CSCE 312 Lab 3

Kevin Lei

February 25, 2024

Problem 1

Here we implement a D flip-flop from scratch using only NAND gates. The D flip-flop uses two D latches, which are implemented as follows:

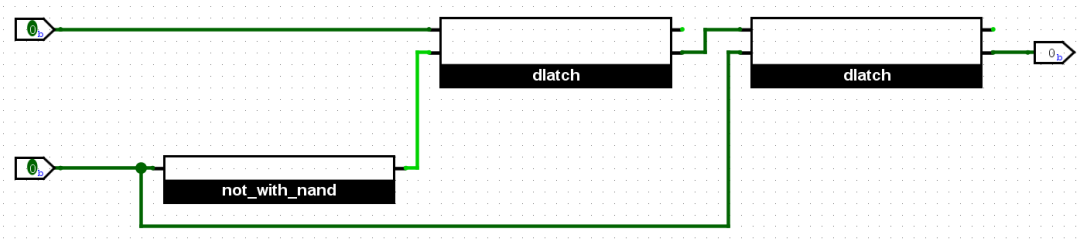

Figure 1: D Flip-Flop

The D latches are implemented as follows:

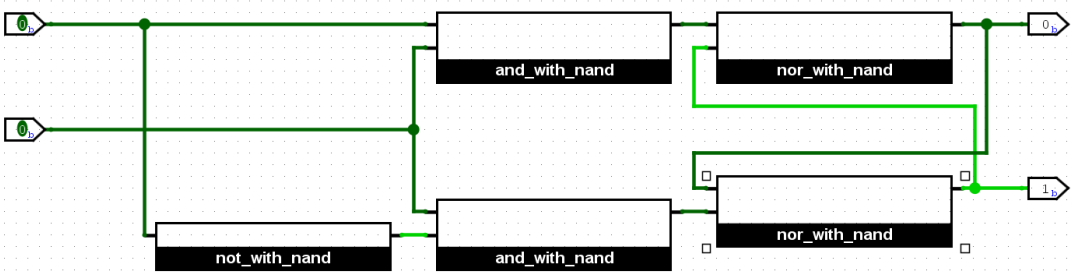

Figure 2: D Latch

The NOR, NOT, and AND gates are implemented as follows:

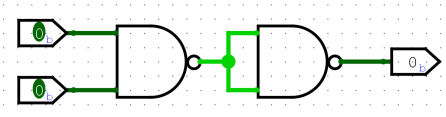

Figure 3: AND Gate

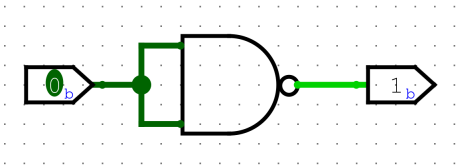

Figure 4: NOT Gate

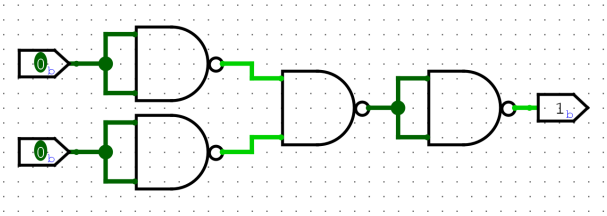

Figure 5: NOR Gate

Problem 2

Part A

Electromechanical switches can be described by their number of poles and throws. A pole is a common connection in a switch, and a throw is the number of positions the pole can connect to. Therefore, a single-pole, single-throw (SPST) switch has one pole and one throw, which means it is just a simple on-off switch that connects or disconnects a single circuit. The term NO means normally open, and it is used to describe the throw of a switch when it is not actuated (open means that the circuit is not connected).

