

A

Practical Activity Report submitted for
Engineering Design Project-II (UTA-014)

by

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|------------------------|------------------|
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Submitted to

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List of Experiments

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| 6 | 4 | Serial Communications: a. Serial.begin(9600); b. Serial.print(); c. Serial.println() d. Serial.read() e. Serial.write() |
| 7 | 5(a) | Write a program to demonstrate sending data from the computer to the Arduino board and control brightness of LED. |
| 8 | 5(b) | Write a program to demonstrate sending data from the computer to the Arduino board and control brightness of LED |
| 9 | 6 | WAP for following pattern using for loop: ***** Roll No. _____ ***** Name: _____ ***** Branch: _____ ***** |
| 10 | 7 | WAP for following logic gates using serial communication and 5 LEDs such that the following condition must satisfy. Output of AND Gate-> LED1 should blink Output of NAND Gate-> LED2 should blink Output of NOR Gate-> LED3 should blink Output of XOR Gate-> LED4 should blink Output of XNOR Gate-> LED5 should blink |

Experiment: 1

Objective: Introduction to Arduino Microcontroller.

Software Used: Arduino IDE

Hardware Component Used:

| Sr. No | Name of Components | Value |
|--------|--------------------|-------|
| 1. | Arduino Uno R3 | NA |

Theory:

A microcontroller is a computer. Microcontrollers are "embedded" inside some other device so that they can control the features or actions of the product. A microcontroller also takes input from the device it is controlling and controls the device by sending signals to different components in the device. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on computer, used to write and upload computer code to the physical board.

Logical Circuit diagram (Tinkercad Circuit diagram):



1. Power Button: Arduino board can be powered by using the USB cable from our computer. All we need to do is connect the USB cable to the USB connection.
2. Power (Barrel Jack): Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack .

3. Voltage Regulator: The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.

4. Crystal Oscillator: The crystal oscillator helps Arduino in dealing with time issues.

5. Pins (3.3, 5, GND)

3.3V (6) – Supply 3.3 output voltage

5V (7) – Supply 5 output voltage

Most of the components used with Arduino board works fine with 3.3 volt and 5 volt.

GND (8)(Ground) – GND pins on the Arduino, any of which can be used to ground your circuit.

6. Analog pins

The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value which is readable.

7. Digital I/O

The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic. The pins labelled “~” can be used to generate PWM.

Discussion:

In this experiment, we came across the concept of Arduino and the functionalities involved in it. We dealt with the concept of pins and basics of this Arduino Uno board, its different miniature analogies and how it basically works (surface approach).

Experiment: 2(a)

Objective: Write a program in Arduino to blink a LED. (Single)

Software Used: Arduino IDE

Hardware Component Used:

| Sr. No | Name of Components | Value |
|--------|--------------------------|--------------|
| 1. | Resistor (1) | 220 Ω |
| 2. | Light Emitting Diode (1) | Green |
| 3. | Arduino Uno R3 (1) | NA |
| 4. | Breadboard (1) | NA |
| 5. | Connecting Wires (2) | NA |

Theory:

1. **Resistor:**

A two terminal device in circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines.

2. **Arduino:**

An Arduino Uno is an open source microcontroller board which is developed with multiple analog and digital input output pins that may be interacted to various circuits.

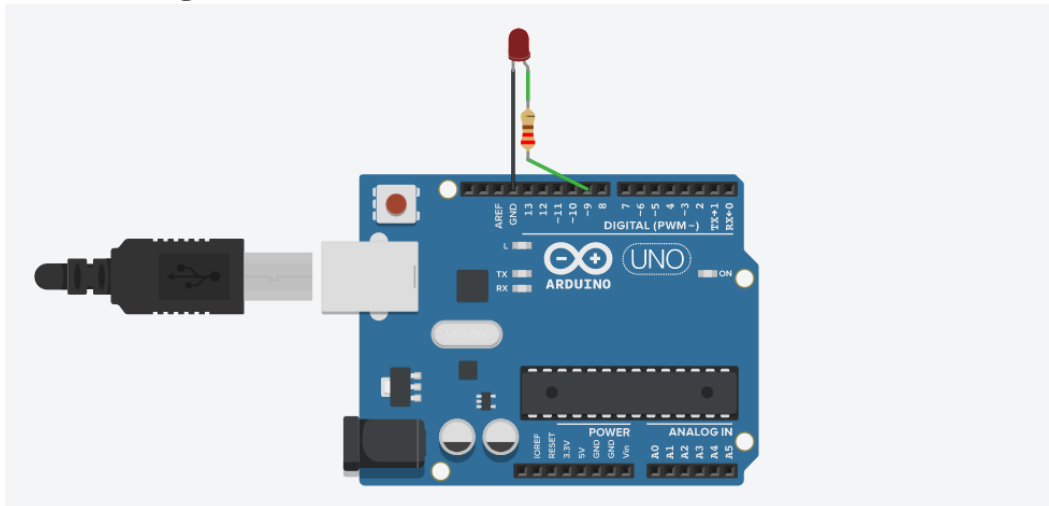
3. **Breadboard:**

A breadboard is a rectangular plastic board with a bunch of tiny holes in it which let in to easily insert electronic components to prototype.

