

**ME 133 Winter 2023**  
**Lab 4: *Binary Converter and TTL Logic***  
Feb 9, 2023  
Due: 2/17/2023

Submit a zip file named yourFirstName-Lab1.zip on Canvas with your code, a lab report (following the format in syllabus), and a short video proving the working hardware-software integration.

### **Exercise 1**

#### **Assignment**

Code a base converter, from base 10 to base 2.

The hardware setup is the following. Attach four LEDs to your Arduino. Each LED will represent one bit: LED OFF = "0" and LED ON = "1". When you send an integer (between 0 and 15) to the Arduino through your keyboard, converts it from base 10 to base 2 and displays it through the LEDs. For example, if you send 3, then the LEDs will show the following pattern: OFF-OFF-ON-ON.

Write a function that takes an integer as input, checks whether it is in the allowed bound, computes the conversion in base two, and finally turns the appropriate LEDs on.

Similarly to many other programming languages, with Arduino you can use / for the division operation and % for the remainder operation. See: <https://www.arduino.cc/reference/en/language/structure/arithmetic-operators/remainder/>

To send data from the keyboard you can use the serial communication channel. Here is an example:

```
String input;
void setup() { Serial.begin(9600); }
void loop() {
    if(Serial.available()) {
        input = Serial.readStringUntil("\n");
        int intInput= input.toInt();
        Serial.print("You typed: " );
        Serial.println(intInput);
    }
}
```

### **Exercise 2**

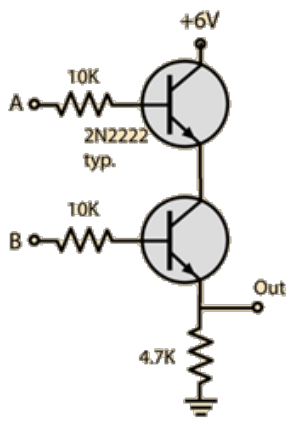
#### **Assignment**

Create two separate circuits, an OR and an AND gates using TTL logic (or something fairly similar). You do not need to program anything for this. Use two buttons to set A and B to either 0 or 5 V. To show the value of  $V_{out}$  use an LED.

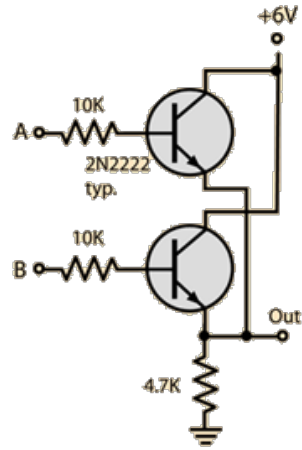
You can use the 5V supplied by the Arduino in place of the 6V in the figures. You can also use the equivalent of a 4 K resistor instead of 4.7 K.

Don't forget: use a pull-down network for the button, like the one shown below. Also put a 330 Ohm resistor in series with the LED on the Out port.

I will give particular attention to the circuit schematic (a picture is NOT a circuit schematic). Include the truth tables for the circuits.



(a) AND gate



(b) OR gate

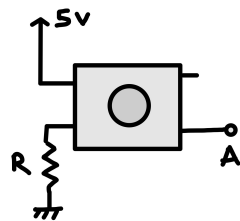


Figure 2: Pull-down network