Universal Gates: NOR Only Logic Design

In this activity you will design a circuit that will have four inputs A, B, C and D. This four inputs will represent integers 0 to 15. This circuit will generate an output signal F, that is true if the input represents a prime number and is false otherwise. A prime number is defined as a number that can be divided only by itself and 1. By definition, the numbers 0 and 1 are not prime.

Procedure

1. Draw a truth table to represent this problem

2. Write down a Boolean equation for F directly from the minterms of the truth table

3. Derive a simplified expression for F using Boolean algebra/Kmap

4. Draw a logic circuit to implement your solution using AND, OR and NOT
    gates

5. Draw a logic circuit to implement your solution using NOR gates only

6. Build and test the two logic circuits that you designed. Verify that the circuits are working as expected.

Conclusion

1. For your AOI implementations, how many ICs (i.e., 74LS04, 74LS08, and 74LS32 chips) were required to implement your circuits? Note: You're not just counting the number of gates used, but rather, the number of IC, in whole or part, that were required.

2. For your NOR implementations, how many ICs (i.e., 74LS00 chips) were required to implement your circuits? Again, we are counting ICs, not gates.

3. In terms of hardware efficiency, how does the NOR implementation compare to the AOI implementation?