4. **Connecting Wires:**

It provides a medium to an electrical current so that they can travel from one point on a circuit to another.

Circuit diagram :



Code:

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

void loop()
{
  // turn the LED on (HIGH is the voltage level)
  digitalWrite(13, HIGH);
  delay(1000); // Wait for 1000 millisecond(s)
  // turn the LED off by making the voltage LOW
  digitalWrite(13, LOW);
  delay(1000); // Wait for 1000 millisecond(s)
}
```

Discussion:

In this experiment, we have learnt how we can select the pin of an Arduino board and set it HIGH or LOW depending upon the usage. The delay time between the transition for the desired interval time could be set giving the command.

Experiment: 2(b)

Objective: Write a program in Arduino to blink a multiple LED.

Software Used: Arduino IDE

Hardware Component Used:

| Sr. No | Name of Components | Value |
|--------|--------------------------|------------------|
| 1. | Resistor (3) | 100 Ω |
| 2. | Light Emitting Diode (3) | Green/Red/Yellow |
| 3. | Arduino Uno R3 (1) | NA |
| 4. | Breadboard (1) | NA |
| 5. | Connecting Wires (4) | NA |

Theory:

1. Resistor:

A two terminal device in circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines.

2. Arduino:

An Arduino Uno is an open source microcontroller board which is developed with multiple analog and digital input output pins that may be interacted to various circuits.

3. Breadboard:

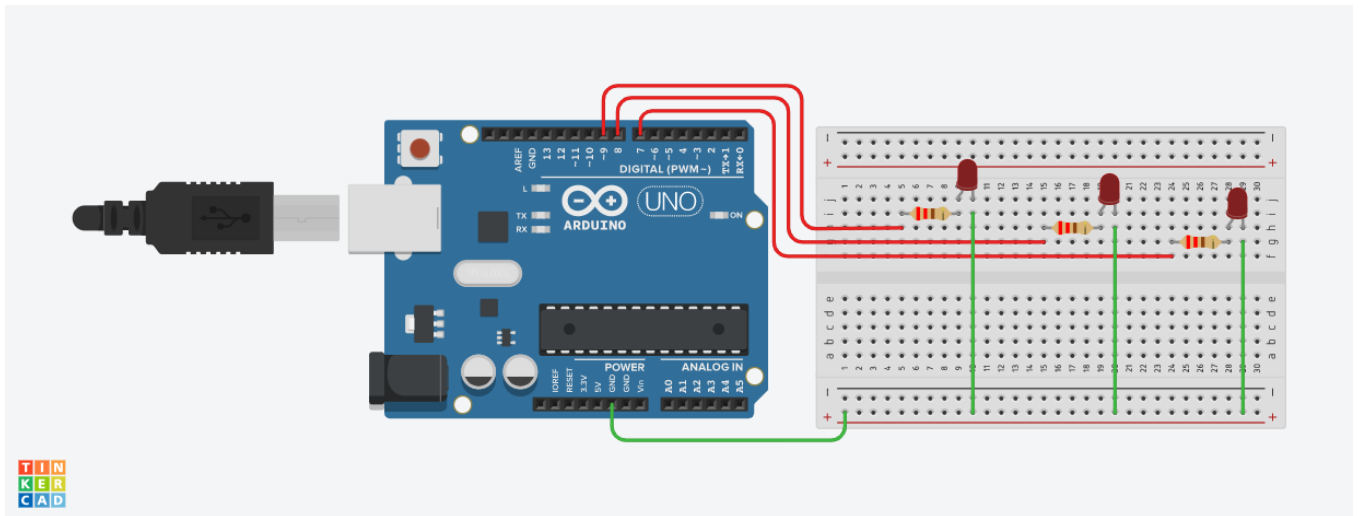
A breadboard is a rectangular plastic board with a bunch of tiny holes in it which let in to easily insert electronic components to prototype.

4. Connecting Wires:

It provides a medium to an electrical current so that they can travel from one point on a circuit to another.

In this program, we will blink multiple LEDs using repetitive programming code giving delay times.

Circuit diagram:



Code:

