Automated and data-driven chemistry

LECTURE 6 :
Elements of Robotics
Practical Session

Pascal Miéville
Florian de Nanteuil
Edy Mariano
Jean-Charles Cousty

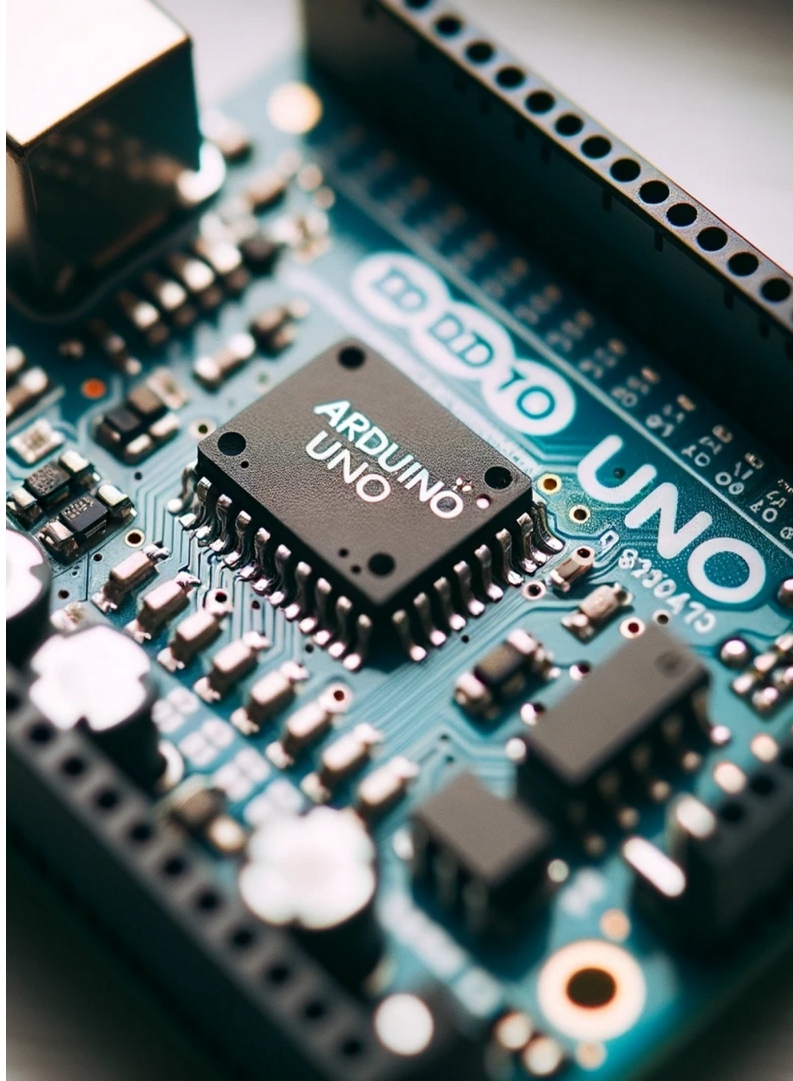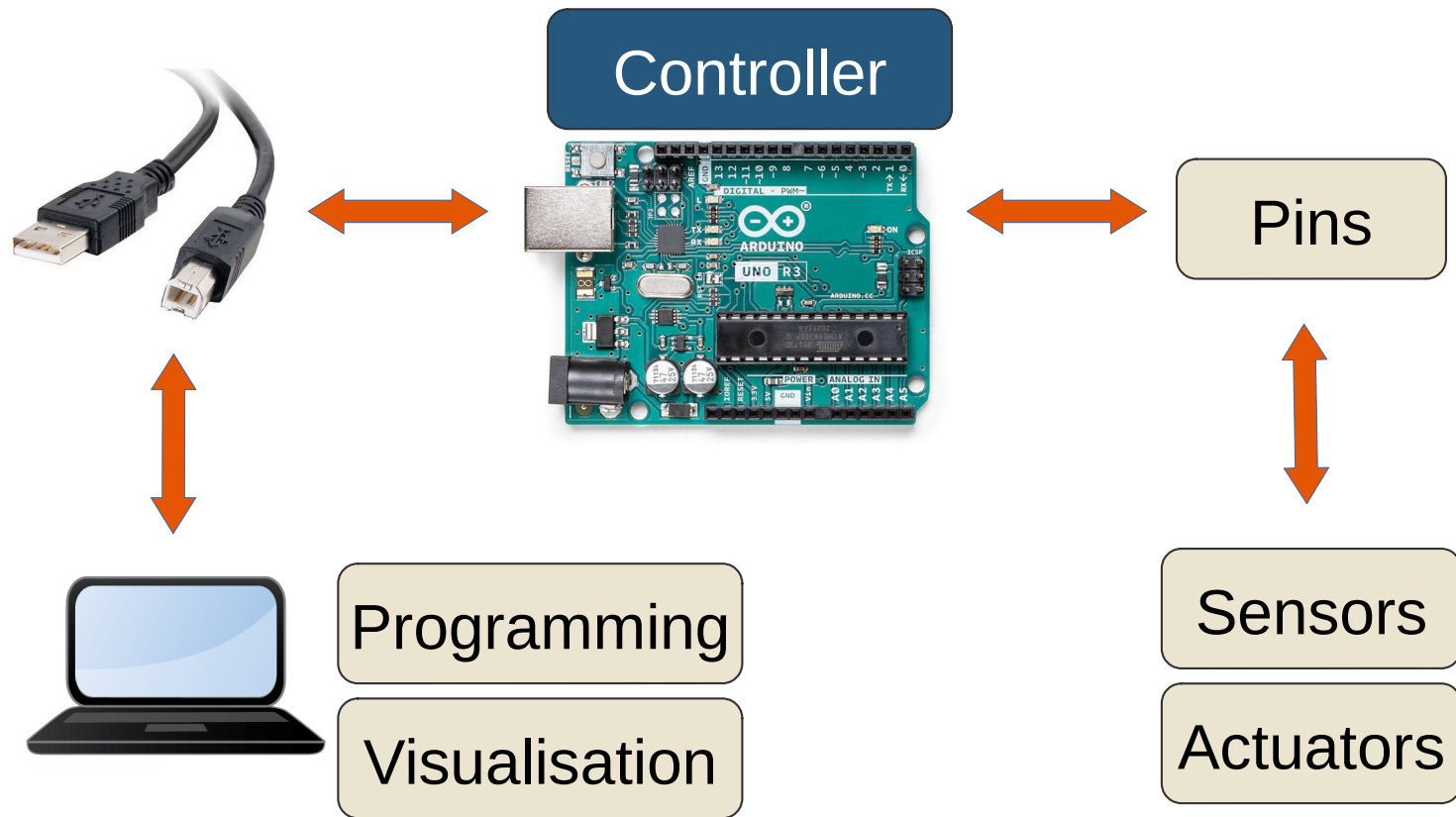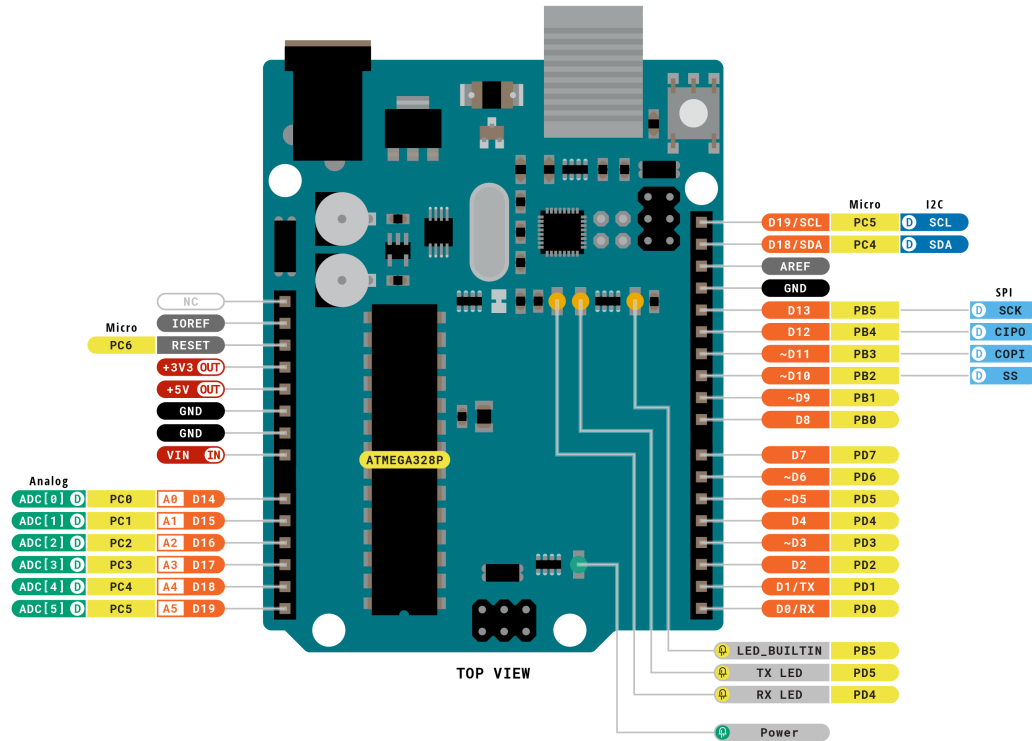**01** What is Arduino ?

