



**PAMANTASAN NG LUNGSOD NG MAYNILA**  
(University of the City of Manila)  
Intramuros, Manila

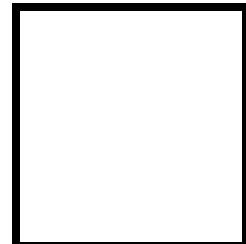
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## **Microprocessor Lab**

Laboratory Activity No. 3

### **Binary Representation of 8 LEDs in Tinkercad and Arduino Programming**



Score

*Submitted by:*

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<Saturday | 01:00 PM – 07:00 PM> / <CPE 0412.1 – 2 >

*Date Submitted*

**14-10-2023**

*Submitted to:*

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## I. Objectives

This laboratory activity aims to create Arduino circuit of Binary representation (decimal 0-256 using 8 LEDs):

- creating an Arduino programming and circuit diagram.

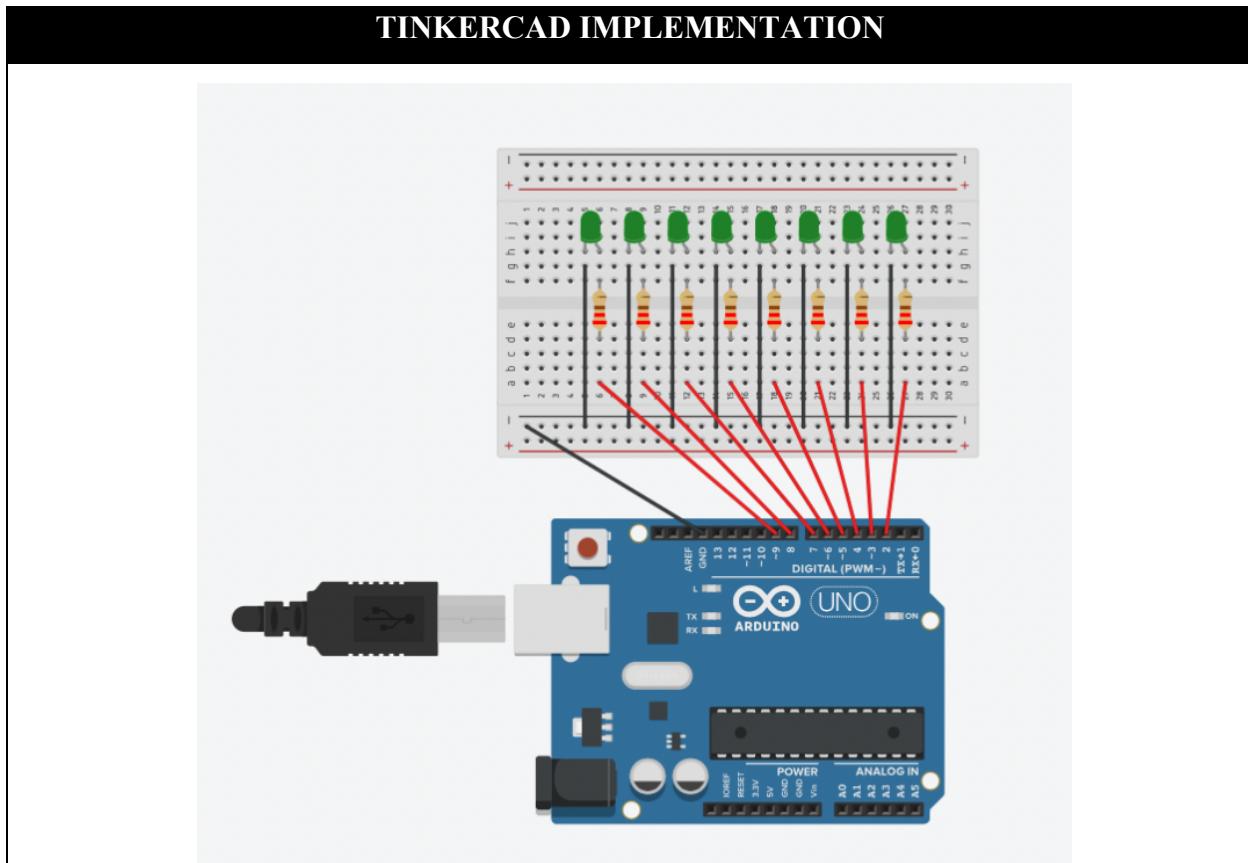
## II. Method/s

- Perform a task problem given in the presentation.
- Write a code and perform an Arduino circuit diagram of a ring counter that display eight (8) LEDs starting from left.

## III. Results

### Components Used

1. 8 LEDs
2. Resistor
3. Breadboard



**Fig. 1 Binary Representation of 8 LEDs Circuit Diagram**

TINKERCAD LINK: [Microprocessor Lab Page 2](https://www.tinkercad.com/things/aWxSVSMUc5J-arduino-circuit-of-binary-representation>Editel?sharecode=follOXwwCsqW_XgvfUT05NrhPdQe_hgjO1gmLl4QZyg</a></p></div><div data-bbox=)

