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

Microprocessor Lab

Laboratory Activity No. 3

Binary Representation of 8 LEDs

in TinkerCad and Arduino Programming

Score

Submitted by:

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Sat 1:00 PM – 4:00 PM / CPE-412.1-2

Date Submitted

14-10-2023

Submitted to:

Engr. Maria Rizette H. Sayo

I. Objectives

This laboratory activity aims to implement the principles and techniques of hardware programming using Arduino through:

- create Arduino circuit of Binary representation (decimal 0-256 using 8 LEDs)

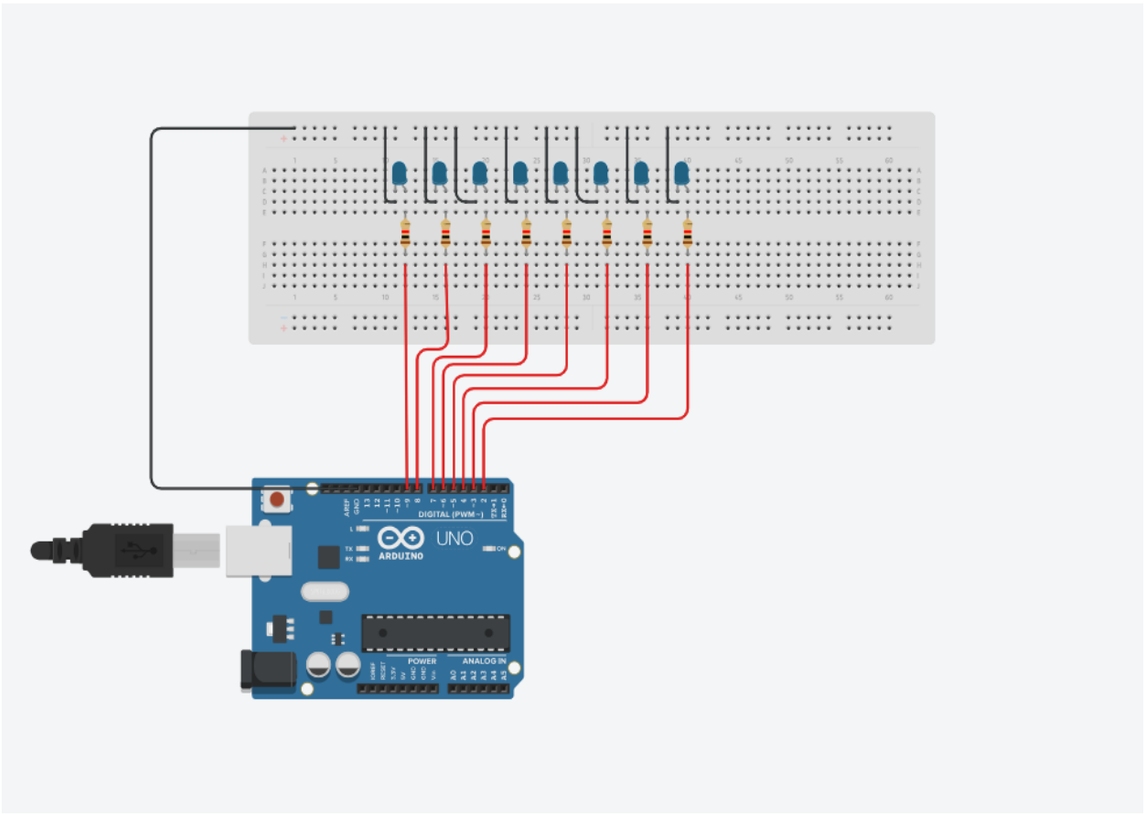
II. Method/s

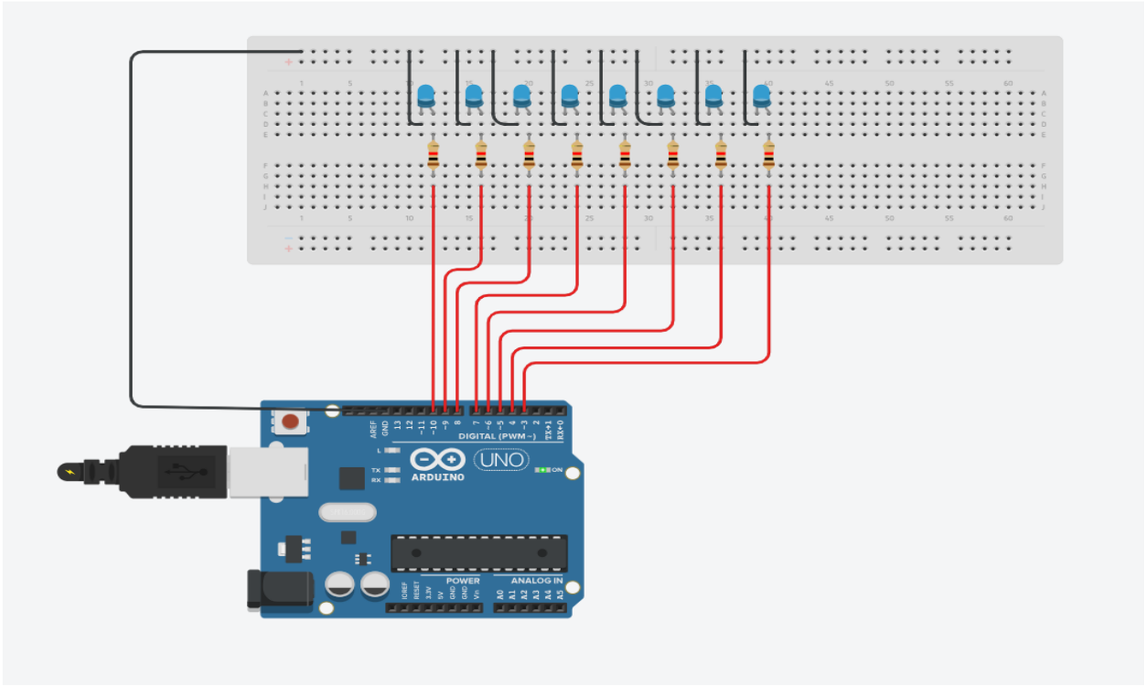
- Perform a task problem given in the presentation.
- Write your own code and perform an Arduino circuit diagram of a Binary counter that represents decimal 0-256 using 8 LEDs.
- Show in the output the Binary to Decimal Conversion

III. Results

TINKERCAD SIMULATION:

(Figures: Binary Counter using 8 LEDs)





CODE:

```
// C++ code
// Binary Representation of 8 LEDs in TinkerCad and Arduino Programming


const int ledPins[] = {3, 4, 5, 6, 7, 8, 9,10 };

int byteValue = 0;

void setup() {

  for (int l = 0; l < 8; l++) {
    pinMode(ledPins[l], OUTPUT);

  }
  Serial.begin(9600);
}


void loop() {

  // To display the binary value on the LEDs

  for (int l = 0; l < 8; l++) {
    int bit = (byteValue >> l) & 1 ;
    digitalWrite(ledPins[l], bit);
  }


  Serial.print("BinConvert: ");
  Serial.print(byteValue, BIN);
  Serial.print(" Decimal No.: ");
  Serial.println(byteValue);


  byteValue++;
```

```
    while (byteValue > 256) {

   // Code to be executed in the loop
    byteValue = byteValue++;
  }


  delay(1000); // Wait for one second before incrementing
}
```

