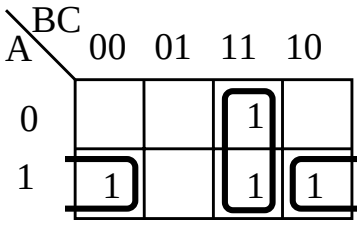
EGR 270
Fundamentals of Computer Engineering
File: Hazards1

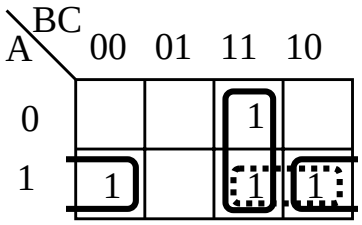
PSPICE Example: Correcting a Static-1 Hazard

A minimal Sum of Products (SOP) expression of the function F(A,B,C) = Σ(3,4,6,7) can be found using a Karnaugh map as follows:



The resulting expression is: F(A,B,C) = AB' + BC (minimal SOP)

One problem with the implementation above is that the circuit has a static-1 hazard. In particular, the output should remain logic 1 as the input changes from input minterm 7 to minterm 6, but it actually goes briefly low. This problem can be corrected by adding a "consensus term". Minterm 6 is covered by the product term AC' and minterm 7 is covered by the product term BC. The term AC' has additional propagation delay since C is inverted, resulting in a "glitch" in the output. The consensus term AB overlaps the other two product terms and eliminates the glitch. The new Karnaugh map is shown below:



The resulting expression is: F(A,B,C) = AB' + BC + AB (static-1 hazard eliminated)

The example above is implemented on the following pages using PSPICE where a timing diagram is used to reveal the glitch in the original circuit and to show that the glitch has been removed in the modified circuit.

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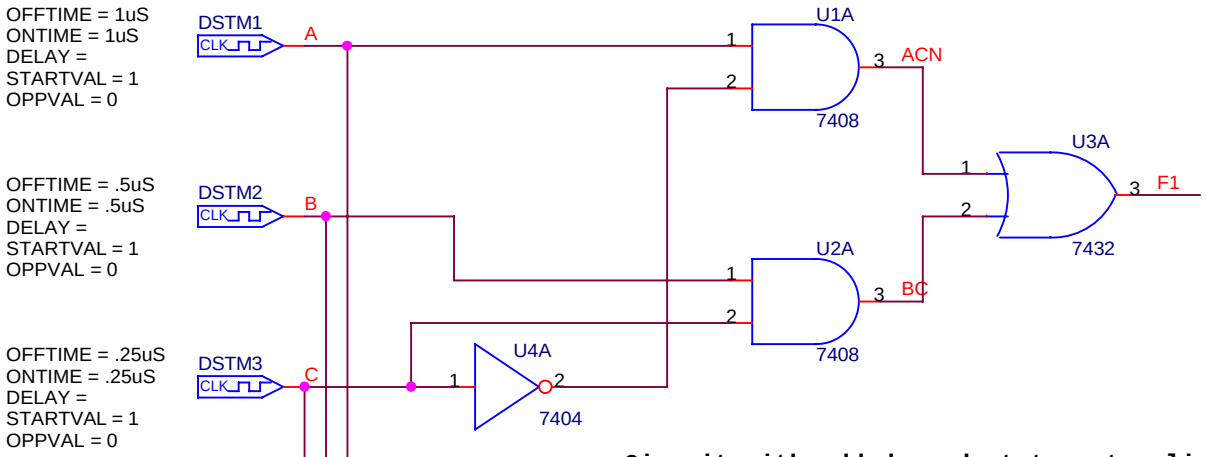
Circuit with Static 1 Hazard

F(A,B,C) = Sum(3,4,6,7)

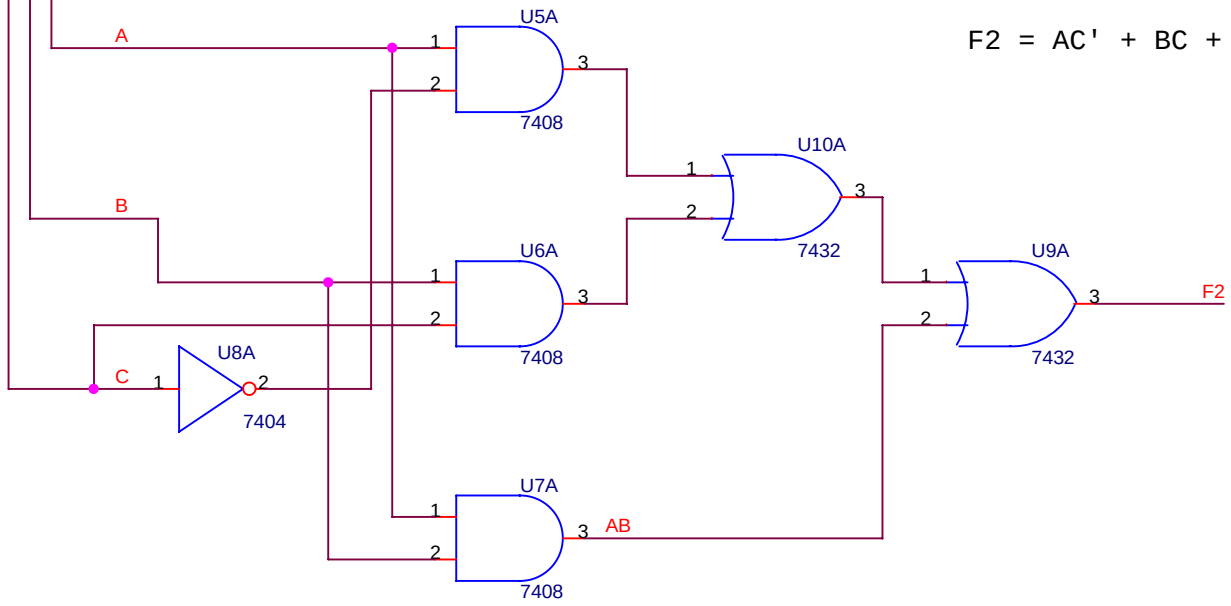
F1 = AC' + BC

(minimal SOP implementation)



Circuit with added product term to eliminate Static 1 Hazard

F2 = AC' + BC + AB



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