

ENEL 353 Section 02 Lecture

Mon Sept 30 2019

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Lab 2 is this week and next week - please do the pre-lab work before your lab period.

Set 3, Slide 4B, continued

From Fri Sept 27...

$$\begin{aligned}C_{out} &= \bar{A}BC_{in} + ABC_{in} \\ &\quad + A\bar{B}C_{in} + ABC_{in} \\ &\quad \quad ABC_{in} + ABC_{in}\end{aligned}$$

Factoring...

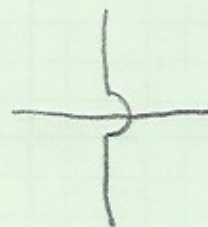
$$\begin{aligned}C_{out} &= BC_{in}(\bar{A} + A) + AC_{in}(\bar{B} + B) + AB(\bar{C}_{in} + C_{in}) \\ &= BC_{in} + AC_{in} + AB\end{aligned}$$

Set 4, Slide 4

Important: Draw wires horizontally or vertically, not diagonally, not curved.

Slide 5

Don't do this in ENEL 353



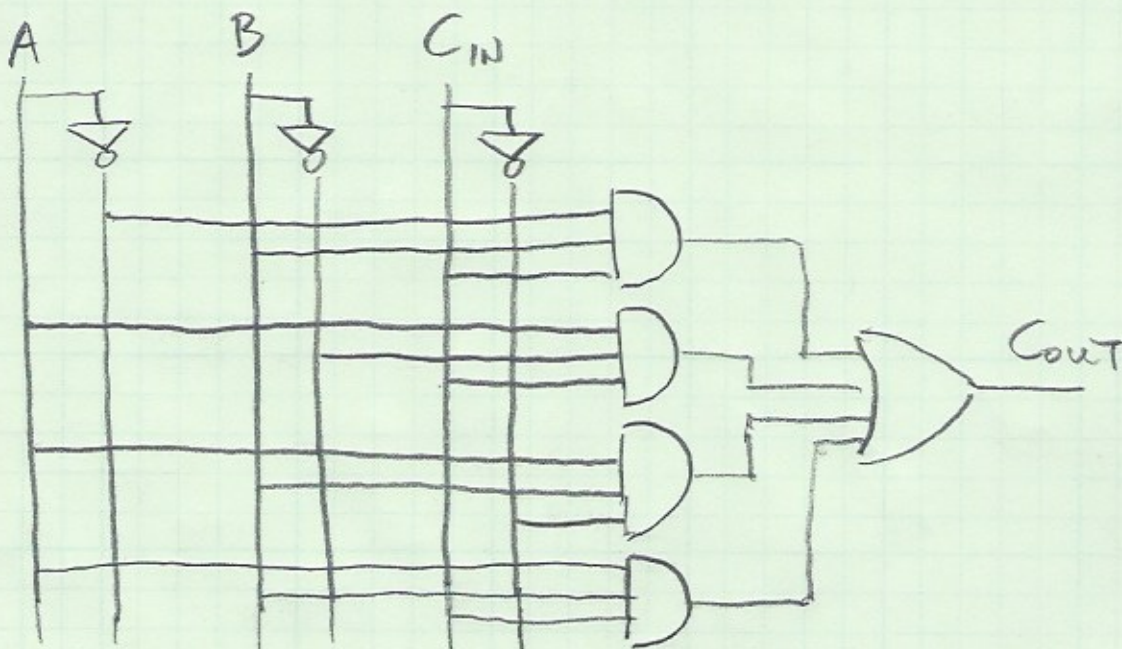
Why not?

- too much use of \rightarrow creates major clutter
- you need to be able to read \perp as not connected

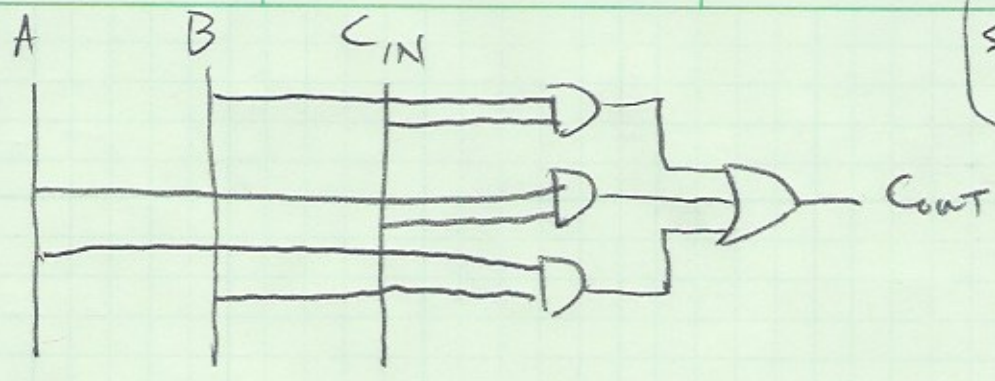
Slide 7 Some wires go right-to-left in multi-bit adder circuits, reflecting the way arithmetic is laid out with pencil and paper (But the flow through elements is top-to-bottom.)

Slide 9

Canonical SOP: $C_{out} = \bar{A}BC_{in} + A\bar{B}C_{in} + AB\bar{C}_{in} + ABC$



Simpler SOP: $C_{out} = BC_{in} + AC_{in} + AB$



Slide 12

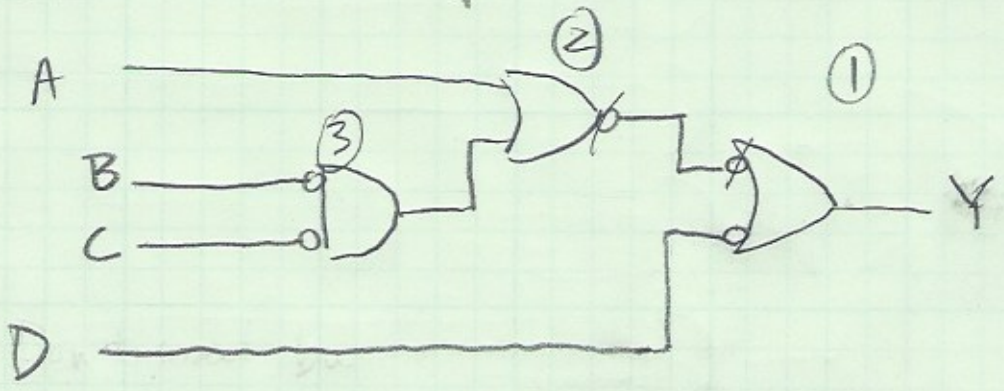
- (1) has 3 products, and other SOP expressions for F have only 2 products
- (2) has 5 literals and another SOP expression has only 4 literals

Slide 17

This is an extreme example - the SOP-based design is terrible, and the tree-of-XORs is small and elegant.

Slide 21

Start at the output...



- ① Don't want bubble on the output of the gate that produces the overall output.

(2) Bubbles cancel on internal wire - so don't bubble-push here

(3) Bubble-push so that ends of internal wire don't have bubbles

Overall function is $Y = (A + \overline{B}\overline{C}) + \overline{D}$

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

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