```
void setup()
{
  pinMode (9, OUTPUT);
  pinMode (8, OUTPUT);
  pinMode (7, OUTPUT);
}
void loop()
{
  for(int i=9; i>=7; i++)
  {
    digitalWrite(i,HIGH);
    delay(1000);
    digitalWrite(i,LOW);
    delay(1000);
  }
}
```

Discussion:

In this experiment, we have learnt how we can select the pin of an Arduino board and set it HIGH or LOW depending upon the usage. The delay time between the transition for the desired interval time could be set giving the command for not one but multiple pins at a time.

Experiment: 3(a)

Objective:

Write a program to design a pattern from sequence of multiple LED using for loop in Arduino (by for loop and switch case).

Software Used: Arduino IDE

Hardware Component Used:

| Sr. No | Name of Components | Value |
|--------|--------------------------------|---------------|
| 1. | Resistor (4) | 100 Ω |
| 2. | Light Emitting Diode (LED) (4) | Multi Colored |
| 3. | Arduino Uno R3 (1) | NA |
| 4. | Breadboard (1) | NA |
| 5. | Connecting Wires (9) | NA |

Theory:

1. Resistor:

A two terminal device in circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines.

2. LED:

A **light-emitting diode (LED)** is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

3. Arduino:

An Arduino Uno is an open source microcontroller board which is developed with multiple analog and digital input output pins that may be interacted to various circuits.

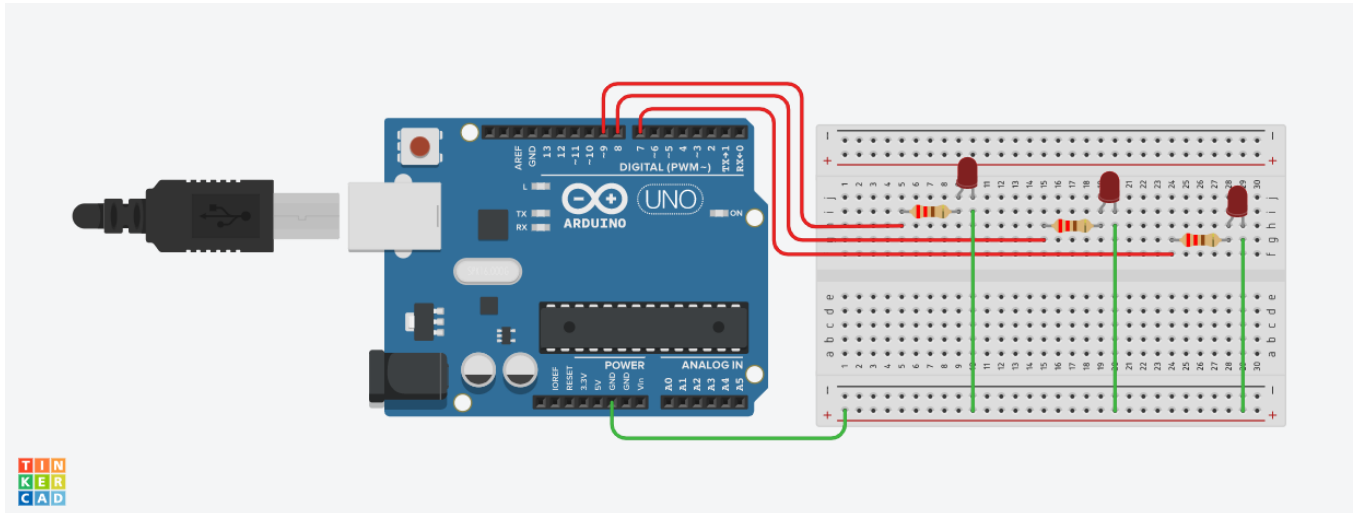
4. Breadboard:

A breadboard is a rectangular plastic board with a bunch of tiny holes in it which let in to easily insert electronic components to prototype.

5. Connecting Wires:

It provides a medium to an electrical current so that they can travel from one point on a circuit to another.

Circuit diagram:



Code:

```
void setup()
{
  pinMode (9, OUTPUT);
  pinMode (8, OUTPUT);
  pinMode (7, OUTPUT);
}
void loop()
{
  for(int i=9; i>=7; i++)
  {
    if(i=9)
    {
      digitalWrite(i,HIGH);
      delay(1000);
      digitalWrite(i,LOW);
      delay(1000);
    }
    if(i=8)
    {
      digitalWrite(i+1,HIGH);
      digitalWrite(i,HIGH);
      delay(1000);
      digitalWrite(i+1,LOW);
      digitalWrite(i,LOW);
    }
  }
}
```

