

Circuit Drawing Tips

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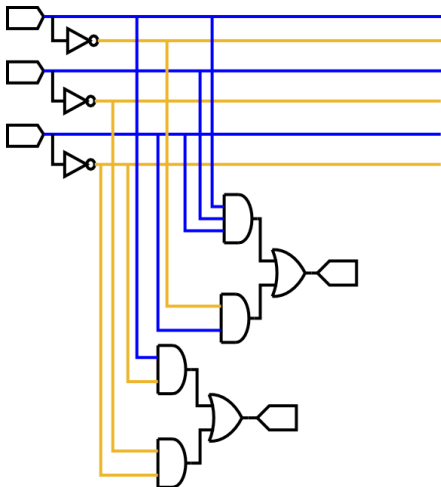
Wilfrid Laurier University

March 1, 2012

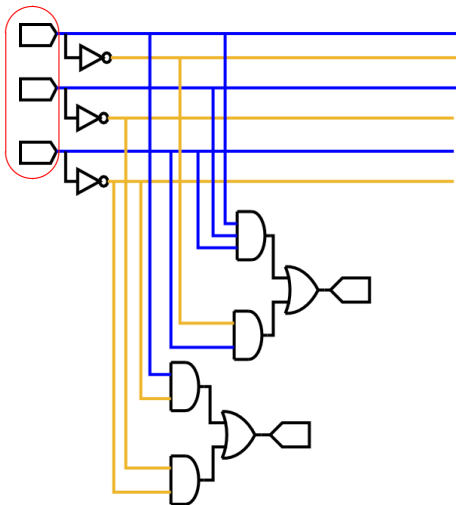
General Layout

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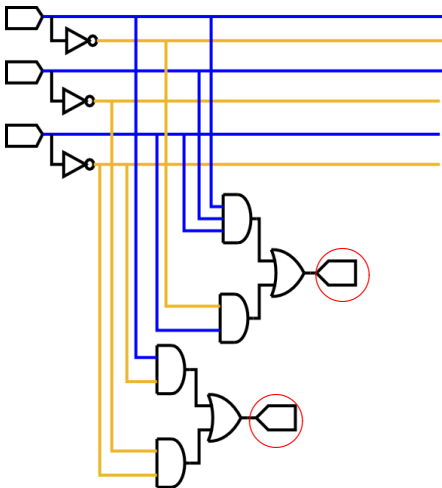
- How you draw a circuit can determine how easy it is to debug.



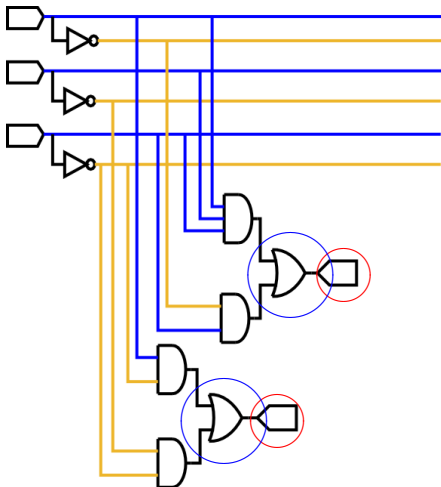
Here is a typical SOP (sum of products) circuit.



It has 3 inputs



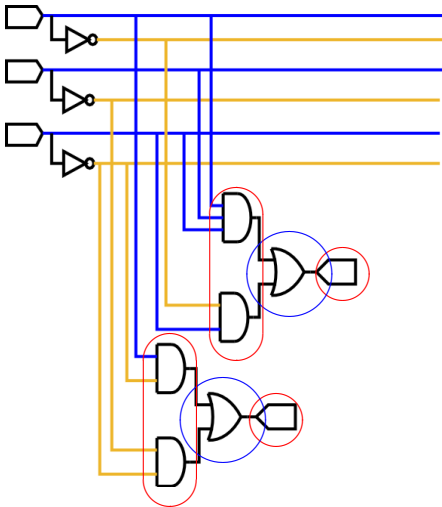
and two outputs.