02 Arduino IDE

03 Practice

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EPFL

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1. What is Arduino ?

What is Arduino ?

Controller

Pins

Programming

Visualisation

Sensors

Actuators

What is Arduino ?

TOP VIEW

Legend:	Digital	I2C
Power	Analog	SPI
Ground	Main Part	Analog

ARDUINO UNO REV3
SKU code: A000066
Pinout
Last update: 6 Oct, 2022

What is Arduino ?

Documentation

https://www.arduino.cc/reference/en/

Download

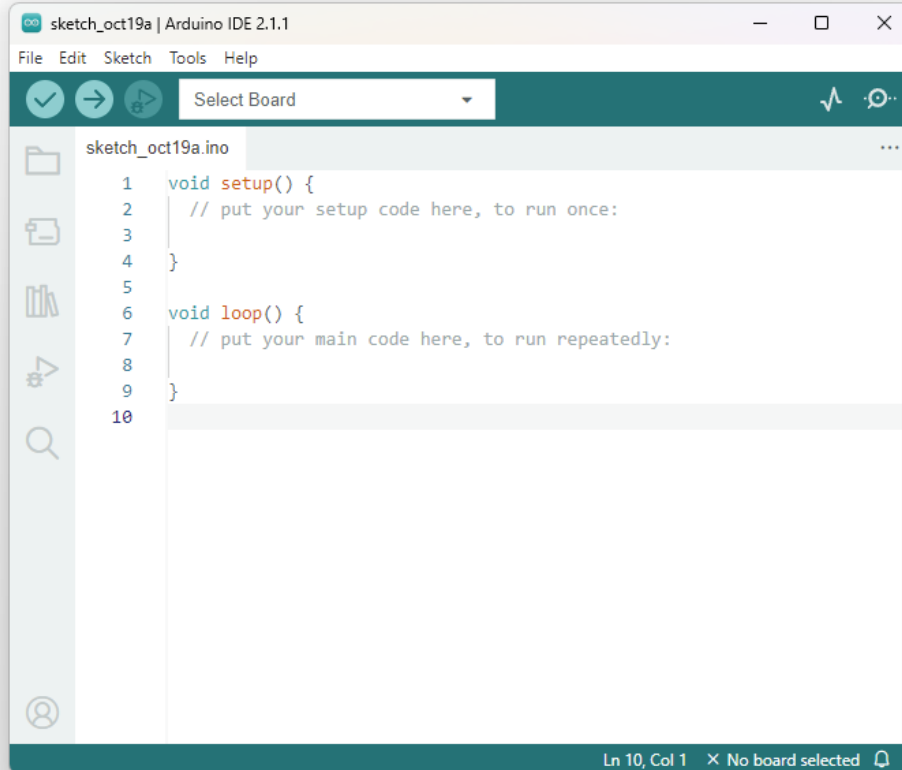https://www.arduino.cc/en/software

1. Arduino IDE
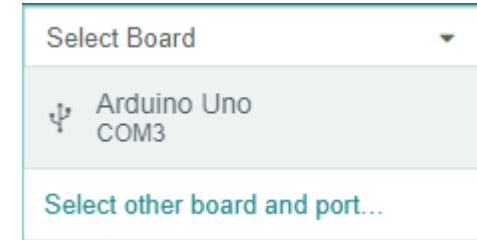
Arduino IDE

Software to program Arduino boards

Verify your program synthax and check if there are errors

Upload your program into the Arduino board through the USB cable

Select Board type depending on the Arduino model that is connected to the PC

Arduino IDE

Code Editor

```
sketch_oct19a.ino
1   void setup() {
2     // put your setup code here, to run once:
3
4   }
5
6   void loop() {
7     // put your main code here, to run repeatedly:
8
9   }
10
```

It is always composed of a minimum of 2 functions.

