

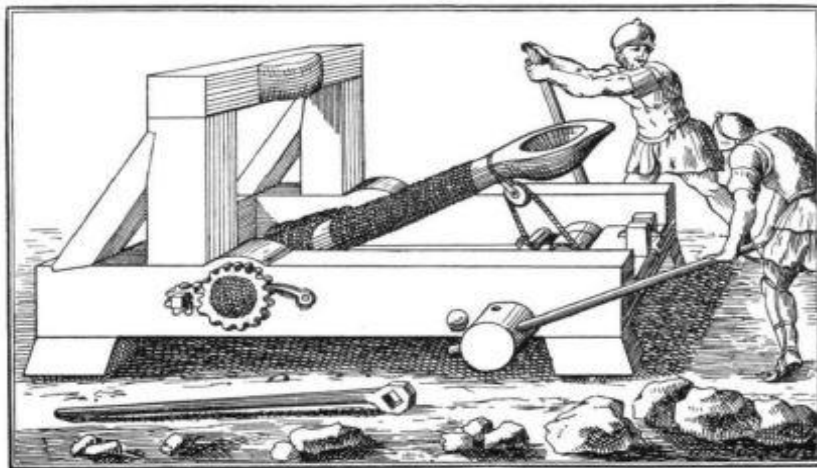


**DEPARTMENT  
OF  
ELECTRONICS AND COMMUNICATION ENGINEERING**



**THAPAR INSTITUTE**  
OF ENGINEERING & TECHNOLOGY  
(Deemed to be University)

**Handout/Assignment-1  
for  
Engineering Design Project-I (UTA013)**

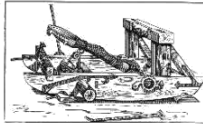


**INSTRUCTOR INCHARGE**

**Name - Meharamt Singh**

**Roll No. - 102003241**

**Group – 2CO10**



## **ASSIGNMENT - 1**

### **INPUT / OUTPUT INTERFACE DESIGN**

#### **Exercise 1 (A) – Blink**

Use Tinkercad to blink the LED with an Arduino for the amount of time equal to the sum of last two digits of your Roll number, leaving the amount of time the LED is 'OFF' to 2 second. (For example, if your Roll No. is 1019\*\*\*27, the LED must be kept on for 9 second).

#### **Hardware/Software Required**

- Arduino Board
- Breadboard
- Tinkercad Software tool (<https://www.tinkercad.com/>)
- LED and Resistors

#### **Circuit description**

To build the circuit, attach a 100-ohm resistor to either leg of the diode. Attach the leg of the LED connected to the flat edge of the body (the negative leg, called the cathode) to ground. Connect the remaining leg (the positive leg, called the anode) to pin 13. Then plug your Arduino board into your computer, start the Arduino program, and upload the code.