BINARY – DECIMAL CONVERSION

```
BinConvert: 0 Decimal No.: 0
BinConvert: 1 Decimal No.: 1
BinConvert: 10 Decimal No.: 2
BinConvert: 11 Decimal No.: 3
BinConvert: 100 Decimal No.: 4
BinConvert: 101 Decimal No.: 5
BinConvert: 110 Decimal No.: 6
BinConvert: 111 Decimal No.: 7
BinConvert: 1000 Decimal No.: 8
BinConvert: 1001 Decimal No.: 9
BinConvert: 1010 Decimal No.: 10
BinConvert: 1011 Decimal No.: 11
BinConvert: 1100 Decimal No.: 12
BinConvert: 1101 Decimal No.: 13
BinConvert: 1110 Decimal No.: 14
BinConvert: 1111 Decimal No.: 15
BinConvert: 10000 Decimal No.: 16
BinConvert: 10001 Decimal No.: 17
BinConvert: 10010 Decimal No.: 18
BinConvert: 10011 Decimal No.: 19
BinConvert: 10100 Decimal No.: 20
BinConvert: 10101 Decimal No.: 21
BinConvert: 10110 Decimal No.: 22
BinConvert: 10111 Decimal No.: 23
BinConvert: 11000 Decimal No.: 24
BinConvert: 11001 Decimal No.: 25
BinConvert: 11010 Decimal No.: 26
```

```
BinConvert: 11011 Decimal No.: 27
BinConvert: 11100 Decimal No.: 28
BinConvert: 11101 Decimal No.: 29
BinConvert: 11110 Decimal No.: 30
BinConvert: 11111 Decimal No.: 31
BinConvert: 100000 Decimal No.: 32
BinConvert: 100001 Decimal No.: 33
BinConvert: 100010 Decimal No.: 34
BinConvert: 100011 Decimal No.: 35
BinConvert: 100100 Decimal No.: 36
BinConvert: 100101 Decimal No.: 37
BinConvert: 100110 Decimal No.: 38
BinConvert: 100111 Decimal No.: 39
BinConvert: 101000 Decimal No.: 40
BinConvert: 101001 Decimal No.: 41
BinConvert: 101010 Decimal No.: 42
BinConvert: 101011 Decimal No.: 43
BinConvert: 101100 Decimal No.: 44
BinConvert: 101101 Decimal No.: 45
BinConvert: 101110 Decimal No.: 46
BinConvert: 101111 Decimal No.: 47
BinConvert: 110000 Decimal No.: 48
BinConvert: 110001 Decimal No.: 49
BinConvert: 110010 Decimal No.: 50
BinConvert: 110011 Decimal No.: 51
```

```
BinConvert: 110100 Decimal No.: 52
BinConvert: 110101 Decimal No.: 53
BinConvert: 110110 Decimal No.: 54
BinConvert: 110111 Decimal No.: 55
BinConvert: 111000 Decimal No.: 56
BinConvert: 111001 Decimal No.: 57
BinConvert: 111010 Decimal No.: 58
BinConvert: 111011 Decimal No.: 59
BinConvert: 111100 Decimal No.: 60
BinConvert: 111101 Decimal No.: 61
BinConvert: 111110 Decimal No.: 62
BinConvert: 111111 Decimal No.: 63
BinConvert: 1000000 Decimal No.: 64
BinConvert: 1000001 Decimal No.: 65
BinConvert: 1000010 Decimal No.: 66
BinConvert: 1000011 Decimal No.: 67
BinConvert: 1000100 Decimal No.: 68
BinConvert: 1000101 Decimal No.: 69
BinConvert: 1000110 Decimal No.: 70
BinConvert: 1000111 Decimal No.: 71
BinConvert: 1001000 Decimal No.: 72
BinConvert: 1001001 Decimal No.: 73
BinConvert: 1001010 Decimal No.: 74
```

```
BinConvert: 1001011 Decimal No.: 75
BinConvert: 1001100 Decimal No.: 76
BinConvert: 1001101 Decimal No.: 77
BinConvert: 1001110 Decimal No.: 78
BinConvert: 1001111 Decimal No.: 79
BinConvert: 1010000 Decimal No.: 80
BinConvert: 1010001 Decimal No.: 81
BinConvert: 1010010 Decimal No.: 82
BinConvert: 1010011 Decimal No.: 83
BinConvert: 1010100 Decimal No.: 84
BinConvert: 1010101 Decimal No.: 85
BinConvert: 1010110 Decimal No.: 86
BinConvert: 1010111 Decimal No.: 87
BinConvert: 1011000 Decimal No.: 88
BinConvert: 1011001 Decimal No.: 89
