

Robotics

LED control

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Basics

● Voltage

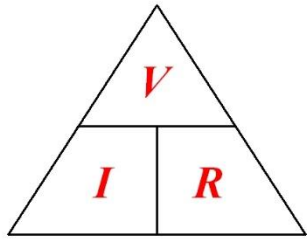
- Difference of electric potential between two points
- Unit: Volt (V)

● Intensity (Electric Current)

- A flow of electric charge
- Unit: Ampere (A)

● Resistance

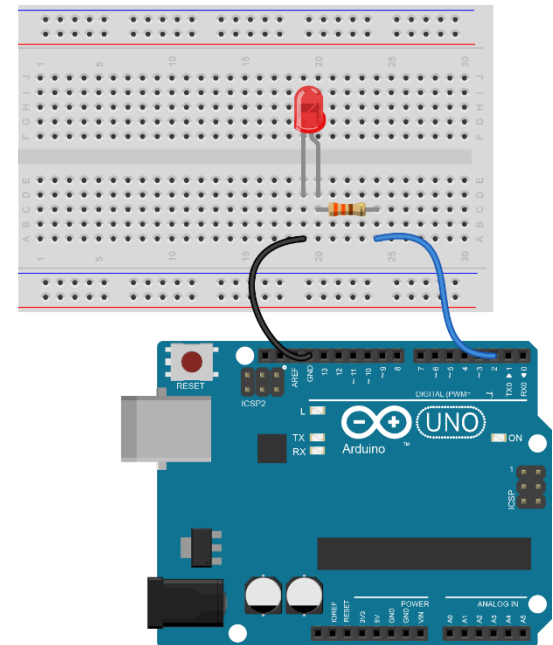
- Opposition to the passage of an electric current
- Unit: Ohm (Ω)

$$V = I R$$


$$I = \frac{V}{R}$$

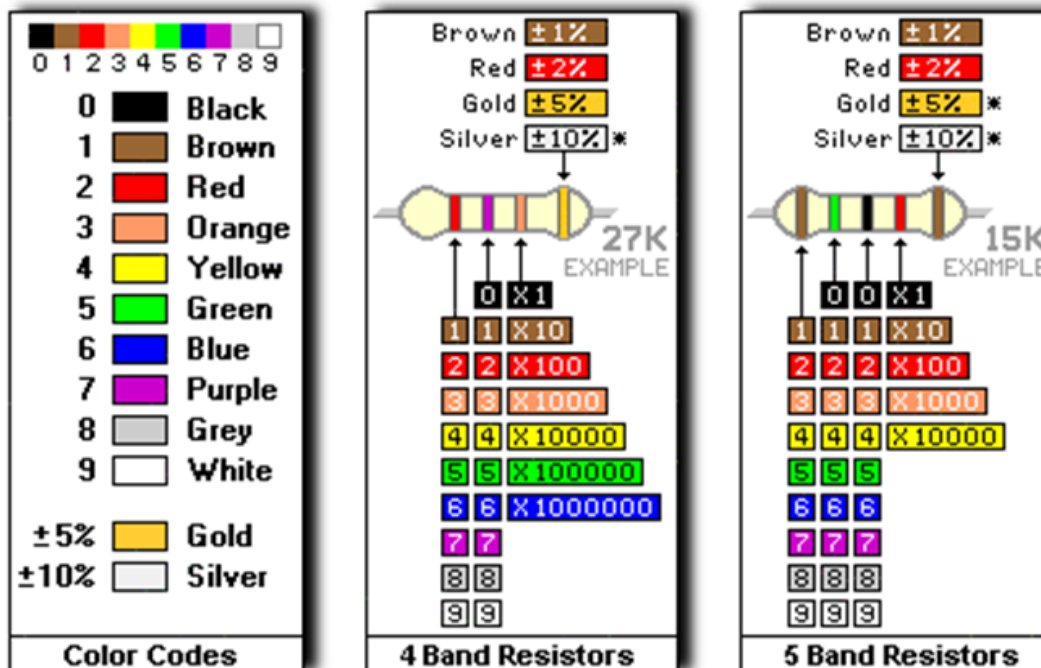
Ohm's law

$$R = \frac{V}{I}$$



Basics [cont.]