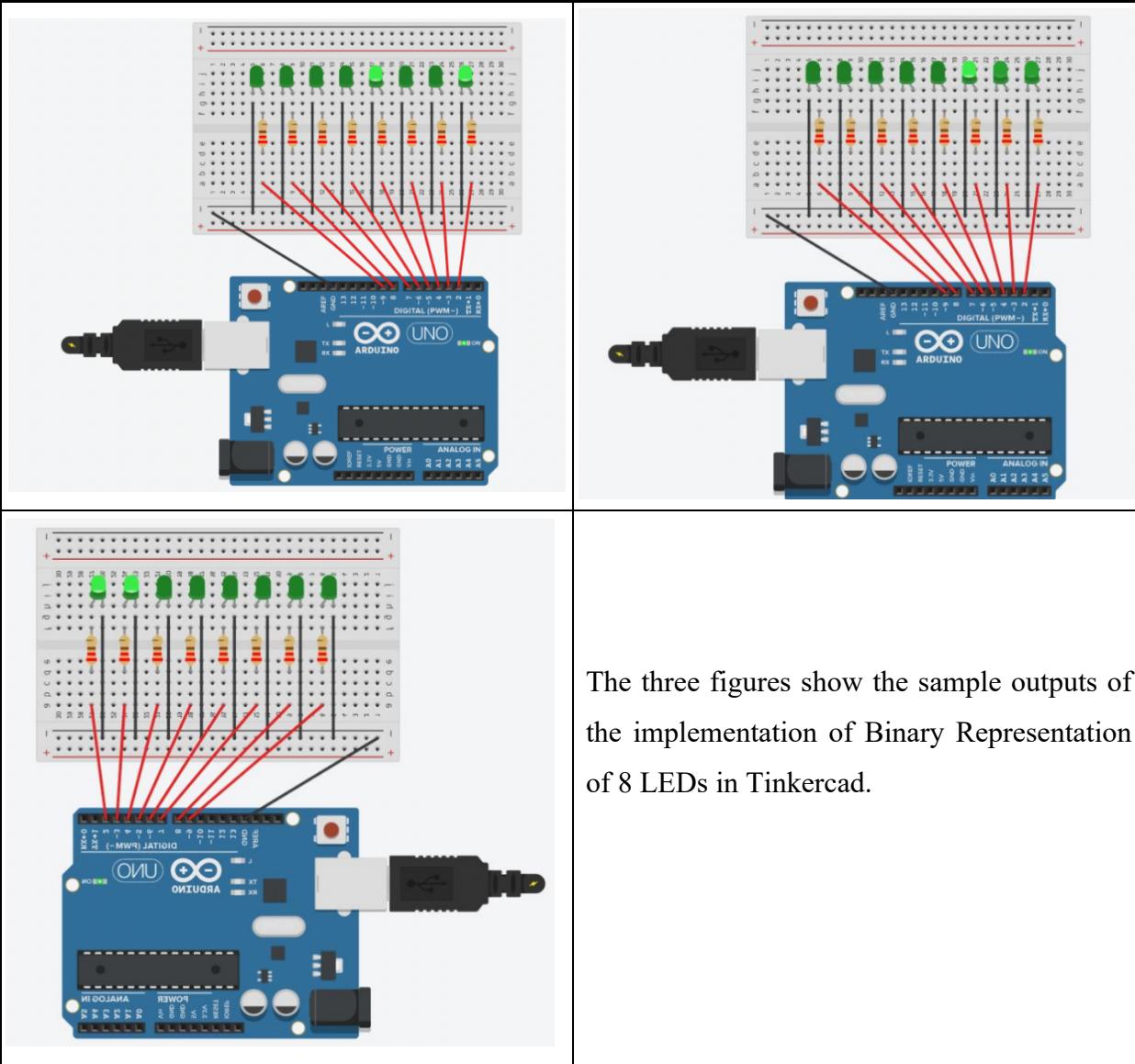
```

1 // LED Pin Variables
2 int ledPins[] = {2, 3, 4, 5, 6, 7, 8, 9};
3
4 void setup() {
5     // Set all LED pins to output mode
6     for (int i = 0; i < 8; i++) {
7         pinMode(ledPins[i], OUTPUT);
8     }
9
10    // Initialize serial communication
11    Serial.begin(9600);
12 }
13
14 void loop() {
15     // Count from 0 to 256
16     for (int i = 0; i <= 256; i++) {
17         /*Convert the decimal number to binary and display it on the LEDs
18         This function takes an integer n as input and converts it to binary.
19         It works by repeatedly dividing n by 2 and storing the remainder in an array.
20         The binary representation is then printed by iterating over the array in reverse order.*/
21         decToBinary(i);
22
23         // Display the generated number and the binary sequence on the serial monitor
24         Serial.print("Decimal: ");
25         Serial.print(i);
26         Serial.print(" Binary: ");
27         for (int j = 7; j >= 0; j--) {
28             Serial.print(bitRead(i, j));
29         }
30         Serial.println();
31         delay(10); // Wait for a short period before moving on to the next number
32     }
33 }