Part B

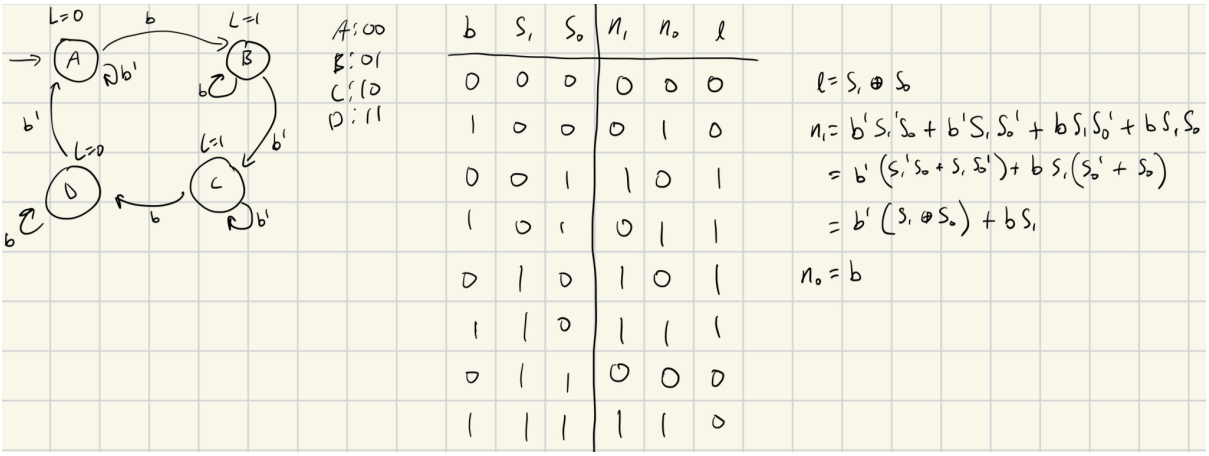

Figure 6: FSM, Truth Table, and boolean expressions for the circuit

Part C

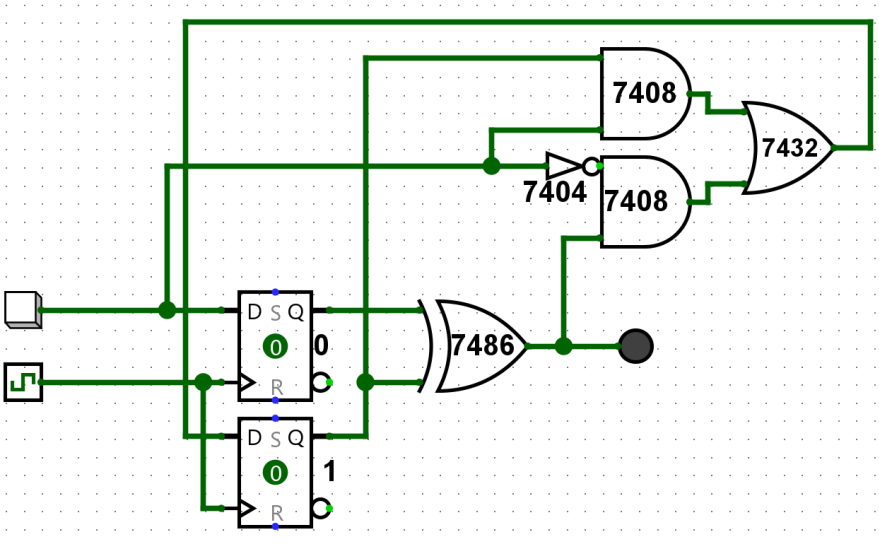

Figure 7: Overall circuit with 74xx series equivalents

Problem 3