BinConvert: 1011010 Decimal No.: 90
BinConvert: 1011011 Decimal No.: 91
BinConvert: 1011100 Decimal No.: 92
BinConvert: 1011101 Decimal No.: 93
BinConvert: 1011110 Decimal No.: 94
BinConvert: 1011111 Decimal No.: 95
BinConvert: 1100000 Decimal No.: 96
BinConvert: 1100001 Decimal No.: 97
BinConvert: 1100010 Decimal No.: 98
```

```
BinConvert: 1100011 Decimal No.: 99
BinConvert: 1100100 Decimal No.: 100
BinConvert: 1100101 Decimal No.: 101
BinConvert: 1100110 Decimal No.: 102
BinConvert: 1100111 Decimal No.: 103
BinConvert: 1101000 Decimal No.: 104
BinConvert: 1101001 Decimal No.: 105
BinConvert: 1101010 Decimal No.: 106
BinConvert: 1101011 Decimal No.: 107
BinConvert: 1101100 Decimal No.: 108
BinConvert: 1101101 Decimal No.: 109
BinConvert: 1101110 Decimal No.: 110
BinConvert: 1101111 Decimal No.: 111
BinConvert: 1110000 Decimal No.: 112
BinConvert: 1110001 Decimal No.: 113
BinConvert: 1110010 Decimal No.: 114
BinConvert: 1110011 Decimal No.: 115
BinConvert: 1110100 Decimal No.: 116
BinConvert: 1110101 Decimal No.: 117
BinConvert: 1110110 Decimal No.: 118
BinConvert: 1110111 Decimal No.: 119
BinConvert: 1111000 Decimal No.: 120
BinConvert: 1111001 Decimal No.: 121
```

```
BinConvert: 1111010 Decimal No.: 122
BinConvert: 1111011 Decimal No.: 123
BinConvert: 1111100 Decimal No.: 124
BinConvert: 1111101 Decimal No.: 125
BinConvert: 1111110 Decimal No.: 126
BinConvert: 1111111 Decimal No.: 127
BinConvert: 10000000 Decimal No.: 128
BinConvert: 10000001 Decimal No.: 129
BinConvert: 10000010 Decimal No.: 130
BinConvert: 10000011 Decimal No.: 131
BinConvert: 10000100 Decimal No.: 132
BinConvert: 10000101 Decimal No.: 133
BinConvert: 10000110 Decimal No.: 134
BinConvert: 10000111 Decimal No.: 135
BinConvert: 10001000 Decimal No.: 136
BinConvert: 10001001 Decimal No.: 137
BinConvert: 10001010 Decimal No.: 138
BinConvert: 10001011 Decimal No.: 139
BinConvert: 10001100 Decimal No.: 140
BinConvert: 10001101 Decimal No.: 141
BinConvert: 10001110 Decimal No.: 142
BinConvert: 10001111 Decimal No.: 143
```

```
BinConvert: 10010000 Decimal No.: 144
BinConvert: 10010001 Decimal No.: 145
BinConvert: 10010010 Decimal No.: 146
BinConvert: 10010011 Decimal No.: 147
BinConvert: 10010100 Decimal No.: 148
BinConvert: 10010101 Decimal No.: 149
BinConvert: 10010110 Decimal No.: 150
BinConvert: 10010111 Decimal No.: 151
BinConvert: 10011000 Decimal No.: 152
BinConvert: 10011001 Decimal No.: 153
BinConvert: 10011010 Decimal No.: 154
BinConvert: 10011011 Decimal No.: 155
BinConvert: 10011100 Decimal No.: 156
BinConvert: 10011101 Decimal No.: 157
BinConvert: 10011110 Decimal No.: 158
BinConvert: 10011111 Decimal No.: 159
BinConvert: 10100000 Decimal No.: 160
BinConvert: 10100001 Decimal No.: 161
BinConvert: 10100010 Decimal No.: 162
BinConvert: 10100011 Decimal No.: 163
BinConvert: 10100100 Decimal No.: 164
```

```
BinConvert: 10100101 Decimal No.: 165
BinConvert: 10100110 Decimal No.: 166
BinConvert: 10100111 Decimal No.: 167
BinConvert: 10101000 Decimal No.: 168
BinConvert: 10101001 Decimal No.: 169
BinConvert: 10101010 Decimal No.: 170
BinConvert: 10101011 Decimal No.: 171
BinConvert: 10101100 Decimal No.: 172
BinConvert: 10101101 Decimal No.: 173