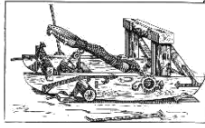
#### **Code:**

```
//C++ code

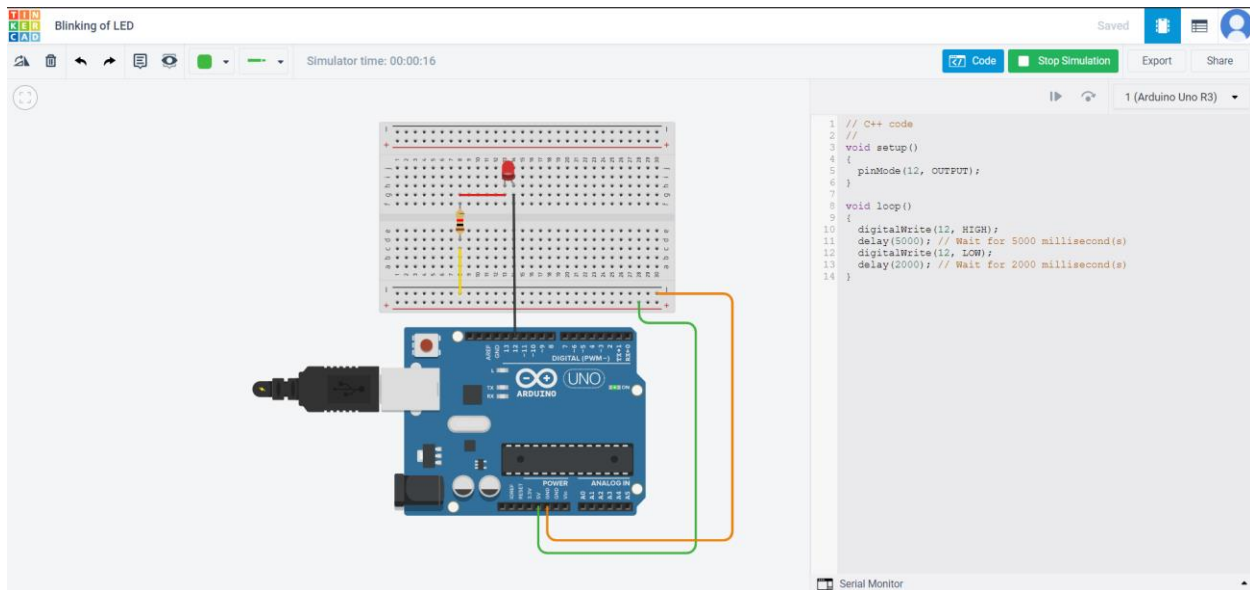
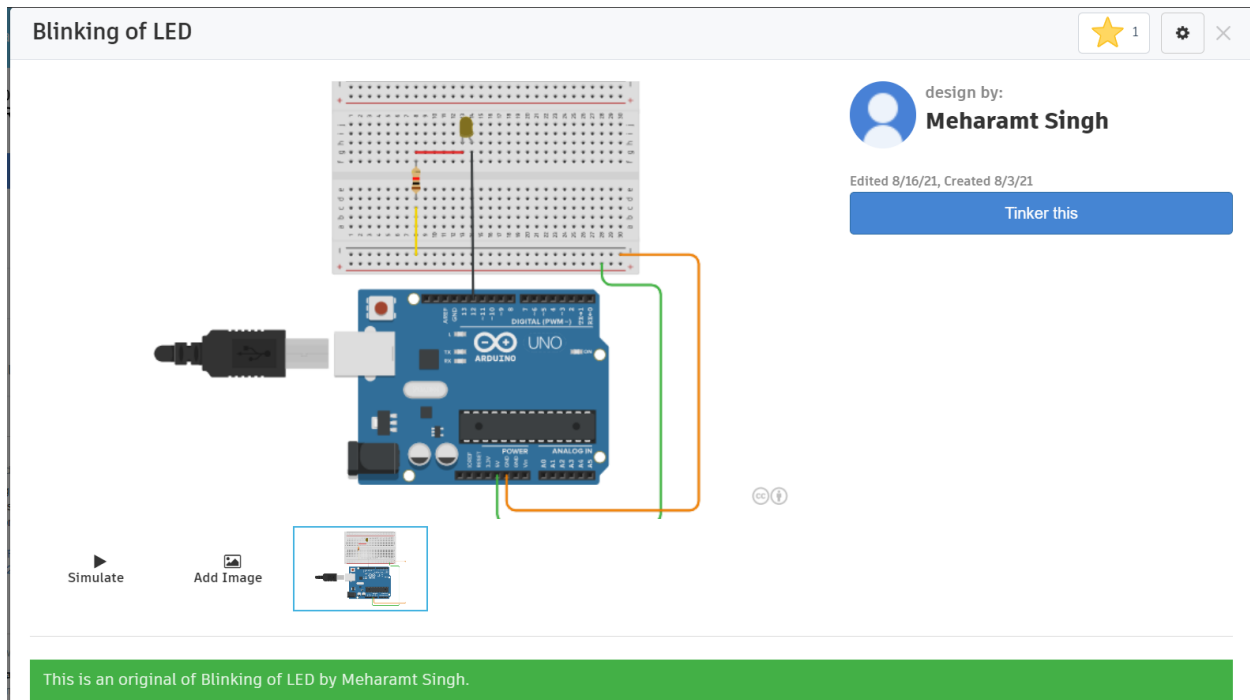
void setup()
{
    pinMode(12, OUTPUT);
}

void loop()
{
    digitalWrite(12, HIGH);
    delay(5000); // wait for 5000 millisecond(s)
    digitalWrite(12, LOW);
    delay(2000); // wait for 2000 millisecond(s)
}
```



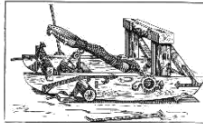


## Tinkercad Snapshots:



## Reflections (Conclusions):

In this experiment we learnt how to blink LED using arduino.



### Exercise 1 (B) – Push Button

Using Tinkercad, connect Pushbutton to turn on the built-in LED on pin 13 i.e., when you press the button LED should glow otherwise it should be in off state.

#### Hardware Required

- Arduino Board
- momentary button or switch
- 10K ohm resistor
- breadboard
- hook-up wire
- Tinkercad Software tool (<https://www.tinkercad.com/>)

#### Circuit description

Connect three wires to the Arduino board. The first two, red and black, connect to the two long vertical rows on the side of the breadboard to provide access to the 5 volt supply and ground. The third wire goes from digital pin 10 to one leg of the pushbutton. The same leg of the button connects through a pull-down resistor (here 10 KOhms) to ground. The other leg of the button connects to the 5 volt supply.

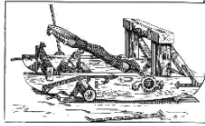
When the pushbutton is open (unpressed) there is no connection between the two legs of the pushbutton, so the pin is connected to ground (through the pull-down resistor) and we read a LOW. When the button is closed (pressed), it makes a connection between its two legs, connecting the pin to 5 volts, so that we read a HIGH.

You can also wire this circuit the opposite way, with a pullup resistor keeping the input HIGH, and going LOW when the button is pressed. If so, the behaviour of the sketch will be reversed, with the LED normally on and turning off when you press the button.

If you disconnect the digital I/O pin from everything, the LED may blink erratically. This is because the input is "floating" - that is, it will randomly return either HIGH or LOW. That's why you need a pull-up or pull-down resistor in the circuit.

