Lab 1: Digital Logic Circuits

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Method

We took turns in writing code and helped each other along with design, truth tables and error fixing. We followed the instructions given in the lab preparation before trying the tasks.

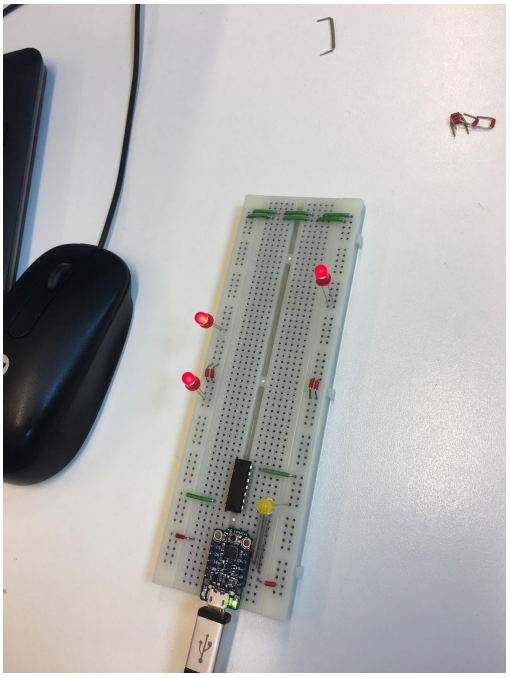
Materials

The Following materials were used in the following tasks.

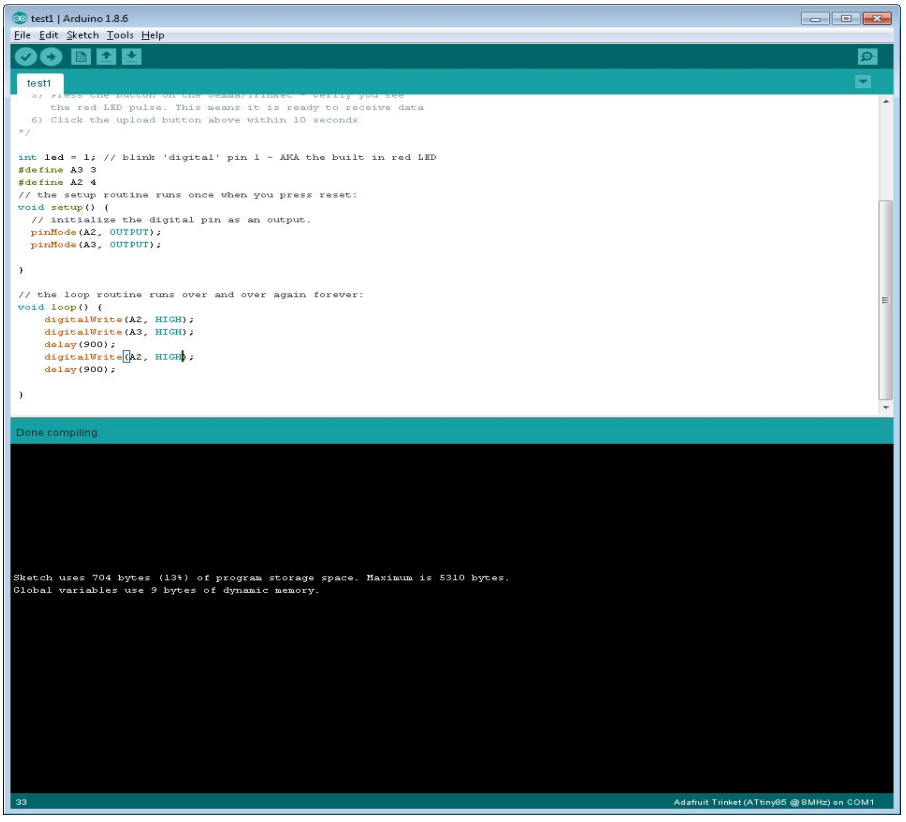
- A solderless breadboard.
- An Adafruit Trinket microcontroller board.
- Wiring kit.
- Micro USB cable.
- LED set.
- 1x 7400-series (SN74ACT00) quad NAND gate arrays.
- 1x 7402-series (SN74HCT02) quad NOR gate arrays.