Part A

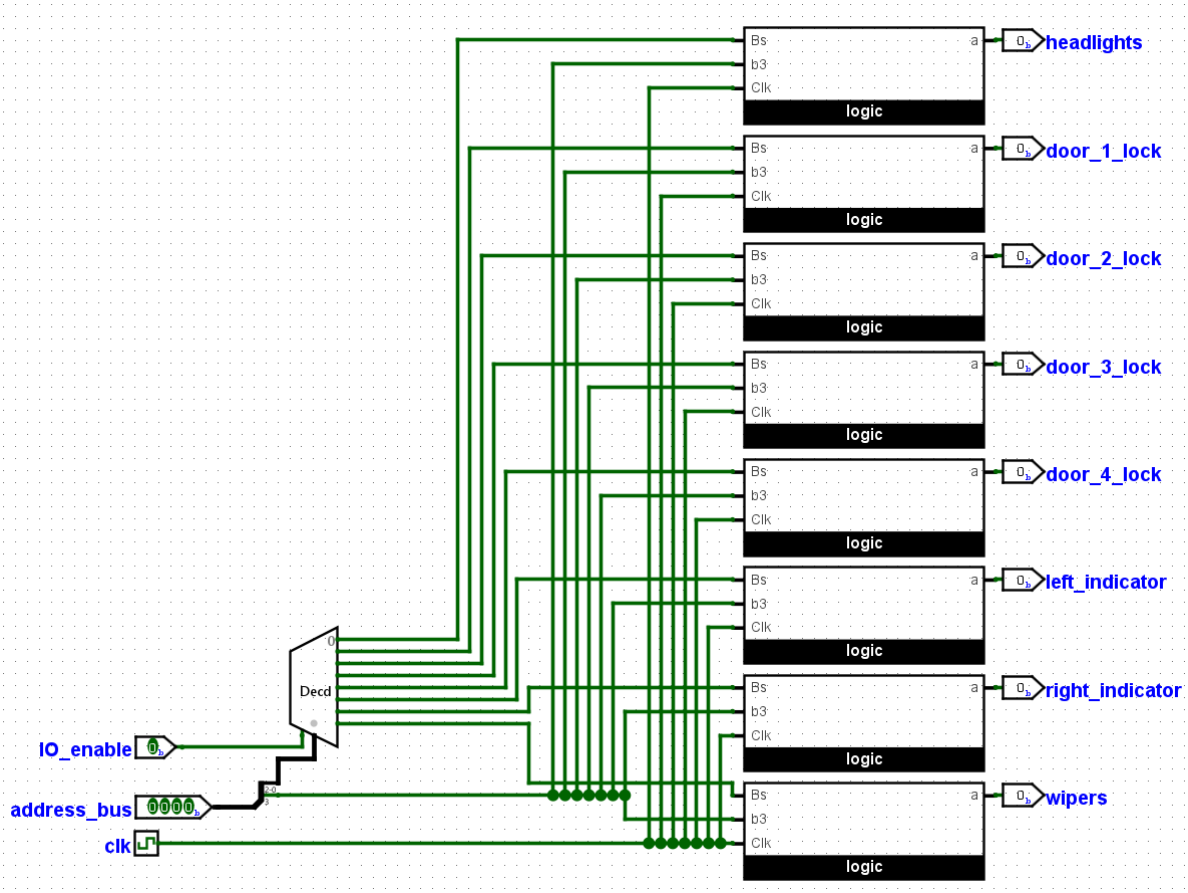

Figure 8: Overall design of the circuit

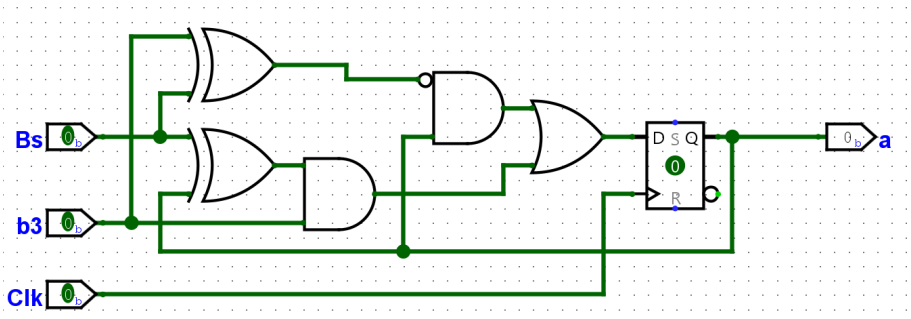

Figure 9: Logic implementation

Part B

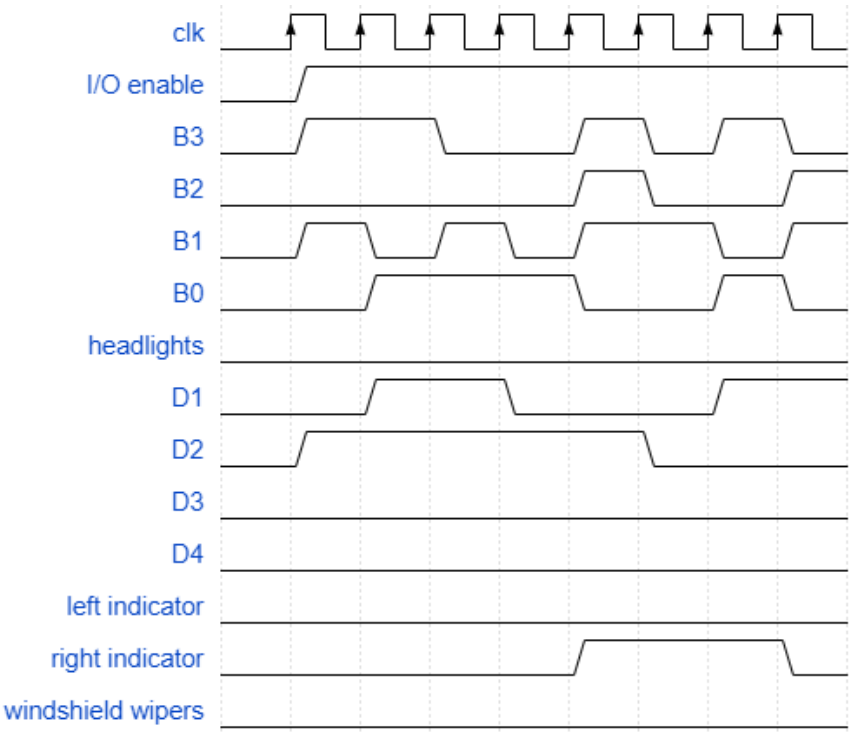

Figure 10: Timing diagram