```
delay(1000);  
}  
if(i=7)  
{  
digitalWrite(i+2,HIGH);  
digitalWrite(i+1,HIGH);  
digitalWrite(i,HIGH);  
delay(1000);  
digitalWrite(i+2,LOW);  
digitalWrite(i+1,LOW);  
digitalWrite(i,LOW);  
delay(1000);  
}  
}  
}
```

Discussion:

In this experiment, we have learnt how we can easily command to obtain desired inputs and delays in interface for multiple pins without repeatedly writing the stuff. For loop could be employed in such symmetric cases to obtain desired results

Experiment: 3(b)

Objective:

Write a program to show Fibonacci Series (0,1,1,2,3,5) with the help of multiple LEDs.

Software Used: Arduino IDE

Hardware Component Used:

| Sr. No | Name of Components | Value |
|--------|--------------------------------|---------------|
| 1. | Resistor (4) | 100 Ω |
| 2. | Light Emitting Diode (LED) (4) | Multi Colored |
| 3. | Arduino Uno R3 (1) | NA |
| 4. | Breadboard (1) | NA |
| 5. | Connecting Wires (9) | NA |

Theory:

1. Resistor:

A two terminal device in circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines.

2. LED:

A **light-emitting diode (LED)** is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

3. Arduino:

An Arduino Uno is an open source microcontroller board which is developed with multiple analog and digital input output pins that may be interacted to various circuits.

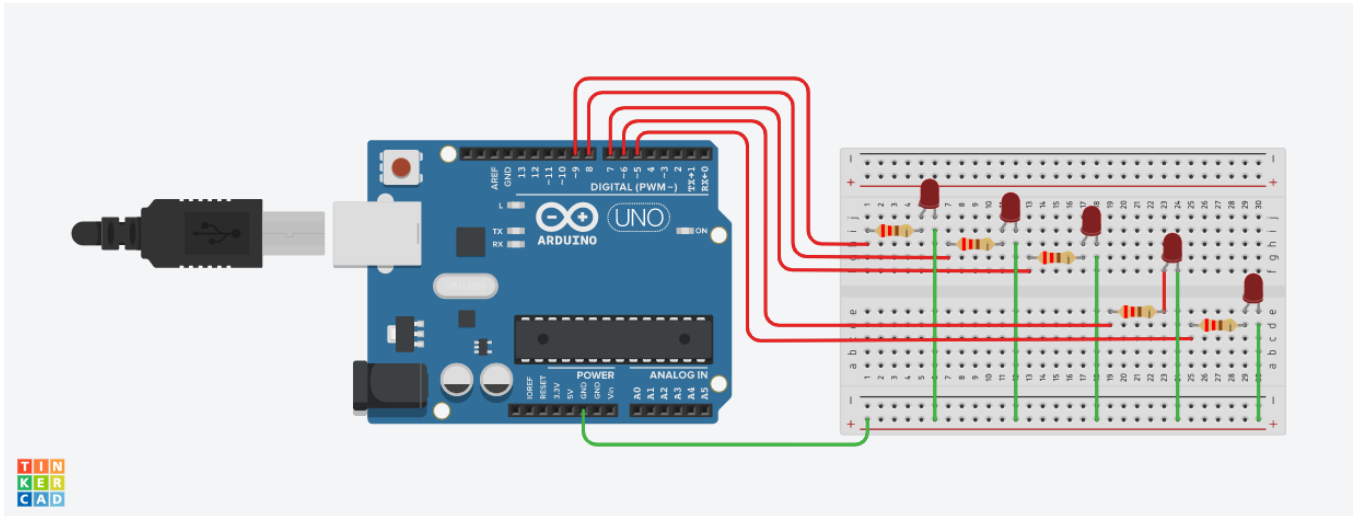
4. Breadboard:

A breadboard is a rectangular plastic board with a bunch of tiny holes in it which let in to easily insert electronic components to prototype.

5. Connecting Wires:

It provides a medium to an electrical current so that they can travel from one point on a circuit to another.

Circuit diagram:



Code:

```
void setup(){
  pinMode(5,OUTPUT);
  pinMode(6,OUTPUT);
  pinMode(7,OUTPUT);
  pinMode(8,OUTPUT);
  pinMode(9,OUTPUT);
}

void loop(){
  int fibo[6] = {0, 1, 1, 2, 3, 5};
  for(int a = 0; a<6; a++)
  {
    int n=fibo[a]+4;
    for(int b=n;b>4;b--)
    {
      digitalWrite(b, HIGH);
    }
    delay(2000);
    for(int b=n;b>4;b--)
    {
      digitalWrite(b, LOW);
    }
    delay(2500);
  }
}
```

Discussion: In this experiment, we have learnt how we can easily command to obtain desired inputs and delays in interface for multiple pins without repeatedly writing the stuff. For loop could be employed in such symmetric cases to obtain desired results

Experiment: 4

Objective:

Serial Communications:

- a. Serial.begin(9600); s
- b. Serial.print();
- c. Serial.println()
- d. Serial.read()
- e. Serial.write()

Software Used: Arduino IDE

Hardware Component Used:

| Sr. No | Name of Components | Value |
|--------|--------------------|-------|
| 1. | Arduino Uno R3 (1) | NA |

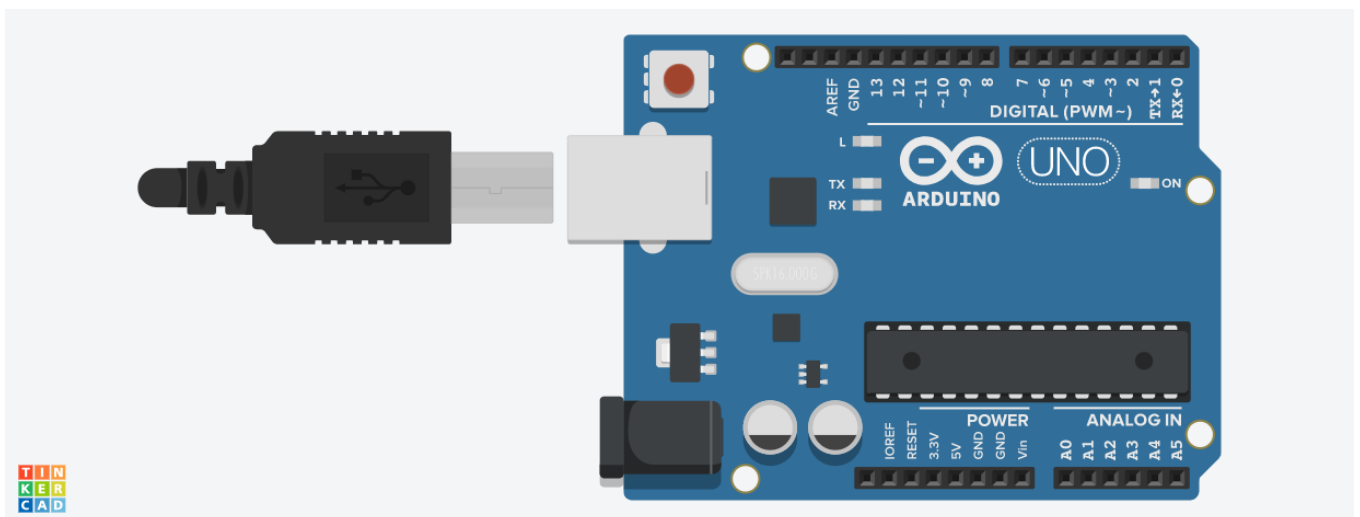
Theory:

1. Arduino:

An Arduino Uno is an open source microcontroller board which is developed with multiple analog and digital input output pins that may be interacted to various circuits.

In this program, we will use codes of serial communication to print ASCII values as an example.

Circuit diagram:



Code:

