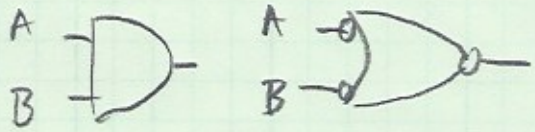
ENEL 353 Section 02 Lecture
Wed Oct 2 2019

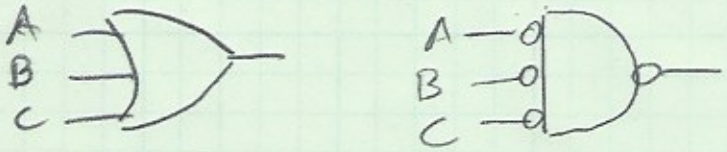
Quiz #2 Tue Oct 8
- topics listed on ENEL 353 Home Page
- Problem Set 2 has been posted

Set 4, Slide 22

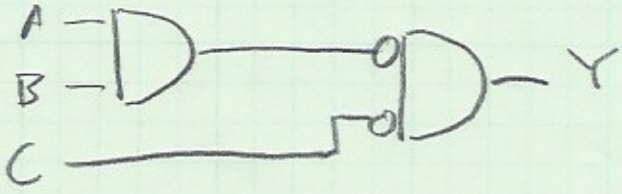
2-input AND $\quad AB = \overline{\overline{AB}} = \overline{(\bar{A} + \bar{B})}$



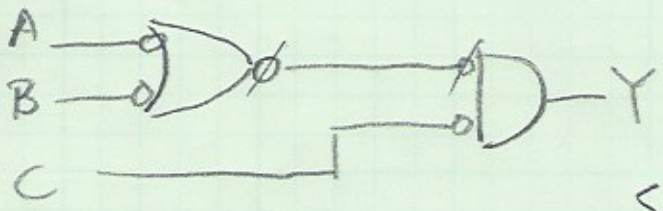
3-input OR $\quad A + B + C = \overline{\overline{A+B+C}} = \overline{\bar{A}\bar{B}\bar{C}}$



For the given example...
Push a bubble starting at output Y



Bubble-push on the AND gate...



So $Y = (\bar{A} + \bar{B})\bar{C}$

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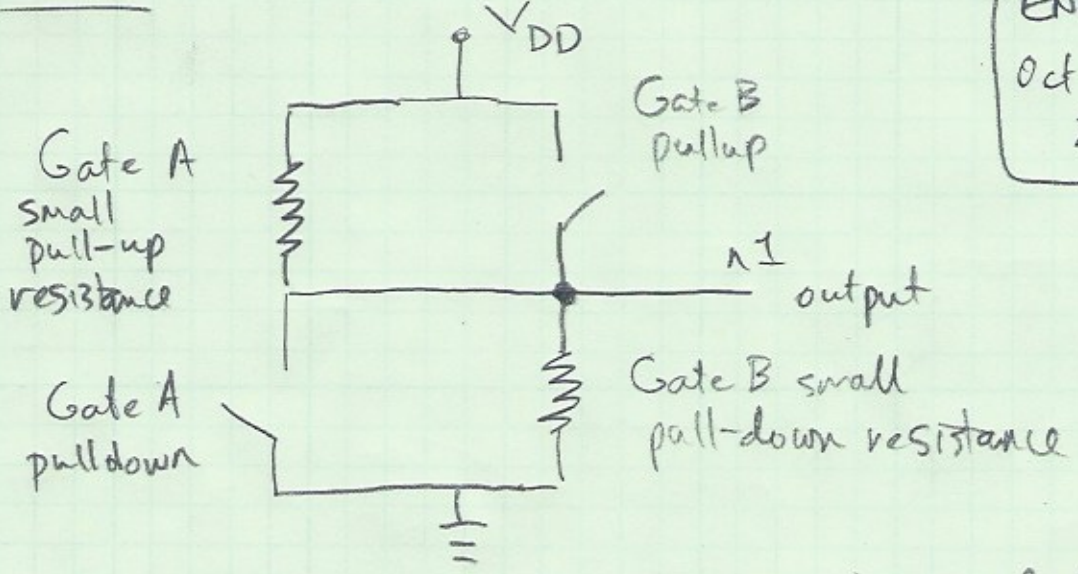

The voltage at n1 depends on the relative strength of the Gate A pull-up and the Gate B pull-down. V_{n1} is probably in the "forbidden zone" This situation is called contention or fighting.

Another problem: There is a low-resistance path from V_{DD} to ground — lots of current, so wasted power, possible circuit destruction.

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The output node is isolated from both V_{DD} and GND. It is said to be floating or in a high-impedance state. Circuits use Z as a symbol for this state

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Let's add a column to the table

E	A	pull-up	pull-down	state of Y
0	0	OFF	OFF	Z
0	1	OFF	OFF	Z
1	0	OFF	ON	LOW - same as A
1	1	ON	OFF	HIGH - same as A

In words, if $E=0$, Y is in state Z.
If $E=1$, Y is a copy of A.

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At any given time, only one E_i should be 1.
Example: If $E_2=1$ and $E_1=E_3=\ldots=E_N=0$, then gate 2 drives the common output wire and gates $1, 3, \ldots, N$ have no effect on the common output wire.

What if all of $E_1, E_2, \ldots, E_N$ are 0?
Common output wire will be in the Z state.
What if two or more of $E_1, \ldots, E_N$ are 1?
Contention is possible.

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