#### Code:

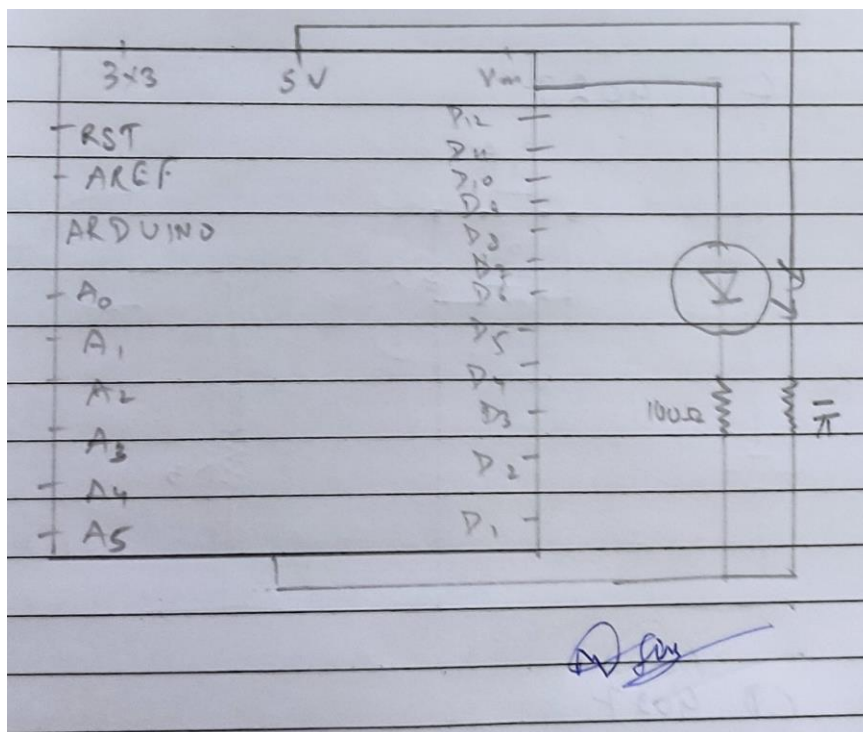


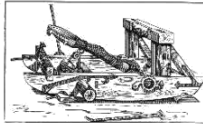


```
//C++ code.

void setup()
{
  pinMode (13, output);
  pinMode (2, input);
}

void loop()
{
  int x = digitalRead (2);
  if (x == HIGH)
  {
    digitalWrite (13, HIGH);
  }
  else
  {
    digitalWrite (13, LOW);
  }
}
}
```





## Tinkercad Snapshots:

Blinking LED using Push Button

design by: **Meharamt Singh**

Edited 8/12/21, Created 8/3/21

Tinker this

This is an original of Blinking LED using Push Button by Meharamt Singh.

Blinking LED using Push Button

Simulator time: 00:00:02

Code Stop Simulation Export Share

1 (Arduino Uno R3)

```
1 // C++ code
2 //
3 void setup()
4 {
5   pinMode(13, OUTPUT);
6   pinMode(2, INPUT);
7 }
8 void loop()
9 {
10  int x=digitalRead(2);
11  if (x==HIGH)
12  {
13    digitalWrite(13, HIGH);
14    //delay(5000); // Wait for 5000 millisecond(s)
15  }
16  else
17  {
18    digitalWrite(13, LOW);
19    //delay(2000); // Wait for 2000 millisecond(s)
20  }
21 }
22 }
```

Serial Monitor

## Reflections (Conclusions):

In this experiment we learnt how to blink LED using a push button.



## Exercise 1 (C) – Tinkercad

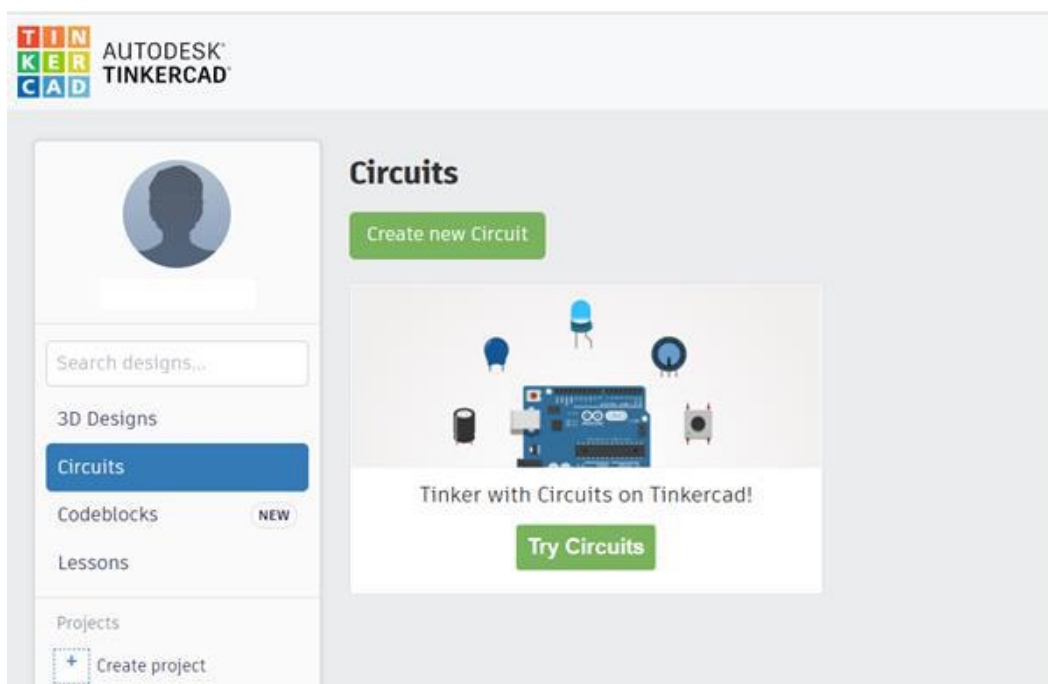
Tinkercad is a free, online collection of software tools for 3D design, electronics, and coding