```
void setup(){ Serial.begin(9600);  
Serial.print("Welcome");  
}  
void loop(){  
Serial.println("Hello");  
}
```

Discussion:

In this experiment, we have learnt how to use serial communication commands in a program and various usage of them in built up of a code to obtain certain set of desired results. ASCII values as whole were discussed in this experiment

Experiment: 5

Objective: Write a program to demonstrate sending data from the computer to the Arduino board and control brightness of LED.

Software Used: Arduino IDE

Hardware Component Used:

| Sr. No | Name of Components | Value |
|--------|--------------------------------|--------------|
| 1. | Resistor (1) | 220 Ω |
| 2. | Light Emitting Diode (LED) (1) | Green |
| 3. | Arduino Uno R3 (1) | NA |
| 4. | Breadboard (1) | NA |
| 5. | Connecting Wires (2) | NA |

Theory:

6. Resistor:

A two terminal device in circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines.

7. LED:

A **light-emitting diode (LED)** is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

8. Arduino:

An Arduino Uno is an open source microcontroller board which is developed with multiple analog and digital input output pins that may be interacted to various circuits.

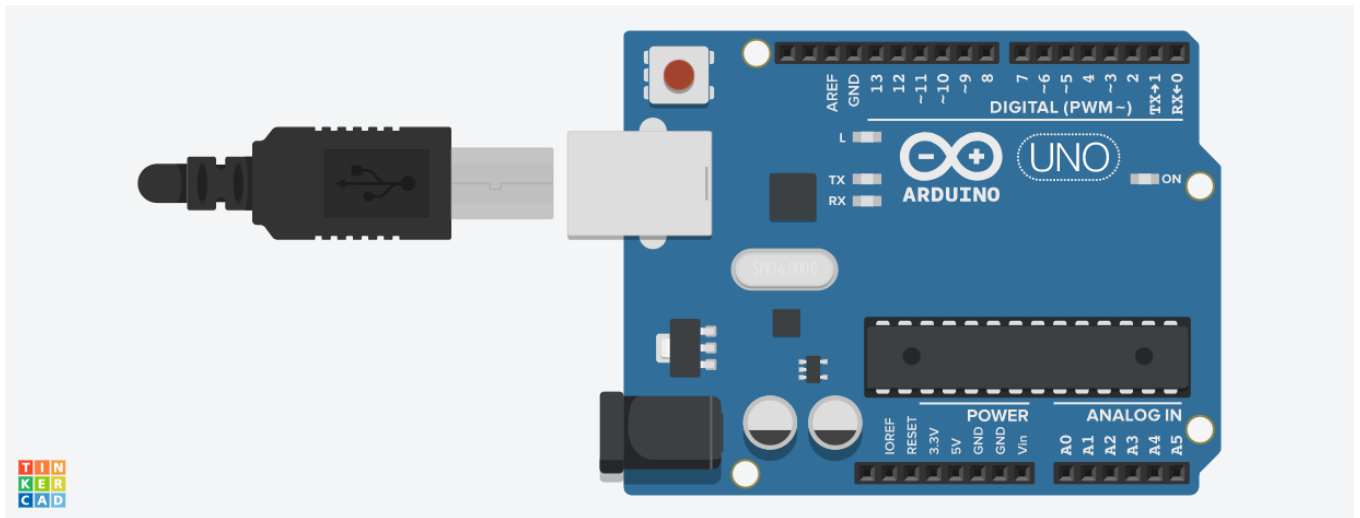
9. Breadboard:

A breadboard is a rectangular plastic board with a bunch of tiny holes in it which let in to easily insert electronic components to prototype.

10. Connecting Wires:

It provides a medium to an electrical current so that they can travel from one point on a circuit to another.

Circuit diagram:



CODE:

```
void setup(){ Serial.begin(9600);  
Serial.print("Welcome");  
}  
void loop(){  
Serial.println("Hello");  
}
```

Discussion:

In this experiment, we have learnt how we can control the input by sending it from the hardware. Here in case, the brightness of the LED was controlled by sending its value from the system using `parseInt` command

Experiment: 5(a)

Objective: Write a program in Arduino to control the brightness of the LED for the range of 0-255

Software Used: Arduino IDE

Hardware Component Used:

| Sr. No | Name of Components | Value |
|--------|--------------------------------|--------------|
| 1. | Resistor (5) | 220 Ω |
| 2. | Light Emitting Diode (LED) (5) | Red |
| 3. | Arduino Uno R3 (1) | NA |
| 4. | Breadboard (1) | NA |
| 5. | Connecting Wires (2) | NA |

Theory:

1. Resistor:

A two terminal device in circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines.

2. LED:

A **light-emitting diode (LED)** is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

3. Arduino:

An Arduino Uno is an open source microcontroller board which is developed with multiple analog and digital input output pins that may be interacted to various circuits.

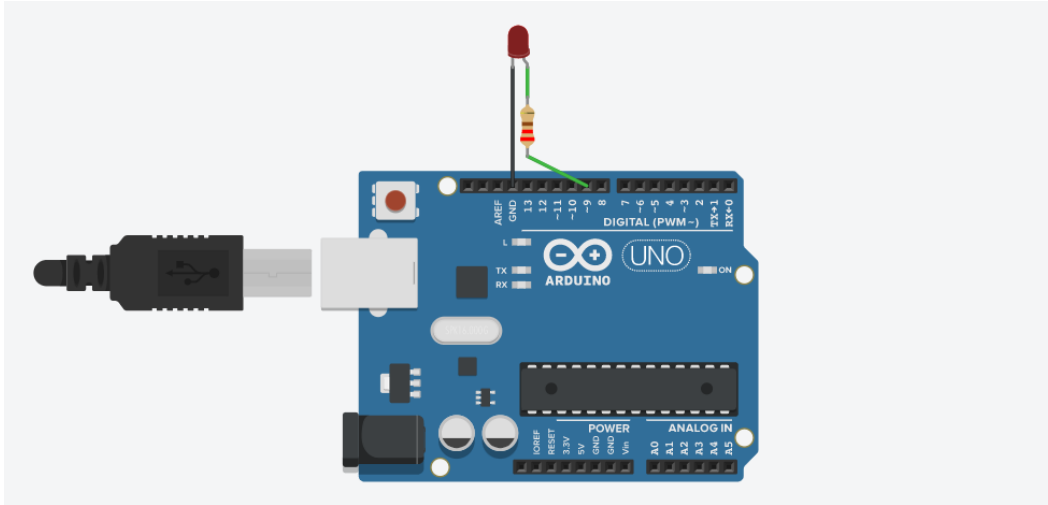
4. Breadboard:

A breadboard is a rectangular plastic board with a bunch of tiny holes in it which let in to easily insert electronic components to prototype.

5. Connecting Wires:

It provides a medium to an electrical current so that they can travel from one point on a circuit to another.

Circuit diagram:



CODE:

```
void setup ()
{
  Serial.begin(9600);
  pinMode (11 , OUTPUT) ;
  pinMode (10 , OUTPUT) ;
  pinMode (9 , OUTPUT) ;
  pinMode (6 , OUTPUT) ;
  pinMode (5 , OUTPUT) ;
}
void loop ()
{
  int i= Serial.parseInt () ;
  if (0<=i && i<=51)
  {
    analogWrite (11, i);
    delay (1000) ;
    analogWrite (11, LOW) ;
    delay (2000) ;
  }
  else if (52<=i && i<=102)
  {
    analogWrite(10,i);
    delay (1000) ;
    analogWrite (10, LOW) ;
    delay (2000) ;
  }
  else if (103<=i && i<=154)
  {
    analogWrite(9,i);
    delay (1000) ;
    analogWrite (9, LOW) ;
    delay (2000) :
  }
}
```

