Task 1. Connect the circuit as shown in the picture:
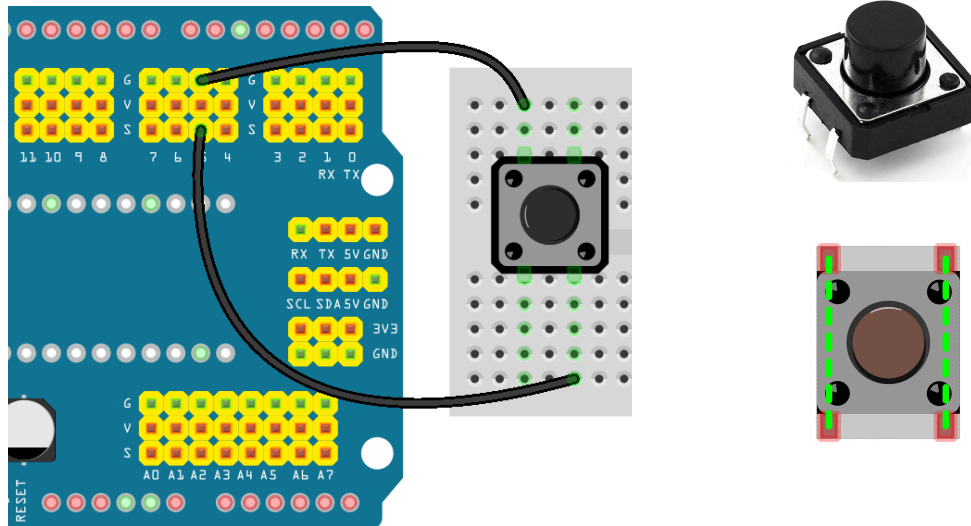

Code example:

```
#define BAUDRATE 115200

#define BUTTON1_PIN 5

int buttonstate;


void setup() {

 pinMode(BUTTON1_PIN,INPUT_PULLUP);

 Serial.begin(BAUDRATE); }


void loop() {

 buttonstate = digitalRead(BUTTON1_PIN);

 if(buttonstate == LOW)

     Serial.println("Button is down");

  else

     Serial.println("Button is up");

 delay(250); }
```

What's new:

digitalRead function, **_if_** statement, **_int_** type variable

Task 2. Using the circuit from Task 1, write a program that controls the built-in LED. The LED should be turned on if the button connected to DIO 5 is pressed.

```
#define BAUDRATE 115200
#define BUTTON1_PIN 5
int buttonstate;

void setup() {
 pinMode(LED_BUILTIN,OUTPUT);
 pinMode(BUTTON1_PIN,INPUT_PULLUP);
 Serial.begin(BAUDRATE); }

void loop() {
 buttonstate = digitalRead(BUTTON1_PIN);
 if(buttonstate == LOW) {
     digitalWrite(LED_BUILTIN,HIGH);
     Serial.println("Button is down"); }
  else {
     digitalWrite(LED_BUILTIN,LOW);
     Serial.println("Button is up"); }
 delay(250);
}
```

Task 3. Write a program that will blink (turn on and then turn off) the built-in LED 5 times, every time the DIO5 button is pressed.

```
#define BAUDRATE 115200
#define BUTTON1_PIN 5
int buttonstate;

void setup() {
```

```
pinMode(LED_BUILTIN,OUTPUT);
pinMode(BUTTON1_PIN,INPUT_PULLUP);
Serial.begin(BAUDRATE); }


void loop() {
 buttonstate = digitalRead(BUTTON1_PIN);
 if(buttonstate == LOW)
  for(int i=0;i<5;i++) {
   Serial.println(i);
 digitalWrite(LED_BUILTIN,HIGH);
 delay(500);
 digitalWrite(LED_BUILTIN,LOW);
 delay(500); }
 delay(250);
}
```

What's new:

    for expression, increment operator

Task 4. Using the code from the previous task, create a function that allows the user to define a number and period of blinks.

```
#define BAUDRATE 115200
#define BUTTON1_PIN 5
int buttonstate;

void setup() {
 pinMode(LED_BUILTIN,OUTPUT);
 pinMode(BUTTON1_PIN,INPUT_PULLUP);
 Serial.begin(BAUDRATE);
}
```

```
void loop() {
 buttonstate = digitalRead(BUTTON1_PIN);
 if(buttonstate == LOW)
   led_blink(5,1000);
 delay(250);
}


void led_blink(int times,int duration) {
 for(int i=0;i<times;i++) {
     Serial.println(i);
     digitalWrite(LED_BUILTIN,HIGH);
     delay(duration/2);
     digitalWrite(LED_BUILTIN,LOW);
     delay(duration/2); }
}
```

What's new:

       void function

Task 5. Write a program that works in the following way - if the DIO5 button is pressed, the built-in LED should be turned off, if the button is not pressed, the LED should be turned on.

```
#define BUTTON1_PIN 5

void setup() {
 pinMode(LED_BUILTIN,OUTPUT);
 pinMode(BUTTON1_PIN,INPUT_PULLUP); }

void loop() {
 digitalWrite(LED_BUILTIN,digitalRead(BUTTON1_PIN)); }
```

Task 6. Write a program that switches off the built-in LED, after 4 seconds from when the user releases the button.