BinConvert: 10101110 Decimal No.: 174
BinConvert: 10101111 Decimal No.: 175
BinConvert: 10110000 Decimal No.: 176
BinConvert: 10110001 Decimal No.: 177
BinConvert: 10110010 Decimal No.: 178
BinConvert: 10110011 Decimal No.: 179
BinConvert: 10110100 Decimal No.: 180
BinConvert: 10110101 Decimal No.: 181
BinConvert: 10110110 Decimal No.: 182
BinConvert: 10110111 Decimal No.: 183
BinConvert: 10111000 Decimal No.: 184
BinConvert: 10111001 Decimal No.: 185
BinConvert: 10111010 Decimal No.: 186
```

```
BinConvert: 10111011 Decimal No.: 187
BinConvert: 10111100 Decimal No.: 188
BinConvert: 10111101 Decimal No.: 189
BinConvert: 10111110 Decimal No.: 190
BinConvert: 10111111 Decimal No.: 191
BinConvert: 11000000 Decimal No.: 192
BinConvert: 11000001 Decimal No.: 193
BinConvert: 11000010 Decimal No.: 194
BinConvert: 11000011 Decimal No.: 195
BinConvert: 11000100 Decimal No.: 196
BinConvert: 11000101 Decimal No.: 197
BinConvert: 11000110 Decimal No.: 198
BinConvert: 11000111 Decimal No.: 199
BinConvert: 11001000 Decimal No.: 200
BinConvert: 11001001 Decimal No.: 201
BinConvert: 11001010 Decimal No.: 202
BinConvert: 11001011 Decimal No.: 203
BinConvert: 11001100 Decimal No.: 204
BinConvert: 11001101 Decimal No.: 205
BinConvert: 11001110 Decimal No.: 206
BinConvert: 11001111 Decimal No.: 207
BinConvert: 11010000 Decimal No.: 208
```

```
BinConvert: 11010001 Decimal No.: 209
BinConvert: 11010010 Decimal No.: 210
BinConvert: 11010011 Decimal No.: 211
BinConvert: 11010100 Decimal No.: 212
BinConvert: 11010101 Decimal No.: 213
BinConvert: 11010110 Decimal No.: 214
BinConvert: 11010111 Decimal No.: 215
BinConvert: 11011000 Decimal No.: 216
BinConvert: 11011001 Decimal No.: 217
BinConvert: 11011010 Decimal No.: 218
BinConvert: 11011011 Decimal No.: 219
BinConvert: 11011100 Decimal No.: 220
BinConvert: 11011101 Decimal No.: 221
BinConvert: 11011110 Decimal No.: 222
BinConvert: 11011111 Decimal No.: 223
BinConvert: 11100000 Decimal No.: 224
BinConvert: 11100001 Decimal No.: 225
BinConvert: 11100010 Decimal No.: 226
BinConvert: 11100011 Decimal No.: 227
BinConvert: 11100100 Decimal No.: 228
BinConvert: 11100101 Decimal No.: 229
BinConvert: 11100110 Decimal No.: 230
```

```
BinConvert: 11100111 Decimal No.: 231
BinConvert: 11101000 Decimal No.: 232
BinConvert: 11101001 Decimal No.: 233
BinConvert: 11101010 Decimal No.: 234
BinConvert: 11101011 Decimal No.: 235
BinConvert: 11101100 Decimal No.: 236
BinConvert: 11101101 Decimal No.: 237
BinConvert: 11101110 Decimal No.: 238
BinConvert: 11101111 Decimal No.: 239
BinConvert: 11110000 Decimal No.: 240
BinConvert: 11110001 Decimal No.: 241
BinConvert: 11110010 Decimal No.: 242
BinConvert: 11110011 Decimal No.: 243
BinConvert: 11110100 Decimal No.: 244
BinConvert: 11110101 Decimal No.: 245
BinConvert: 11110110 Decimal No.: 246
BinConvert: 11110111 Decimal No.: 247
BinConvert: 11111000 Decimal No.: 248
BinConvert: 11111001 Decimal No.: 249
BinConvert: 11111010 Decimal No.: 250
BinConvert: 11111011 Decimal No.: 251
BinConvert: 11111100 Decimal No.: 252
```

```
BinConvert: 11111101 Decimal No.: 253
BinConvert: 11111110 Decimal No.: 254
BinConvert: 11111111 Decimal No.: 255
BinConvert: 100000000 Decimal No.: 256
```