Each output is a **sum**

Drawing Tips

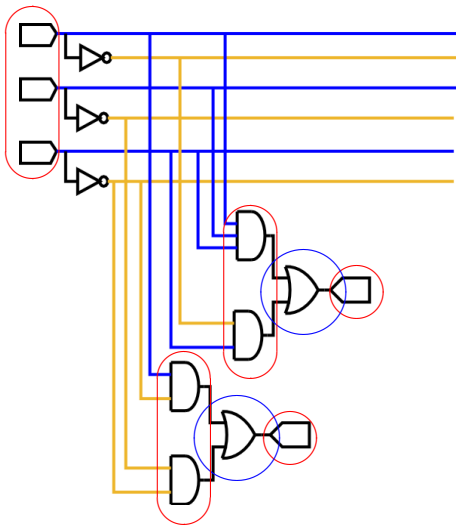
General Layout
Repeated Terms
Unused Inputs



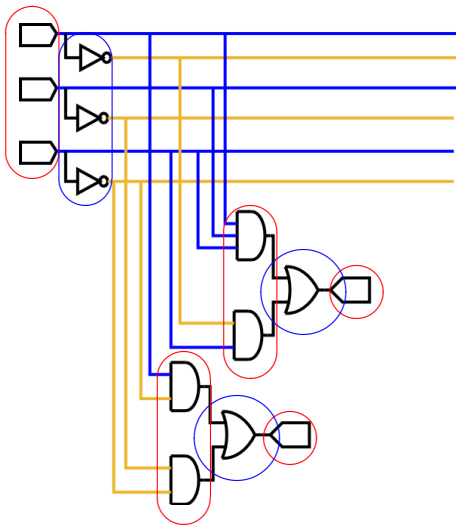
of products

Drawing Tips

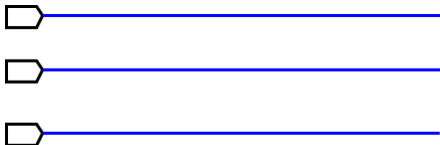
General Layout
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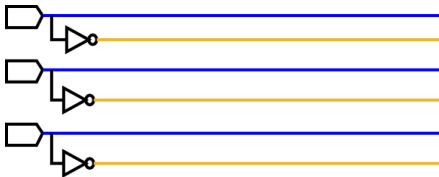
of its **inputs**



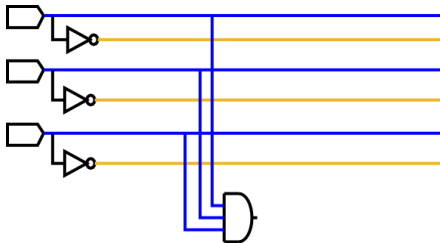
or their **inverses**.



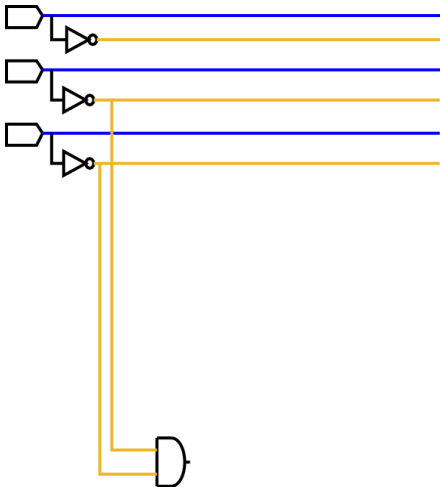
Start with the inputs at the *top left* and draw wires across the page.



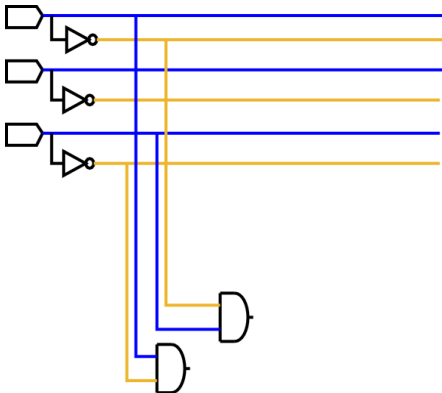
For each input, add an inverter as shown and add wires, as with the inputs.