Task 1:

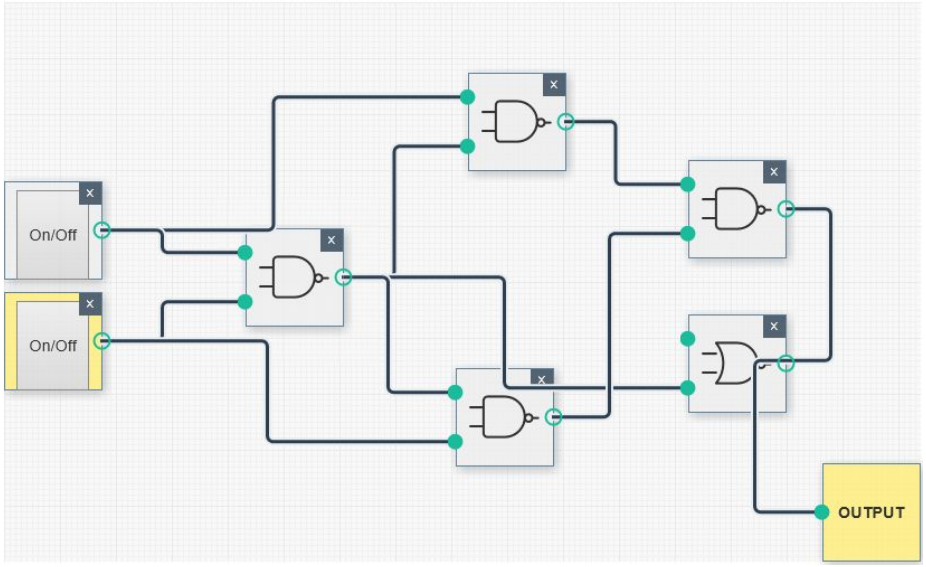
First off, we followed figure 1(a) to set up our bredboard which was successful since the LED was powered. Thereafter the steps for acquiring a similar setup to the one in figure 1(b) was done.



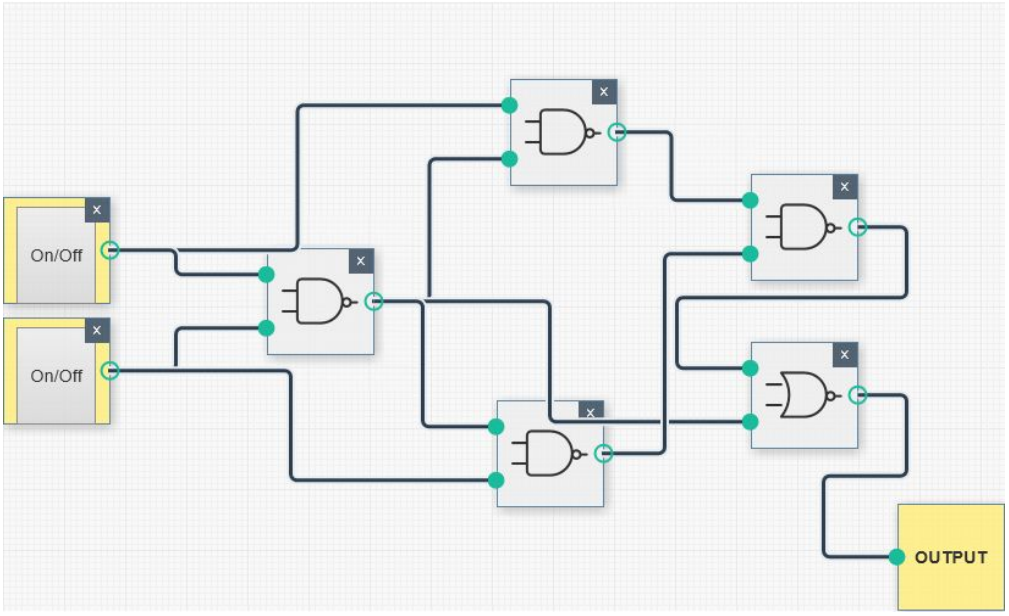
In order to verify that the NAND gate works as expected we had to follow the truth table for NAND. When A2 and A3 are both HIGH(1 and 1) then the truth table tells us that the output should be LOW(0) which was the only way we could ge tit not to light up. As the picture of the bredboard above shows, the yellow light is not powered which verifies that the NAND gate works properly. We also tried with low and high A2(1) and A3(0) and got the yellow light working.