```

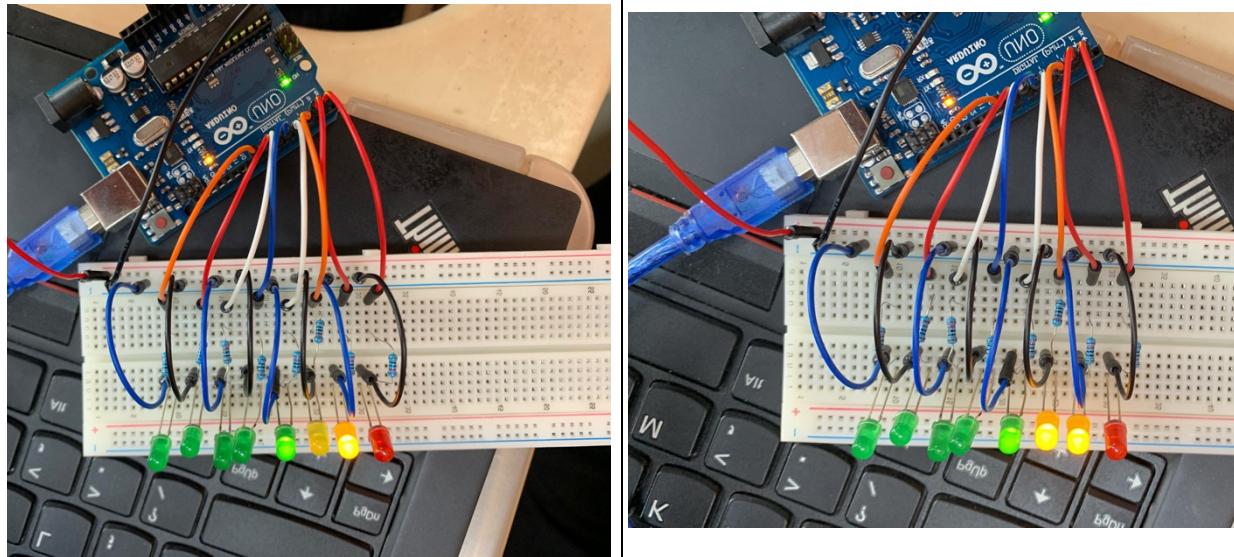
**Fig 2. Code of Binary Representation of 8 LEDs**