### Software Required

- Tinkercad Software tool (<https://www.tinkercad.com/>)

### Getting Started:

1. Visit <https://www.tinkercad.com/>
2. Sign in through your google account (Thapar Email ID only)
3. On the Dashboard, select **Circuits** from the drop box and click on **Create new Circuit**



## Exercise 2– Study of ICs

To verify the function tables of CD4027 and CD4081 ICs.

### Hardware Required

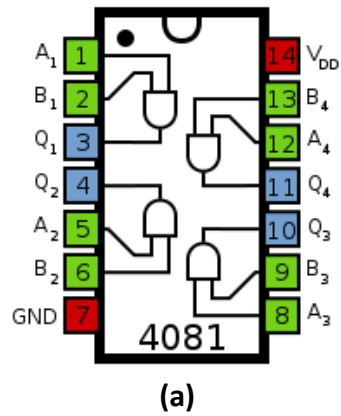
- Breadboard
- CD 4027 and CD 4081



- Single core connecting wires
- Tinkercad Software tool (<https://www.tinkercad.com/>)

## Theory

The data sheet of CD4027 and CD4081 is given below.



Input 1	Input 2	Output
0	0	0
0	1	0
1	0	0
1	1	1

Figure 1: Datasheet of CD4081 IC (a) pin diagram (b) functional truth table

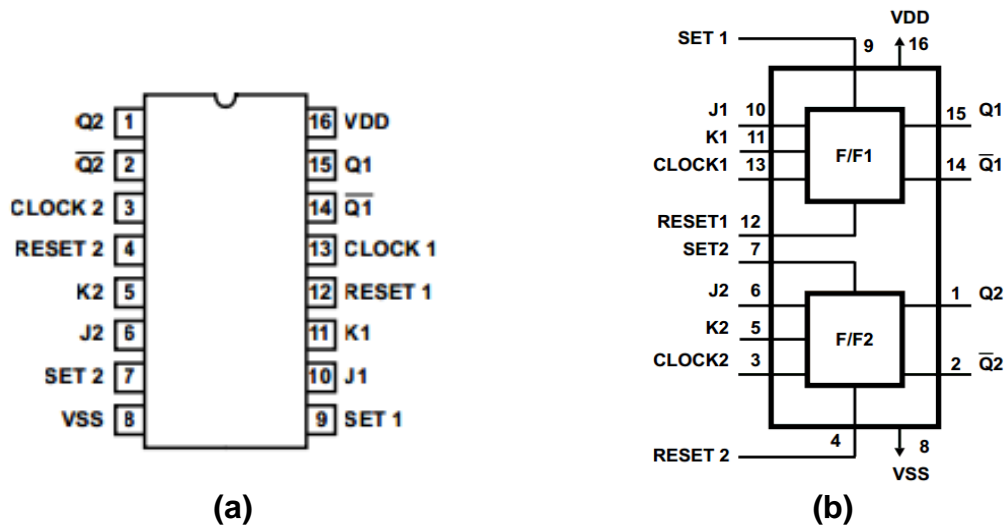
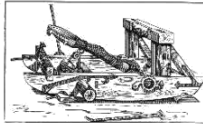