Setup
It runs once. Typically contains initialisations, communication definitions, …

Loop
It runs repeatedly. Typically contains the core logic of the program, handle input and output

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Arduino IDE

Functions

Performs a specific action or calculation
Always in the following format

functionName(parameter 1, parameter 2, ...)

```
1 void setup() {
2   pinMode(1, OUTPUT);    // sets the digital pin 1 as output
3 }
4
5 void loop() {
6   digitalWrite(1, HIGH); // sets the digital pin 1 on
7 }
```

Arduino IDE

Variables

Used to store a specific value (number, text, ...)
Always in the following format

VariableType variableName

```
1 int pinNumber = 1; // Store the value 1 in the variable pinNumber to use it after
2
3 void setup() {
4   pinMode(pinNumber, OUTPUT);
5 }
6
7 void loop() {
8   digitalWrite(pinNumber, HIGH);
9 }
```

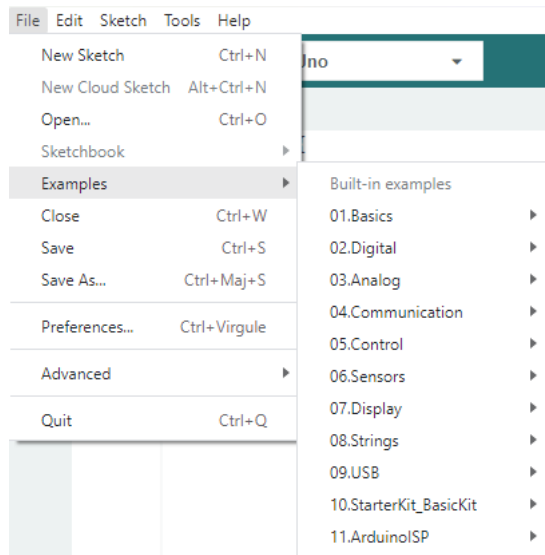Automated and data-driven chemistry

Structures

Control Structures are used to create the logic of the program, for example conditions

if (condition) {statement(s)}

```
1  int pinNumber = 1;
2  bool isReady = false;
3
4  void setup() {
5    pinMode(pinNumber, OUTPUT);
6  }
7
8  void loop() {
9    if(isReady == true){
10     digitalWrite(pinNumber, HIGH);
11   }
12 }
```