Solution #1:

```
#define BUTTON1_PIN 5
int buttonstate;

void setup() {
pinMode(LED_BUILTIN,OUTPUT);
pinMode(BUTTON1_PIN,INPUT_PULLUP);
digitalWrite(LED_BUILTIN,HIGH);
}

void loop() {
 buttonstate = digitalRead(BUTTON1_PIN);
 if(buttonstate == LOW) {
 delay(100);
 while(buttonstate == LOW) {
  buttonstate = digitalRead(BUTTON1_PIN);
  delay(100); }
 delay(4000);
 digitalWrite(LED_BUILTIN,LOW);
 while(1);
 }
}
```

Solution #2:

```
#define BUTTON1_PIN 5

void setup() {
 pinMode(LED_BUILTIN,OUTPUT);
 pinMode(BUTTON1_PIN,INPUT_PULLUP);
```
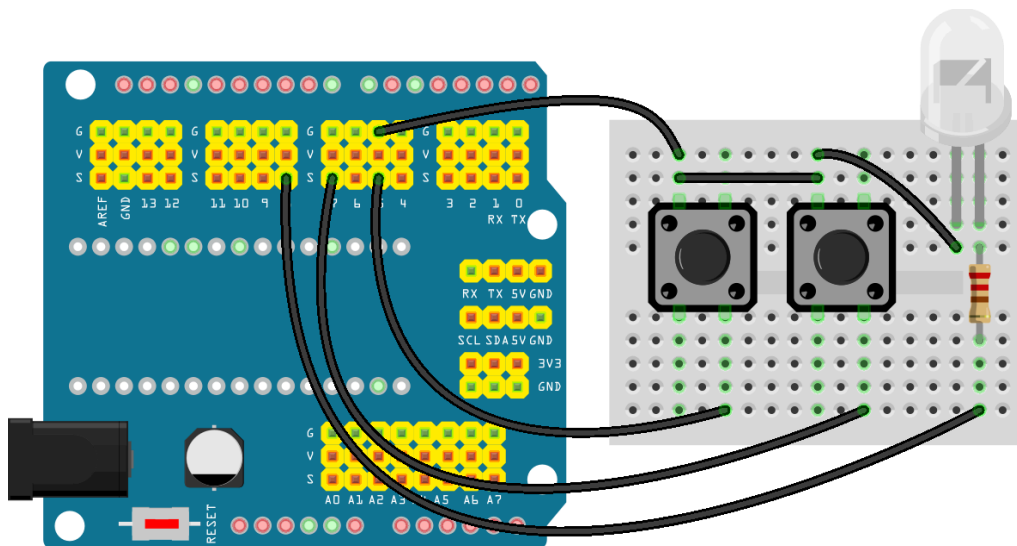
```
digitalWrite(LED_BUILTIN,HIGH); }


void loop() {
 if(digitalRead(BUTTON1_PIN) == LOW) {
  delay(100);
  while(digitalRead(BUTTON1_PIN) == LOW)
   delay(100);
  delay(4000);
  digitalWrite(LED_BUILTIN,LOW);
 while(1); } }
```

What's new:

> ***while*** expression

Task 7. Connect the circuit as shown in the picture. Write a program that works as follows - one button should turn on the LED, and the other should turn it off.
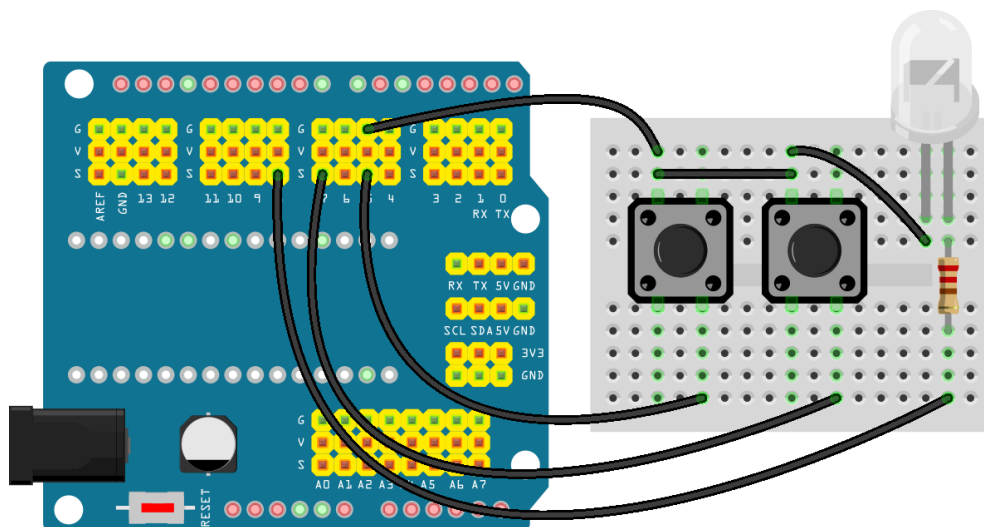


```
#define BUTTON1_PIN 5
#define BUTTON2_PIN 7
#define LED_PIN 8
```

```
void setup() {
 pinMode(LED_PIN,OUTPUT);
 pinMode(BUTTON1_PIN,INPUT_PULLUP);
 pinMode(BUTTON2_PIN,INPUT_PULLUP);
 digitalWrite(LED_PIN,LOW);  }

void loop() {
 if(digitalRead(BUTTON1_PIN) == LOW) {
  digitalWrite(LED_PIN,HIGH);
  delay(100);
  while(digitalRead(BUTTON1_PIN) == LOW);
  while(digitalRead(BUTTON2_PIN) == HIGH);
  digitalWrite(LED_PIN,LOW);
 }
 delay(100);
}
```

Task 8. Built a prototype of a device that controls the state of an LED with one button.

```
#define BUTTON_PIN 5
#define LED_PIN 8
bool led_state=LOW;


void setup() {
 pinMode(LED_PIN,OUTPUT);
 pinMode(BUTTON_PIN,INPUT_PULLUP);
 digitalWrite(LED_PIN,led_state); }


void loop() {
 if(button_pressed(BUTTON_PIN)) {
  led_state = !led_state;
  digitalWrite(LED_PIN,led_state);
 }
 delay(100);
}


bool button_pressed(int button_pin) {
 if(digitalRead(button_pin) == LOW) {
  delay(100);
  while(digitalRead(button_pin) == LOW);
  return true;
 }
 else
  return false;
}
```

Task 9. Built a prototype of a device that measures the user's reaction time.

Hint:

```
#define BAUDRATE 115200
unsigned long timer;
```

```
void setup() {
 Serial.begin(BAUDRATE);
 Serial.println(timer); }


void loop() {
 timer = millis();
 Serial.println(timer);
 delay(500); }
```

What's new:

> **millis()** function, **unsigned long** data type.

Function **millis()** returns the number of milliseconds passed since the Arduino board began running the program. This number will overflow (go back to zero), after approximately 50 days.

Reference:

> www.arduino.cc/reference/en/language/functions/time/millis/

Task 10. Built a prototype of a device that blinks 3 LEDs. The first LED should blink once per second, the second LED twice, and the third LED three times per second. Using *millis()* function is mandatory.

For those interested:

1. Basics of Tactile Switches:

    components.omron.com/us-en/ds_related_pdf/A293-E1.pdf

2. The debounce debacle:

    www.edn.com/the-debounce-debacle/

3. Pull-up Resistors:

    learn.sparkfun.com/tutorials/pull-up-resistors

Solution for task 9

```
#define BAUDRATE 9600
#define BUTTON1_PIN 7
int buttonstate;
int start_time;
int result;

void setup() {
pinMode(LED_BUILTIN,OUTPUT);
pinMode(BUTTON1_PIN,INPUT_PULLUP);
Serial.begin(BAUDRATE);
digitalWrite(LED_BUILTIN,HIGH);}

void loop() {
 digitalWrite(LED_BUILTIN,HIGH);
 Serial.println("Reaction time meter");
 Serial.println("Press the button after the LED is off.");
 delay(4000);
 buttonstate = digitalRead(BUTTON1_PIN);
 while(buttonstate != HIGH) {
   Serial.println("Please remove your finger from the button");
   buttonstate = digitalRead(BUTTON1_PIN);
   delay(1000);}
 digitalWrite(LED_BUILTIN,LOW);
 start_time = millis();
 buttonstate = digitalRead(BUTTON1_PIN);
 while(buttonstate == HIGH)
   buttonstate = digitalRead(BUTTON1_PIN);
 result = millis() - start_time;
 Serial.print("Result: ");
 Serial.println(result);
 while(1); }
```