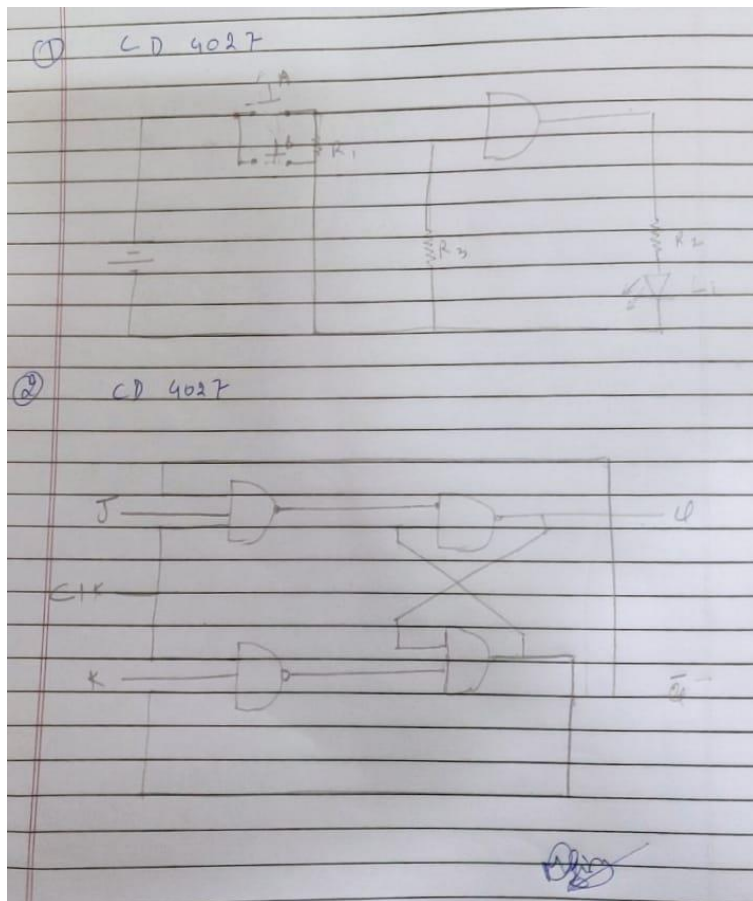


Figure 2: CD4027 IC (a) pin diagram (b) Internal architecture



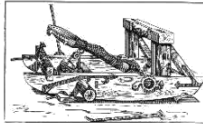
Trigger	Inputs		Output				Inference
			Present State		Next State		
CLK	J	K	Q	Q'	Q	Q'	
	x	x	-		-		Latched
	0	0	0	1	0	1	No Change
			1	0	1	0	
	0	1	0	1	0	1	Reset
			1	0	0	1	
	1	0	0	1	1	0	Set
			1	0	1	0	
	1	1	0	1	1	0	Toggles
			1	0	0	1	

### Schematic:



### Reflections (Conclusions):

In this experiment we verify the truth table of both the IC's.

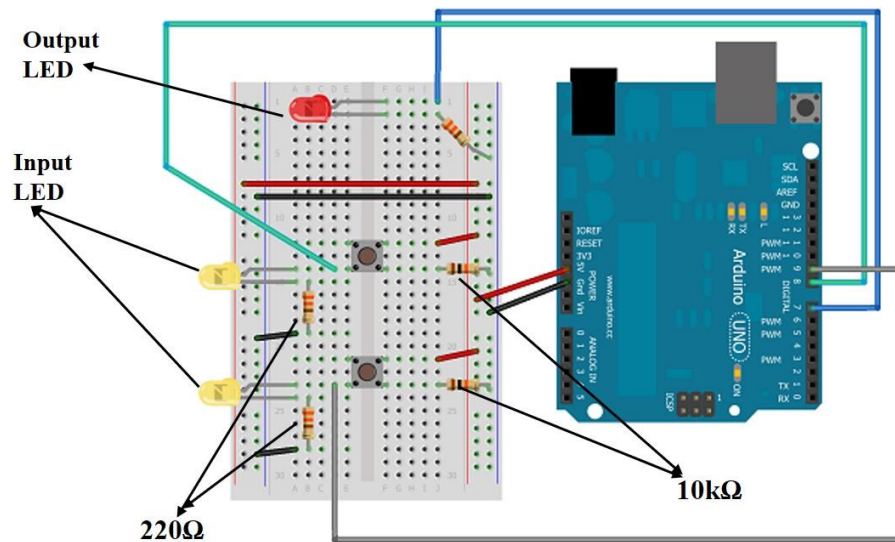


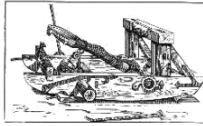
## Assignment Tasks:

*Note: Each student must attach separate sheets for submitting the below mentioned Assignment Task A-B.*

- A. Using Tinkercad, Illustrate the pin configuration and verify the truth table of IC 74HC08 and IC 74H73
- B. With the help of Tinkercad, use push buttons to simulate the behaviour of listed logic gates (Without using ICs of logic gates)
  - a) Logic gates: AND, NAND, XOR for students with odd numbered Roll Number.
  - b) Logic gates: OR, NOR, XNOR for students with even numbered Roll Number.