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Arduino IDE

Examples Programs

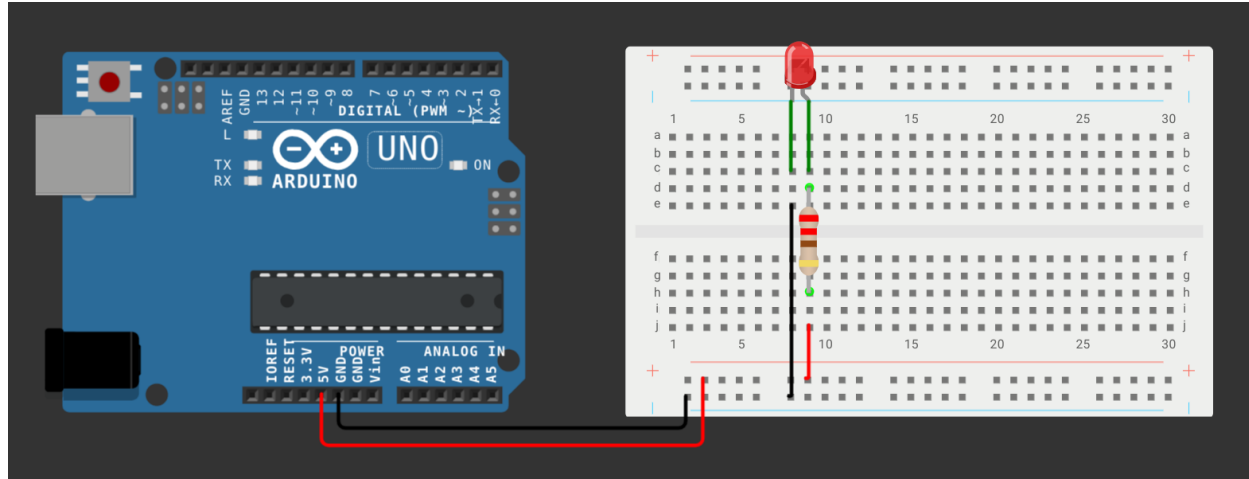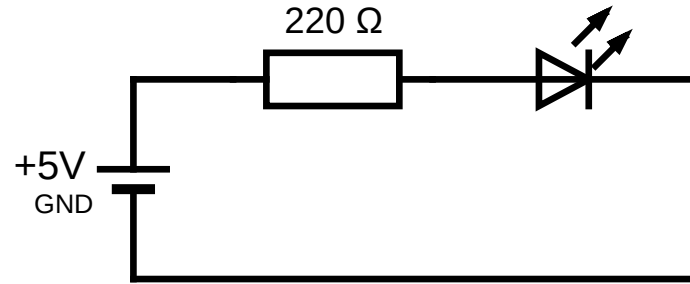Basic examples about typical applications


```
Blink.ino
1   /*
2     Blink
3
4     Turns an LED on for one second, then off for one second, repeatedly.
5
6     Most Arduinos have an on-board LED you can control. On the UNO, MEGA and ZERO
7     it is attached to digital pin 13, on MKR1000 on pin 6. LED_BUILTIN is set to
8     the correct LED pin independent of which board is used.
9     If you want to know what pin the on-board LED is connected to on your Arduino
10    model, check the Technical Specs of your board at:
11    https://www.arduino.cc/en/Main/Products
12
13    modified 8 May 2014
14    by Scott Fitzgerald
15    modified 2 Sep 2016
16    by Arturo Guadalupi
17    modified 8 Sep 2016
18    by Colby Newman
19
20    This example code is in the public domain.
21
22    https://www.arduino.cc/en/Tutorial/BuiltInExamples/Blink
23  */
24
25  // the setup function runs once when you press reset or power the board
26  void setup() {
27    // initialize digital pin LED_BUILTIN as an output.
28    pinMode(LED_BUILTIN, OUTPUT);
29  }
30
31  // the loop function runs over and over again forever
32  void loop() {
33    digitalWrite(LED_BUILTIN, HIGH);   // turn the LED on (HIGH is the voltage level)
34    delay(1000);                       // wait for a second
35    digitalWrite(LED_BUILTIN, LOW);    // turn the LED off by making the voltage LOW
36    delay(1000);                       // wait for a second
37  }
38
```
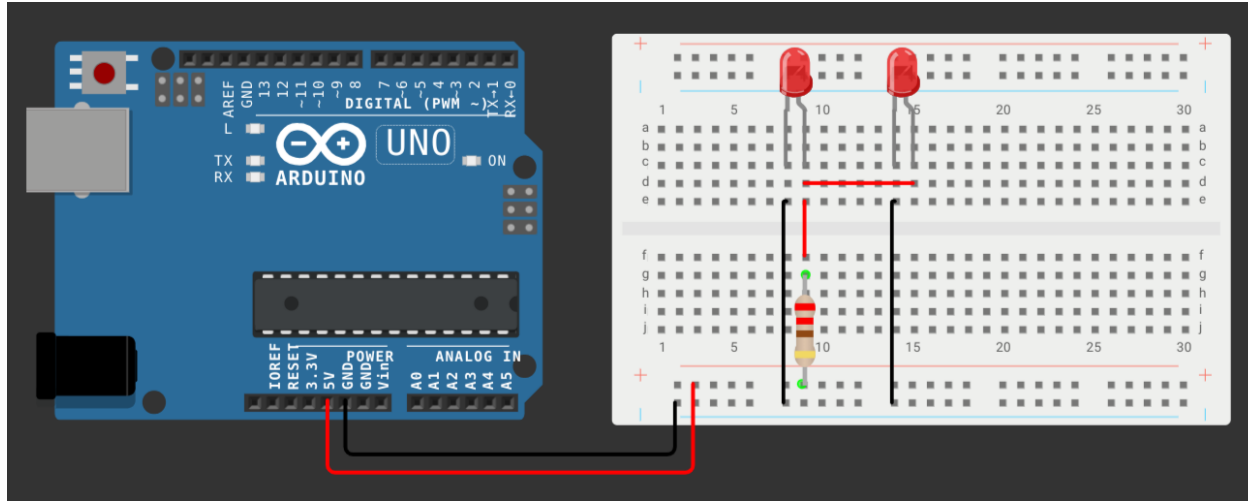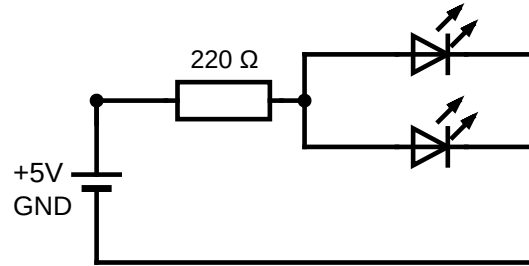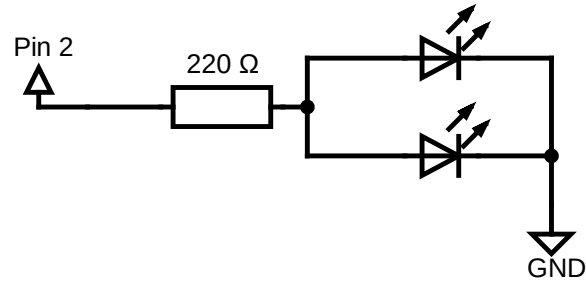
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1. Practice

