Digital Electronics

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1 NAND Circuit

We created a NAND gate using the instructions given in the lab manual. This was pretty straightforward, as long as you know which condition represents a logical 1 and logical 0. In our case, a logical 1 was represented by a closed switch and a logical 0 by an open switch for the input. For the output the logical 1 was set to 5V, or the LED in the circuit being turned on, and the logical 0 was set to the reference potential or the LED turned off.

2 Stability of IC-Chip

In this part of the lab, we created a simple logic circuit using an integrated circuit consisting of 4 NAND gates, using the blueprints given in the lab manual. Here we learned, that the power for the IC's should always be connected to a separate 5 V supply in order to ensure the chips stability. We measured that the circuit began to malfunction for an input voltage less than 2.5V and that the integrated chip started to malfunction for a supply voltage less than 1.5V.

3 Half-adder

When looking at the truth table for a half adder, as seen below, it is easy to see that it is comprised of an OR-gate for A and an AND-gate for OF.

E1	E2	A	OF
0	0	0	0
0	1	1	0
1	0	1	0
1	1	1	1

So we created a circuit combining the two to make our half-adder.

4 SR-Latch

After we made the SR-latch as given to us in the lab manual, we noticed that it works well, but not perfectly. If we set both inputs to logic 1, then both Q1 and $\overline{Q1}$ will both be set to logic 1, which contradicts the fact that they are supposed to be opposites. This however is fixed by introducing the D-flipflop, which we did in order to create the pseudo-number generator.

5 Pseudo-random number generator

For the pseudo-random number generator we first built the circuit without the D-Flipflop to verify that the circuit with only the counter worked as intended. After that we added the D-Flipflop and after some debugging everything worked.

This circuit is only considered to be *pseudo*-random, because theoretically one could count very fast, along the counter, to always know what number is going to show up. As we humans can't do that, we still consider it to be *random*.