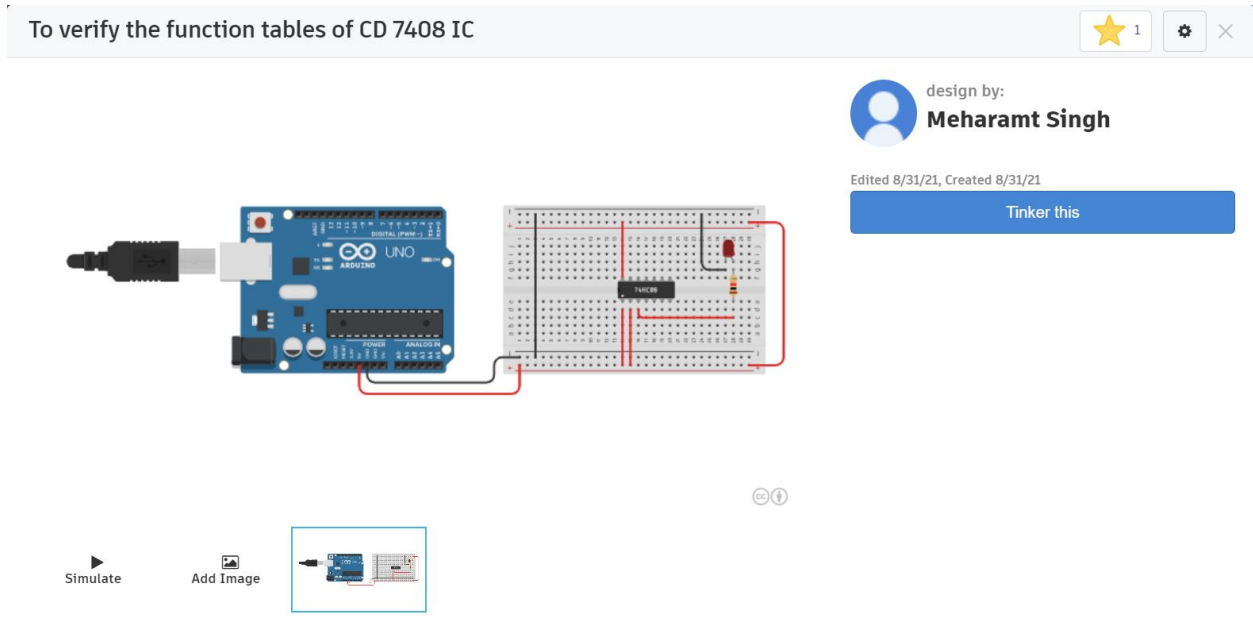
### Hint:



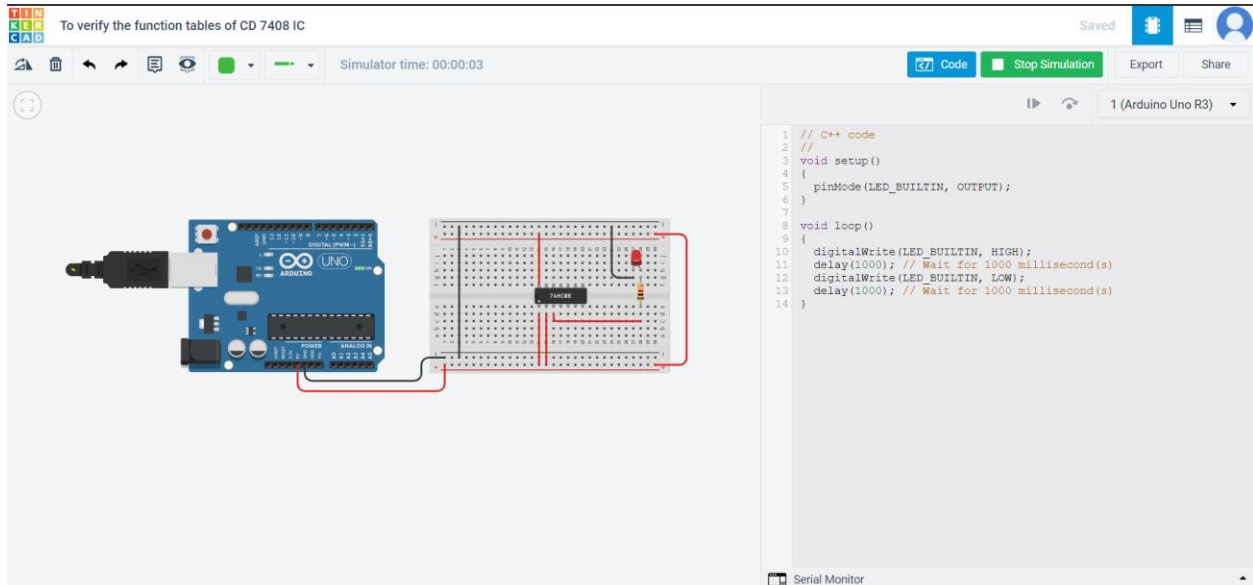


## PART - A (102003241)

### Tinkercad snapshots:



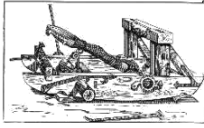
This is an original of To verify the function tables of CD 7408 IC by Meharamt Singh.



To verify the function tables of CD 7473 IC

### Reflections (Conclusions):

In this experiment we illustrated the pin configuration and verified the truth table of IC 74HC08 and IC 74H73.