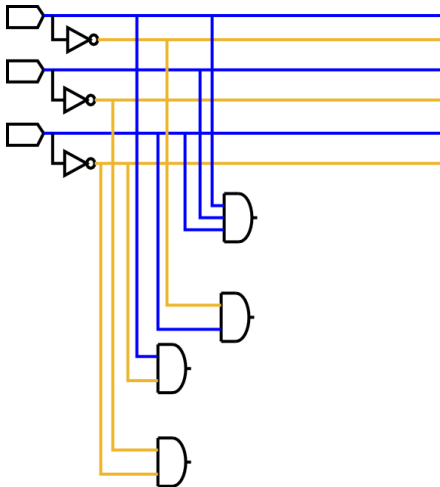
Drop down wires from inputs to make product terms.



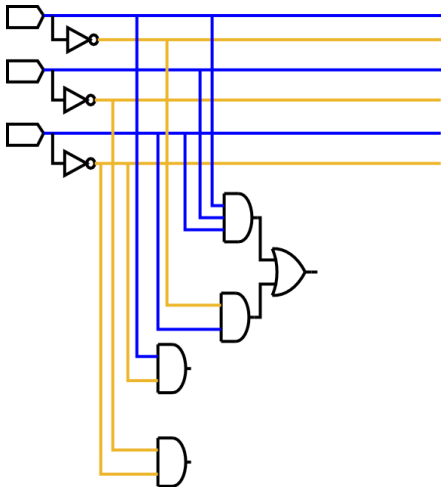
Inverses of inputs can have drop down wires as well.



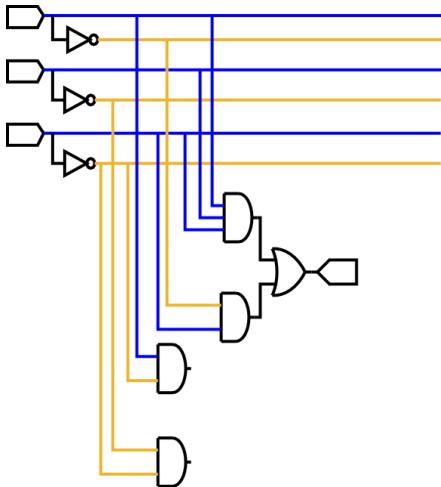
Many products will use some inputs and some inverses.



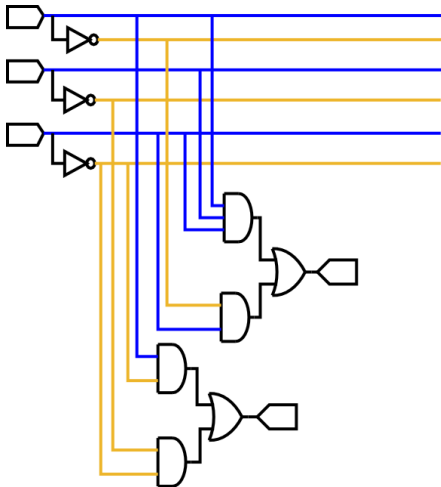
Continue until you have created all of the required product terms.



Sum the product terms for each output.



Add and label each output.



Repeat until you're done.

Repeated Terms

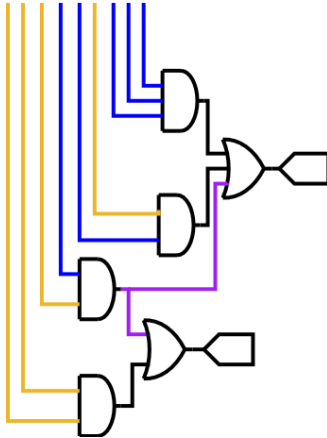
Repeated Terms

Sometimes the same logical term shows up in the equations for multiple outputs.

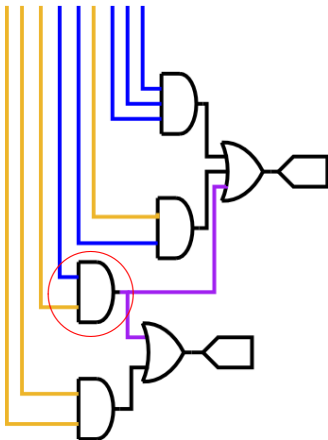
Repeated Terms

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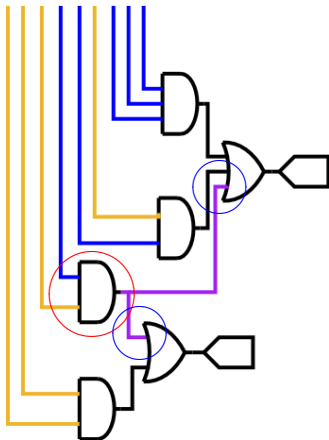
This makes drawing the circuit easier.



