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Lab 1: Digital Logic Circuits

Task 1

In order to test the NAND gate, we set the output on pin 3 on the trinket to HIGH, and pin 4 to alternate between HIGH and LOW. The NAND gate should make the LED blink, which it did. Using the original sketch, provided by the document, had the LED stay HIGH at all times.

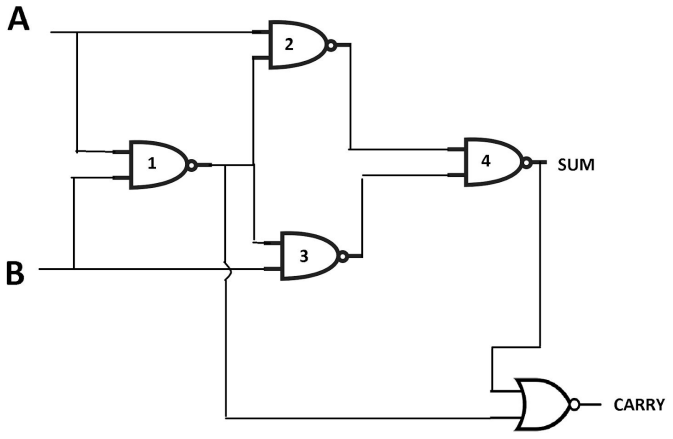
Sketch: Attachment 1

Task 2

To build the half-adder with 4 NAND gates and 1 NOR gate we needed to recalculate the logic circuit from the XOR/AND circuit in the lab instructions. An XOR gate can be constructed with 4 NAND gates, so that is where we started. The hard part was to figure out where to put the NOR gate to make it output a carry bit when there should be one. What we did to solve this problem was to make a drawing of the four NAND gates connected, and make a note of what output each gate gave with all the different inputs. We wanted the NOR gate to output a 1 only when both A and B were 1, and using the notes we took it was easy to find where to put the two input pins of the NOR gate. We found that the NOR gate should be supplied by NAND #4 and NAND #1. Once we had done this it was transferred onto the breadboard and a sketch was made in Arduino Genuino IDE. In the sketch we made a loop which iterated through the possible combinations of A and B. On the breadboard we implemented the SUM output and the CARRY output with a yellow respectively red LED. We later added a LED for both A and B to easily see what the input to the circuit was.

Sketch: Attachment 2

A	B	SUM	CARRY
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1



Appendix

1 - Sketch for task 1

```
int led = 1; // blink 'digital' pin 1 - AKA the built in red LED

// the setup routine runs once when you press reset:
void setup() {
    // initialize the digital pin as an output.
   pinMode(led, OUTPUT);

}

// the loop routine runs over and over again forever:
void loop() {
   digitalWrite(led, HIGH);
   delay(1000);
   digitalWrite(led, LOW);
   delay(1000);
}
```

2 - Sketch for task 2

```
void setup() {

}

void loop() {
        digitalWrite(A3, LOW);
        digitalWrite(A2, LOW);
        delay(1500);

        //digitalWrite(A3, LOW);
        digitalWrite(A2, HIGH);
        delay(1500);

        digitalWrite(A3, HIGH);
        digitalWrite(A2, LOW);
        delay(1500);

        //digitalWrite(A3, HIGH);
        digitalWrite(A2, HIGH);
   delay(1500);
}
```