```
else if (155<=i && i<=206)
{
analogWrite (6, i) ;
delay (1000) ;
analogWrite (6, LOW) ;
delay (2000) ;
}

else if (103<=i && i<=154)
{
analogWrite(9,i);
delay (1000) ;
analogWrite (9, LOW) ;
delay (2000) :
}

else if (155<=i && i<=206)
{
analogWrite (6, i) ;
delay (1000) ;
analogWrite (6, LOW) ;
delay (2000) ;
}

else if (207<i && i<=255)
{
analogWrite (5, i) ;
delay (1000) ;
analogWrite (5, LOW) ;
delay (2000) ;
}
}
```

Discussion:

In this experiment, we have learnt how we can control the input by sending it from the hardware. Here in case, the brightness of the LED was controlled by sending its value from the system using `parseInt` command

Experiment: 6

Objective: WAP for following pattern using for loop:

Roll_No. _____

Name: _____

Branch: _____

Software Used: Arduino IDE

Hardware Component Used:

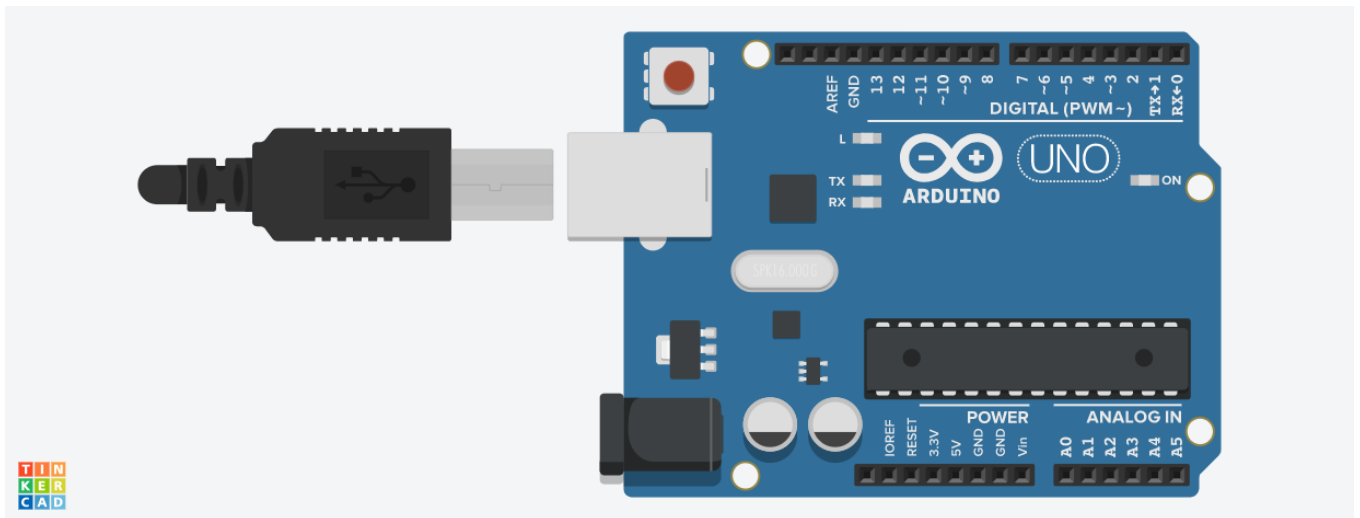
| Sr. No | Name of Components | Value |
|--------|--------------------|-------|
| 1. | Arduino Uno R3 (1) | NA |

Theory:

1. Arduino:

An Arduino Uno is an open-source microcontroller board which is developed with multiple analog and digital input output pins that may be interacted to various circuits.

Circuit diagram:



Code:

```
void setup() {  
  Serial.begin(9600);  
  
  for(int i=0; i<46; i++) { Serial.print("*"); }  
  Serial.println(" ");  
  Serial.println("Roll Number: 102108196");  
  
  for(int i=0; i<38; i++) { Serial.print("*");  
  }  
  
  Serial.println(" ");  
  Serial.println("Name:Aman Saini");  
  
  for(int i=0; i<53; i++) { Serial.print("*"); }  
  Serial.println(" ");  
  Serial.println("Branch: 2ME8");  
  