Exercice 1 - LED

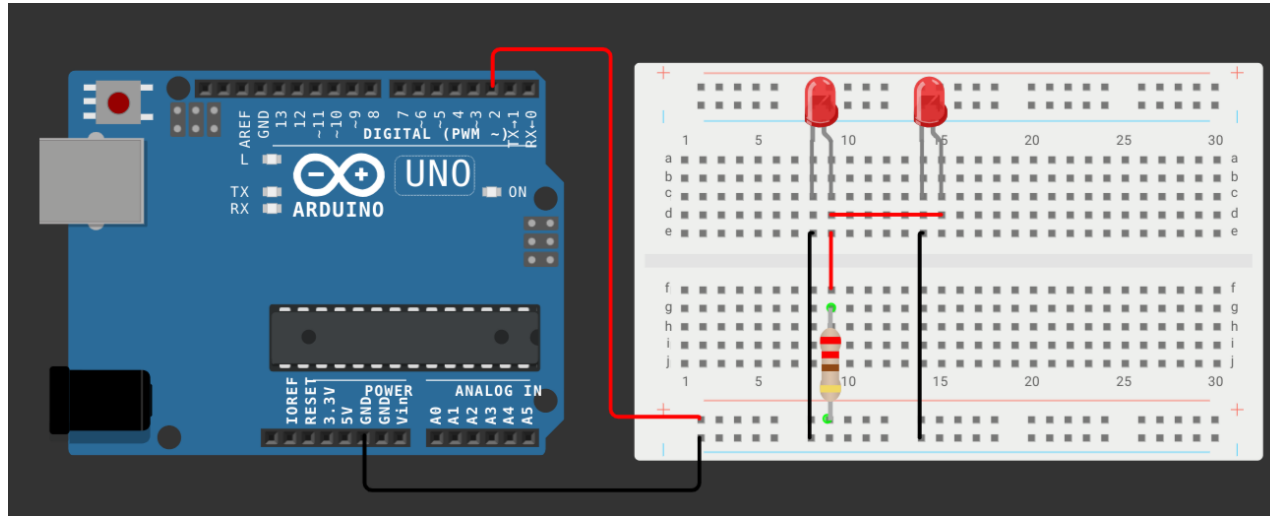# Exercice – LED in Parallel

Exercice – LED blink

```
1  void setup() {
2    pinMode(2, OUTPUT);
3  }
4
5  void loop() {
6    digitalWrite(2, HIGH);
7    delay(1000);
8    digitalWrite(2, LOW);
9    delay(1000);
10 }
```
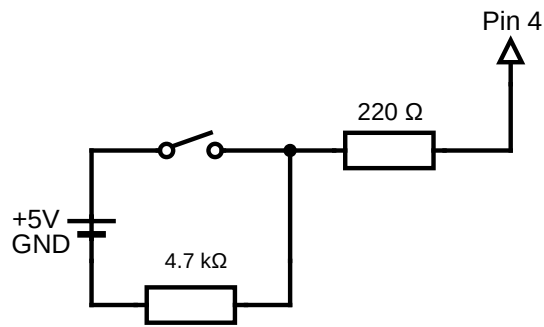
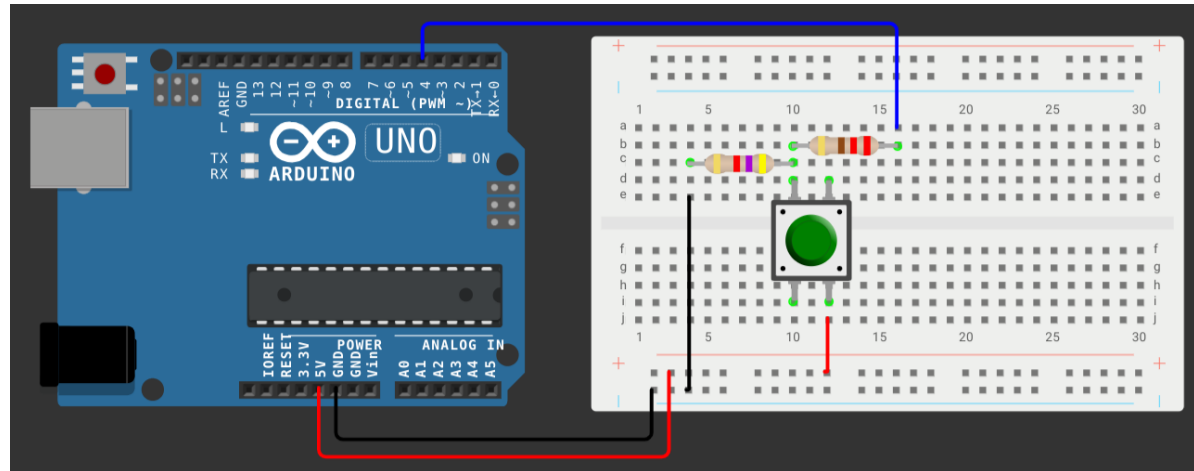Make a circuit with 4 LED of different colors blinking one after the others.

They must blink a certain amount of time and it can be easily modified (use of variable)

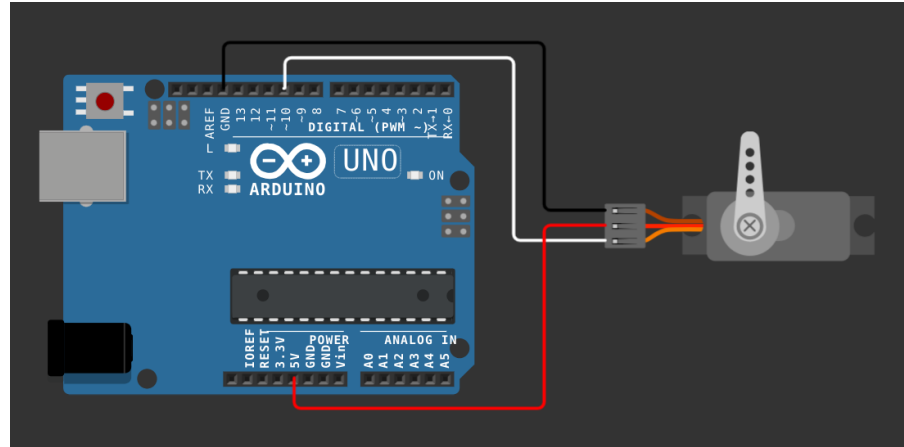The order of the led blinking can also be changed easily (use of variable)

Exercice – Button

Pin 4

```
int buttonState = LOW;

void setup() {
  pinMode(4, INPUT);
}

void loop() {
  buttonState = digitalRead(4);
}
```

220 Ω

+5V
GND

4.7 kΩ

Exercice – Button and LED

Make a circuit with a button and a LED. When the button is pressed, it will light on the LED. If it is not pressed, it will light off the LED.

Exercice – Servo

```
1  #include <Servo.h>
2
3  Servo myservo;
4
5  void setup() {
6    // The servo control wire is connected to Arduino D2 pin.
7    myservo.attach(12);
8  }
9
10 void loop() {
11   myservo.write(135);
12   delay(1000);
13
14   myservo.write(90);
15   delay(1000);
16
17   myservo.write(45);
18   delay(1000);
19
20   myservo.write(90);
21   delay(1000);
22 }
```

Make a circuit with 2 buttons and a Servo.

When the first button is clicked, the Servo will turn during a certain amount of time clock-wise.

When the second button is clicked, the Servo will turn during a certain amount of time counter clock-wise

Theoretical Session

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Conclusion

Thank you for your attention.

Thanks to

Swiss CAT+ team & partners

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

ETH-RAT

EPFL

Innosuisse

Gimp, Ubuntu Foundation