Here is a repeated term.



Here is a repeated term.



Note that you only need to *create* a product term once, but you can *use* it as many times as you need.

Unused Inputs

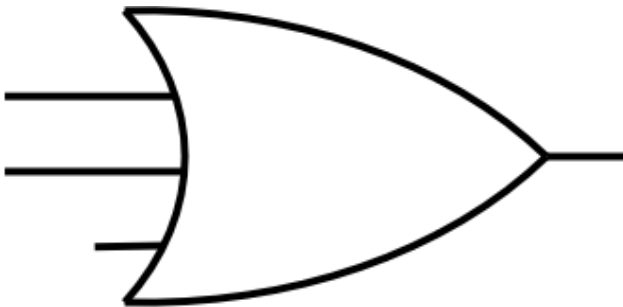
Unused Inputs

Occasionally you need a certain number of inputs to a gate, but no gate exists with that number of inputs.

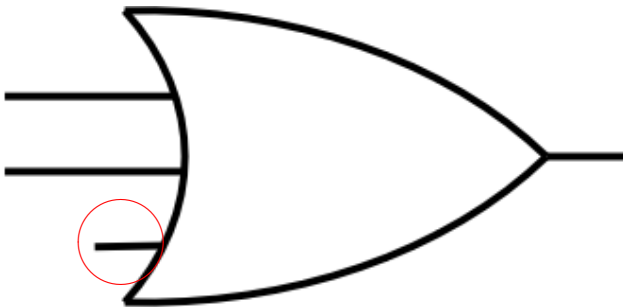
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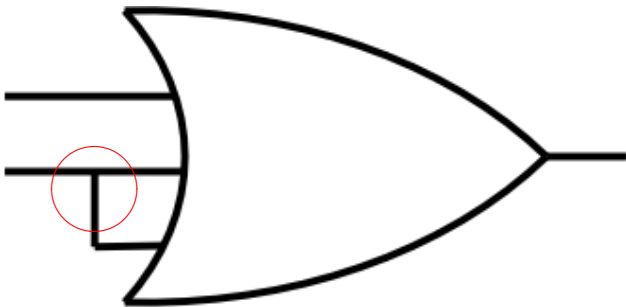
This is no problem if you have gates available with *more* than that number of inputs.



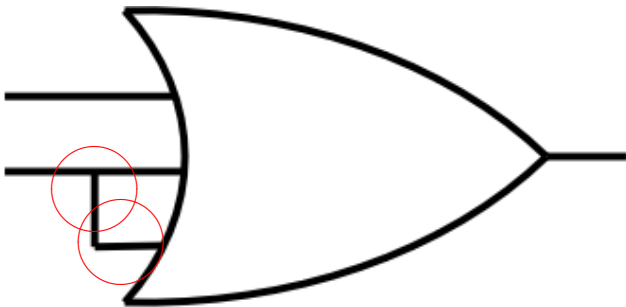
Here is a gate with an extra input.



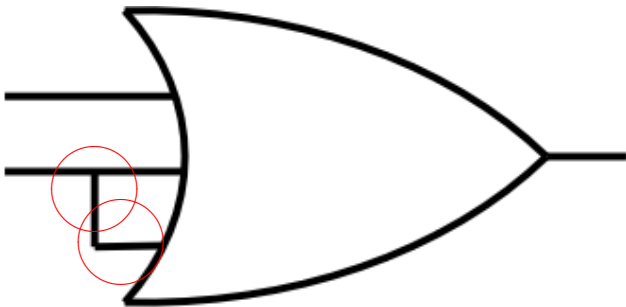
Here is a gate with an extra input.



It has been tied to one of the other inputs.



Whether the gate is an AND or an OR, two inputs tied together will be the same as a single input.



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$$A \times A \equiv A; \quad A + A \equiv A$$