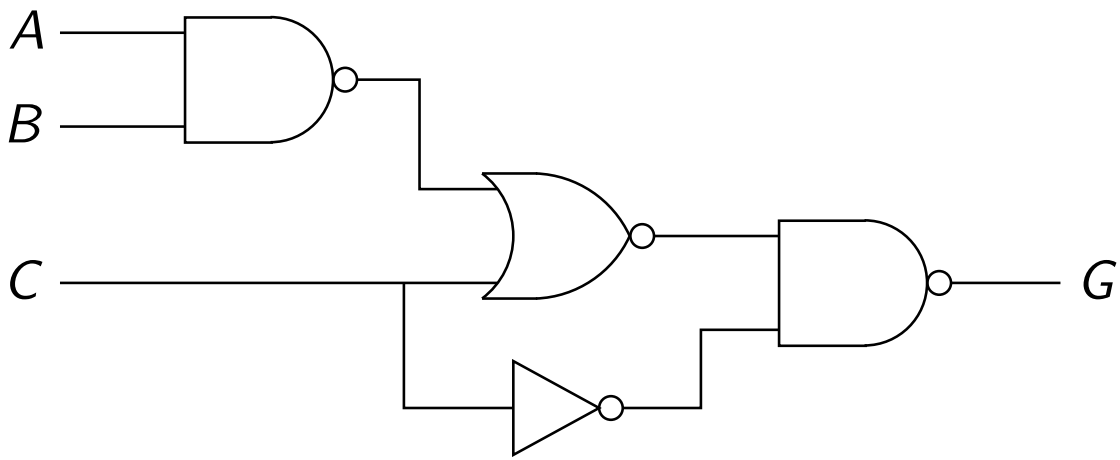
Exercise 1: Algebraic expression to truth table

Write out the truth table for $F(A, B, C) = AB + \bar{A}\bar{B} + A\bar{B}C$.

Exercise 2: Circuit to truth table

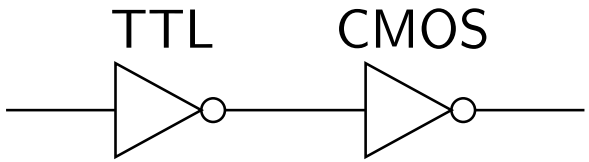
Write out the truth table for $G(A, B, C)$.



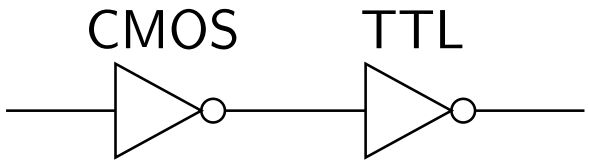
Which would be a simpler description for $G(A, B, C)$: SOP canonical form or POS canonical form?

Exercise 3: Voltage levels

Consider these two buffer designs:

(1) [from TTL gate] 

[to CMOS gates]

(2) [from CMOS gate] 

[to TTL gates]

Use the table below to determine which of the buffer designs will work reliably. Assume that there is no significant additive noise on any of the wires.

Family	V_{DD}	V_{IL}	V_{IH}	V_{OL}	V_{OH}
TTL	5.0 V	0.8 V	2.0 V	0.4 V	2.4 V
CMOS	5.0 V	1.35 V	3.15 V	0.33 V	3.84 V

Exercise 4: Expressions—SOP, SOP canonical, POS, POS canonical

Suppose the input variables for a logic function are A, B and C. Which of the following expressions are in

- sum-of-products form?
- sum-of-products canonical form?
- product-of-sums form?
- product-of-sums canonical form?

1. $A + \bar{B} + C$
2. $\bar{A}\bar{B}C$
3. $AB + \bar{A}\bar{B}\bar{C}$
4. $(A+B+\bar{C})(\bar{A}+B+C)$
5. $\bar{A}BC + A\bar{B}C + AB\bar{C}$
6. $(A+B)\overline{(\bar{B}+\bar{C})}$

Exercise 5: Truth table to SOP and POS canonical forms

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

Write SOP and POS canonical forms for $F(A, B, C)$. Express your answers using literals, and also using minterm or maxterm numbers.

Exercise 6: Algebra practice

From Exercise 1, $F(A, B, C) = AB + \bar{A}\bar{B} + A\bar{B}C$.

Use algebra to get a canonical SOP expression for F.

Then check that the truth table from Exercise 1 leads to the same canonical SOP expression.