## PART - B (102003241)

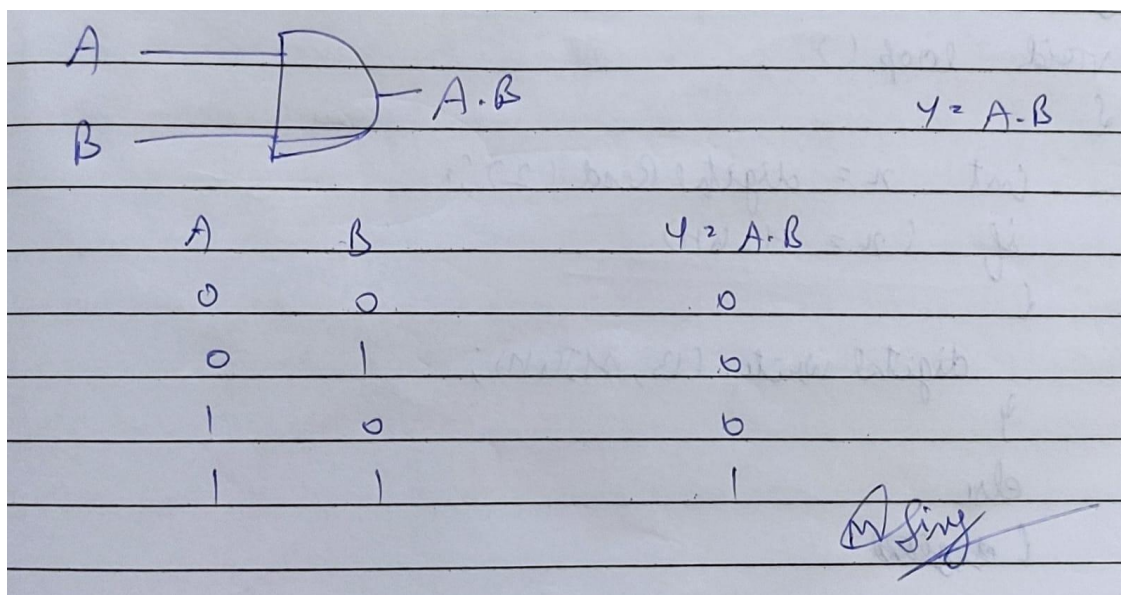
AND

Code:

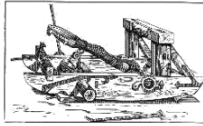
```
void setup()
{
  pinMode (13, INPUT);
  pinMode (12, INPUT);
  pinMode (6, OUTPUT);
}

void loop()
{
  int x = digitalRead (13);
  int y = digitalRead (12);

  if ((x & y) == LOW)
  {
    digitalWrite (6, LOW);
  }
  else
  {
    digitalWrite (6, HIGH);
  }
}
```







## Tinkercad snapshots:

Assignment Task - AND

design by: **Meharamt Singh**

Edited 9/6/21, Created 9/6/21

Tinker this

Simulate Add Image

This is an original of Assignment Task - AND by Meharamt Singh.

Assignment Task - AND

All changes saved

Simulator time: 00:00:18

Code Stop Simulation Export Share

1 (Arduino Uno R3)

```
// C++ code
1 //
2 //
3 void setup()
4 {
5   pinMode(13, INPUT);
6   pinMode(12, INPUT);
7   pinMode(6, OUTPUT);
8 }
9
10 void loop()
11 {
12   int x=digitalRead(13);
13   int y=digitalRead(12);
14
15   if((x*y)==LOW)
16   {
17     digitalWrite(6, LOW);
18   }
19   else
20   {
21     digitalWrite(6, HIGH);
22   }
23 }
```

Serial Monitor

## Reflections (Conclusions):

The gate was verified successfully. The LED will glow when both the inputs are 1.



## NAND

### Code:

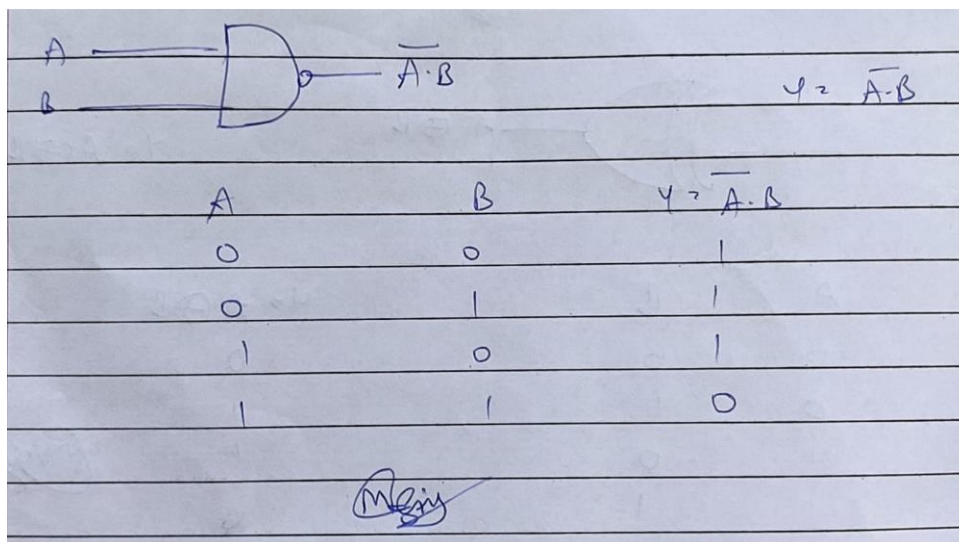
```

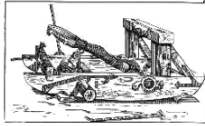
void setup ()
{
  pinMode (13, Input);
  pinMode (12, Input);
  pinMode (6, OUTPUT);
}

void loop ()
{
  int x = digitalRead (13);
  int y = digitalRead (12);

  if ((x & y) == LOW)
  {
    digitalWrite (6, HIGH);
  }
  else
  {
    digitalWrite (6, LOW);
  }
}

```





## Tinkercad snapshots:

Assignment Task - NAND

design by: **Meharamt Singh**

Edited 9/6/21, Created 9/6/21

Tinker this

Simulate Add Image

This is an original of Assignment Task - NAND by Meharamt Singh.