### SAMPLE OUTPUTS



The three figures show the sample outputs of the implementation of Binary Representation of 8 LEDs in Tinkercad.

## ACTUAL IMPLEMENTATION



Both figures above show the sample output of the actual implementation of Binary to Decimal using 8 LEDs. For the decimal 0 value, the converted Binary value is 00000000. As observed, all of the LEDs in the circuit are of LOW or OFF. For the decimal 1 value, the converted Binary value is 00000001. As observed, only the first LED is HIGH or ON and the rest of the LEDs in the circuit are LOW or OFF. The process will continue until the conversion is satisfied up until the decimal value of 255.

## IV. Conclusion

To convert a decimal number to binary, you can use the `decToBinary` function. This function takes an integer `n` as input and converts it to binary. It works by repeatedly dividing `n` by 2 and storing the remainder in an array. The binary representation is then printed by iterating over the array in reverse order. In the `setup` function, this is where we set the digital pins connected to the LEDs as output pins using the `pinMode` function. A function in Arduino which is “`decNumber`” is utilized in this laboratory that takes an integer as input and converts it to binary. It works by iterating over each bit of the input number using a for loop and checking if the bit is 1 or 0 using the `bitRead` function. If the bit is 1, the corresponding LED pin is set to HIGH using the `digitalWrite` function. If the bit is 0, the corresponding LED pin is set to LOW. This function assumes that there are 8 LED pins connected to the Arduino, and that their pin numbers are stored in an array called `ledPins`.

The code for `(int j = 7; j >= 0; j--)` is a for loop in C++ that is used in this laboratory to have a shorter approach code that initializes an integer variable `j` to 7, decrements it by 1 each time the loop runs, and continues running the loop as long as `j` is greater than or equal to 0. This loop will run 8 times, with `j` taking on the values 7, 6, 5, 4, 3, 2, 1, and 0. This type of loop is commonly used to traverse an array or perform a task a fixed number of times. The code inside the loop will execute once for each value of `j`. With this, as we run the code, it will satisfy the binary representation of decimal 0 to 255.

## References

- [1] D.J.D. Sayo. "University of the City of Manila Computer Engineering Department Honor Code," PLM-CpE Departmental Policies, 2020.
- [2] "Arduino 8 bit binary led counter," Arduino 8 bit Binary LED Counter, <https://fritzing.org/projects/arduino-8-bit-binary-led-counter> (accessed Oct. 14, 2023).
- [3] All About Circuits. (n.d.). Ring Counters. All About Circuits. <https://www.allaboutcircuits.com/textbook/digital/chpt-12/ring-counters/>
- [4] ElectroSchematics. (n.d.). Arduino 8-Bit Binary LED. ElectroSchematics. <https://www.electroschematics.com/arduino-8-bit-binary-led/>
- [5] Electronics Course. (n.d.). Ring Counter. Electronics Course. <https://electronicscourse.com/ring-counter>
- [6] S. Rao. "Johnson Ring Counter with 74LS164," 2012