Task 2:

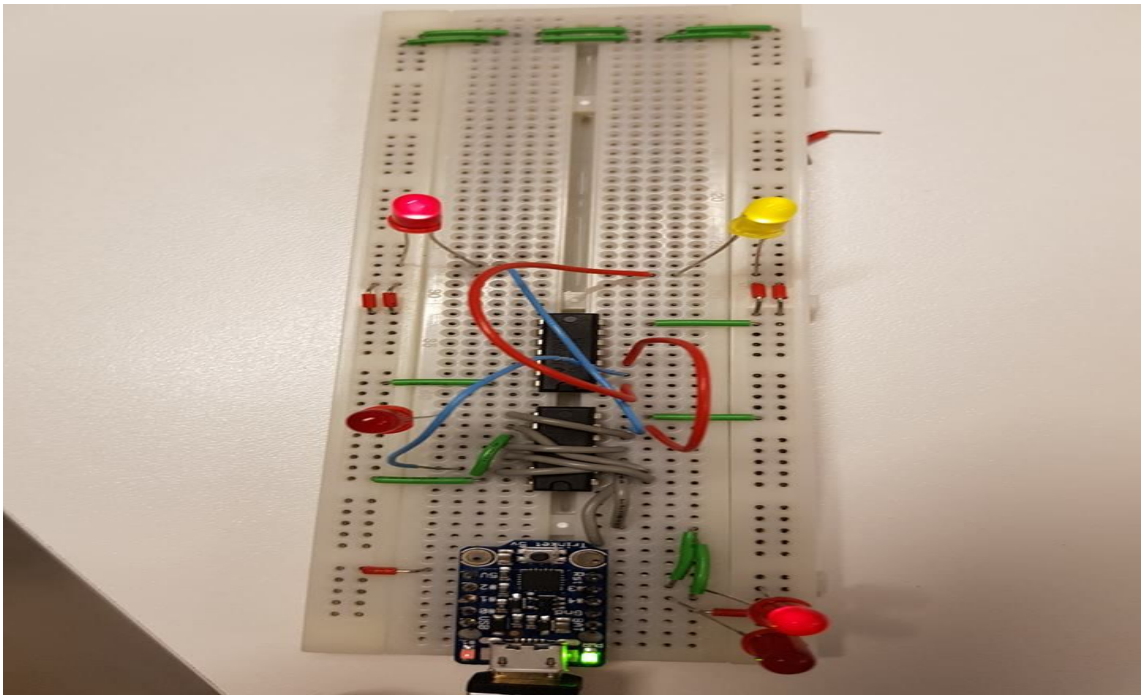


In this task we built the circuit using 4 NAND-gates and one NOR gate. This circuit will generate an output of 00/0, 01/1,10/1,11/0 for sum and 00/0, 01/0, 10/0, 11/1 for the carry which is correct logically. The first figure above shows a 1 as output for any combination of 1 and 0 input.



The figure above shows the carry which is only one when the both inputs are 1.

When implementing this on the breadboard it looked like this;



It was important for us to map out the gates and corresponding input/output on the gates in breadboard according to the design which can be seen in the figure above.
In the implementation we had some problems. Sometimes we got error messages that we did not understand and sometimes the output varied.

We tried many troubleshooting methods and even got help by the lab assistant. We managed to get a correct output;
of 00/0, 01/1,10/1,11/0 for sum and 00/0, 01/0, 10/0, 11/1 for the carry. But in the picture the lights were both on due to testing and is not representative for the actual task, it is just there to demonstrate the breadboard. Because of the instabile state of the breadboard we did not have time to verify all inputs but that we the two inputs needed to vary for sum and carry needed two 1's in input to shine up the led.

For the code we only used pinmode, definition and digitalwrite and delay functions. (figure below) The true challenge in the task was getting the breadboard implementation to work. We used leds to see which outputs for sum (red led) and carry (yellow led) was given when two inputs (red leds) varied.