Assignment Task - NAND

All changes saved

Simulator time: 00:00:04

Code Stop Simulation Export Share

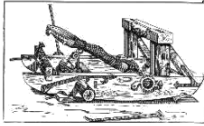
1 (Arduino Uno R3)

```
1 // C++ code
2 //
3 void setup()
4 {
5   pinMode(13, INPUT);
6   pinMode(12, INPUT);
7   pinMode(6, OUTPUT);
8 }
9
10 void loop()
11 {
12   int x=digitalRead(13);
13   int y=digitalRead(12);
14   if((x*y)==LOW)
15   {
16     digitalWrite(6, HIGH);
17   }
18   else
19   {
20     digitalWrite(6, LOW);
21   }
22 }
23 }
```

Serial Monitor

## Reflections (Conclusions):

The gate was verified successfully. The LED will glow when both the inputs are 0 or when one of them is 0 and another one is 1.



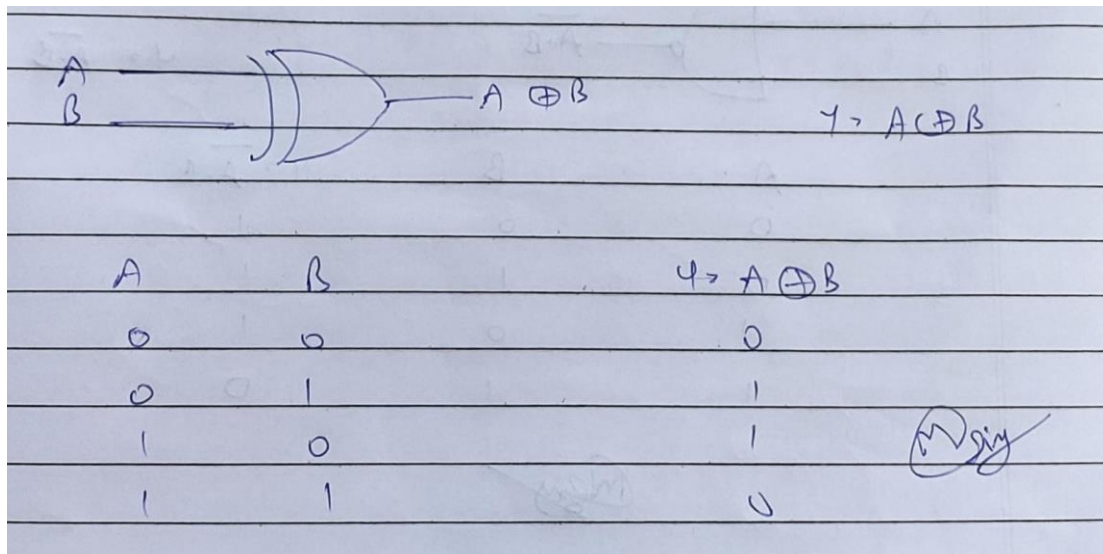
## XOR

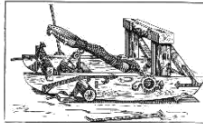
### Code:

```
void setup ()
{
  pinMode (13, Input);
  pinMode (12, INPUT);
  pinMode (6, OUTPUT);
}

void loop ()
{
  int x = digitalRead (13);
  int y = digitalRead (12);

  if (x == y)
  {
    digitalWrite (6, LOW);
  }
  else
  {
    digitalWrite (6, HIGH);
  }
}
```





## Tinkercad snapshots:

Assignment Task - XOR

design by: **Meharamt Singh**

Edited 9/6/21, Created 9/6/21

Tinker this

Simulate Add Image

This is an original of Assignment Task - XOR by Meharamt Singh.

Assignment Task - XOR

All changes saved

Simulator time: 00:00:08

Code Stop Simulation Export Share

1 (Arduino Uno R3)

```
1 // C++ code
2 //
3 void setup()
4 {
5   pinMode(13, INPUT);
6   pinMode(12, INPUT);
7   pinMode(6, OUTPUT);
8 }
9
10 void loop()
11 {
12   int x=digitalRead(13);
13   int y=digitalRead(12);
14   if((x==y))
15   {
16     digitalWrite(6, LOW);
17   }
18   else
19   {
20     digitalWrite(6, HIGH);
21   }
22 }
23 }
```

Serial Monitor

## Reflections (Conclusions):

The gate was verified successfully. The LED will glow when both the inputs are different.