IV. Conclusion

First and foremost, Circuits known as binary counters produce binary sequences that are related to the quantity of clock signal pulses delivered to the input. Regarding this, it is a common practice to divide a decimal value by 2 and set the remainder aside when converting it to binary. Binary values can be created by continually dividing decimal numbers by two and noting the outcome. As a result, understanding binary to decimal conversion is crucial for computer programming. Humans can readily grasp the decimal number system, which has all ten digits, whereas machines can only understand the binary number system, which only has the values 0 and 1.

On the other hand, by doing this laboratory activity, I acquired some knowledge on understanding binary that helps to unravel the mystery of computers as I begin to understand the representation of binary digits on and off. Overall, creating our own design and codes on Tinkercad can be quite difficult but with the help of different viable resources, I've managed to finish the given tasks.

References:

[1] D.J.D. Sayo. “University of the City of Manila Computer Engineering Department Honor Code,” PLM-CpE Departmental Policies, 2020.

[2] “Arduino Binary (8-bit) LED’s counter.,” *www.youtube.com*. https://www.youtube.com/watch?v=HYOsJhSR9S8 (accessed Oct. 14, 2023).

[3] “Connecting an Arduino to a Breadboard to light up LEDs using Tinkercad,” *CodeProject*, Jun. 05, 2018. https://www.codeproject.com/Articles/1247033/Connecting-an-Arduino-to-a-Breadboard-to-light-up (accessed Oct. 14, 2023).

[4] “Let’s create 8-bit LED binary counter,” *GuyWithTech*, Mar. 28, 2017. https://guywithtech.wordpress.com/2017/03/28/lets-create-8-bit-led-binary-counter/ (accessed Oct. 14, 2023).