  for(int i=0; i<60; i++) { Serial.print("*");  
  }  
}
```

Discussion:

In this experiment, we have learnt how to use serial commands for basic functions as well. The usage of for loop with them in addition to serial communications to get/print the desired result.

Experiment: 7

OBJECTIVE:

WAP for following logic gates using serial communication and 5 LEDs such that the following condition must satisfy.

Output of AND Gate-> LED1 should blink

Output of NAND Gate-> LED2 should blink

Output of NOR Gate-> LED3 should blink

Output of ExOR Gate-> LED4 should blink

Output of ExNOR Gate-> LED5 should blink

Software Used: Arduino IDE

Hardware Component Used:

| Sr. No | Name of Components | Value |
|--------|--------------------------------|---------------|
| 1. | Resistor (5) | 100 Ω |
| 2. | Light Emitting Diode (LED) (5) | Multi Colored |
| 3. | Arduino Uno R3 (1) | NA |
| 4. | Breadboard (1) | NA |
| 5. | Connecting Wires (9) | NA |

THEORY:

1. **Resistor:**

A two terminal device in circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines.

2. **LED:**

A **light-emitting diode (LED)** is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

3. **Arduino:**

An Arduino Uno is an open-source microcontroller board which is developed with multiple analog and digital input output pins that may be interacted to various circuits.

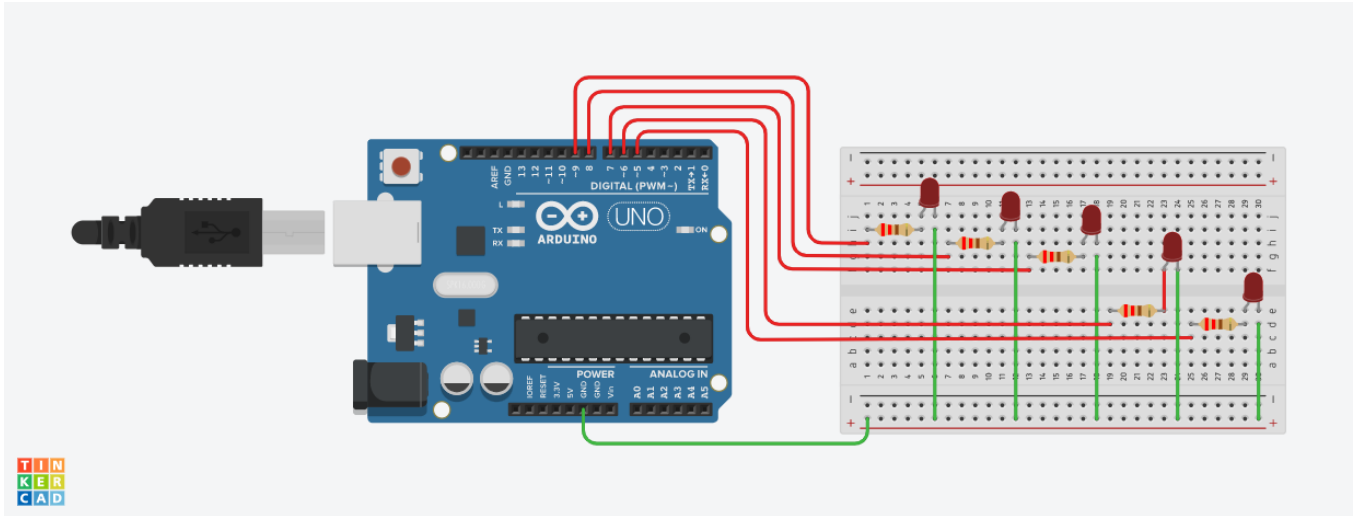
4. **Breadboard:**

A breadboard is a rectangular plastic board with a bunch of tiny holes in it which let in to easily insert electronic components to prototype.

5. **Connecting Wires:**

It provides a medium to an electrical current so that they can travel from one point on a circuit to another.

Circuit diagram:



CODE:

```
void setup()
{
  Serial.begin(9600);
  pinMode (5, OUTPUT);
  pinMode (6, OUTPUT);
  pinMode (9, OUTPUT);
  pinMode (13, OUTPUT);
  pinMode (11, OUTPUT);
}

void loop()
{
  int a = Serial.parseInt();
  int b = Serial.parseInt();
  int c=1;
  switch (c)
  {

  case 1:
  {
    if (a==0 && b==0)
    {
      digitalWrite(5, LOW);
    }
    if (a==0 && b==1)
    {
      digitalWrite(5, LOW);
    }
    if (a==1 && b==0)
    {
      digitalWrite(5, LOW);
    }
    if (a==1 && b==1)
    {
      digitalWrite(5, HIGH);
    }
  }
}
```



```
}  
}  
  
case 2:  
{  
if (a==0 && b==0)  
{  
digitalWrite(6, HIGH);  
}  
  
if (a==0 && b==1)  
{  
digitalWrite(6,HIGH);  
}  
  
if (a==1 && b==0)  
{  
digitalWrite(6,HIGH);  
}  
  
if (a==1 && b==1)  
{  
digitalWrite(6,LOW);  
}  
}  
  
case 3:  
{  
if (a==0 && b==0)  
{  
digitalWrite(9, HIGH);  
}  
  
if (a==0 && b==1)  
{  
digitalWrite(9, LOW);  
}  
  
if (a==1 && b==0)  
{  
digitalWrite(9, LOW);  
}  
  
if (a==1 && b==1)  
{  
    digitalWrite (9, LOW);  
}  
}  
  
case 4:  
{
```

```

if (a==0 && b==0)
{
digitalWrite(13, LOW);
}

if (a==0 && b==1)
{
digitalWrite(13, HIGH);
}

if (a==1 && b==0)
{
digitalWrite(13, HIGH);
}

if (a==1 && b==1)
{
digitalWrite(13,LOW);
}

}

case 5:
{
if(a==0 && b==0)
{
digitalWrite(11, HIGH);
}

if(a==0 && b==1)
{
digitalWrite(11, LOW);
}

if (a==1 && b==0)
{
digitalWrite(11, LOW);
}

if(a==1 && b==1)
{
digitalWrite(11, HIGH);
}
}
}

```

DISCUSSION:

In this experiment we learned how to display output of AND, NAND, NOR, ExOR, ExNOR gate using LEDs and Arduino and also we tried to make a code such that our LEDs blink whenever we input a suitable output of a gate in our serial communicator.8