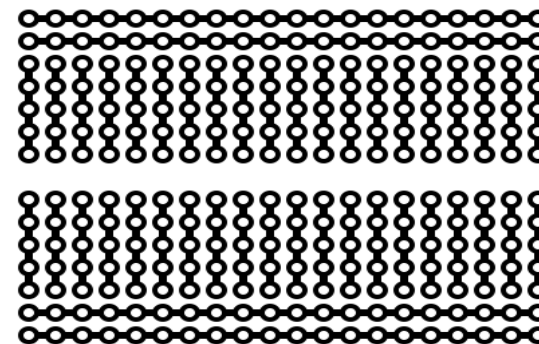
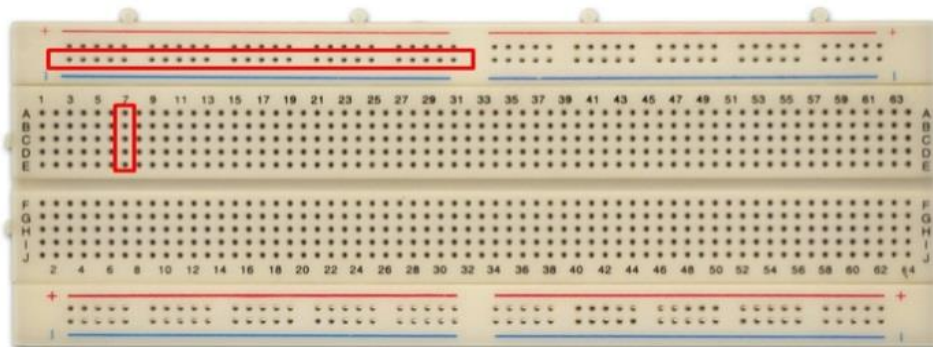
● How to read resistor



Basics [cont.]

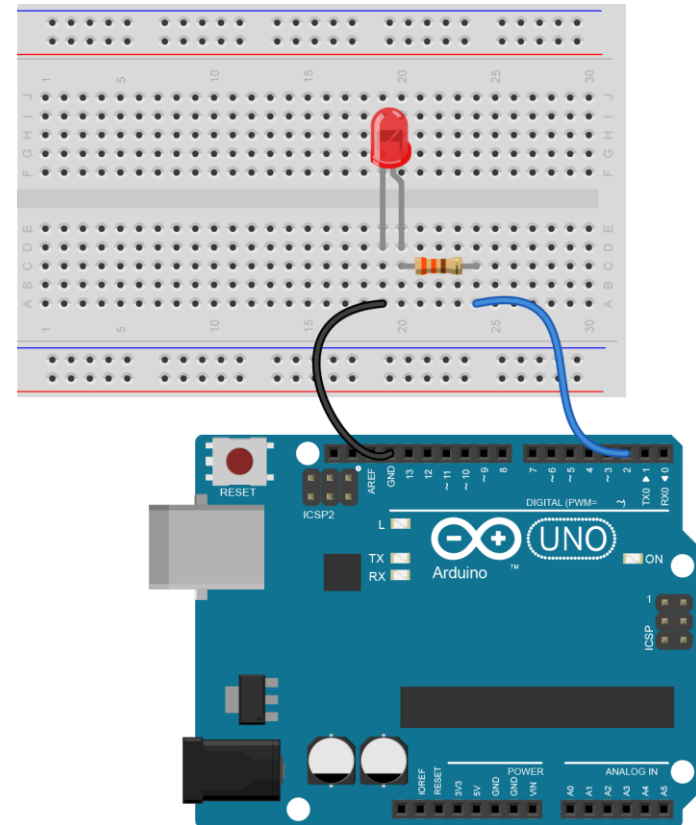
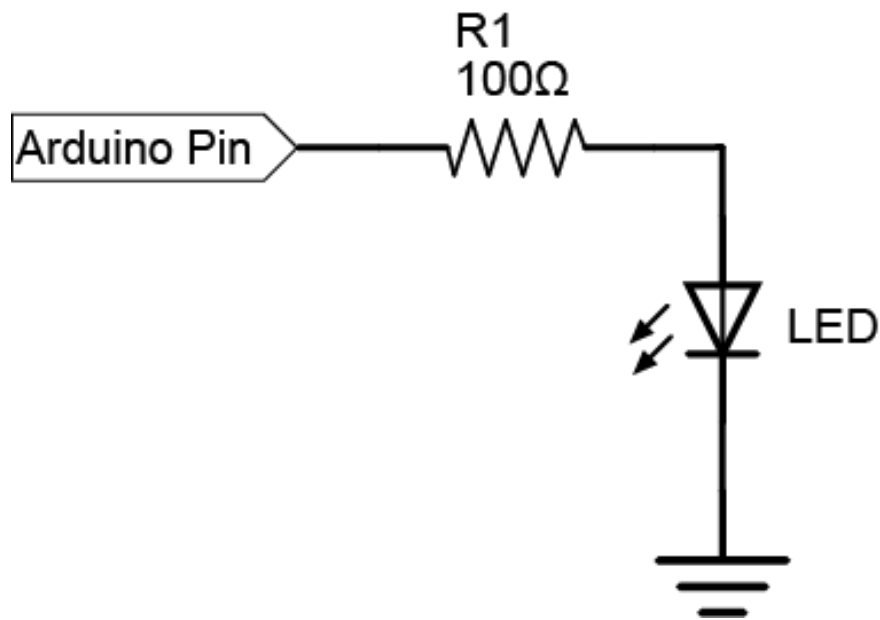
● Breadboard

- Construction base for prototyping of electronics
- Makes it easy to use for creating temporary prototypes and experimenting with circuit designs



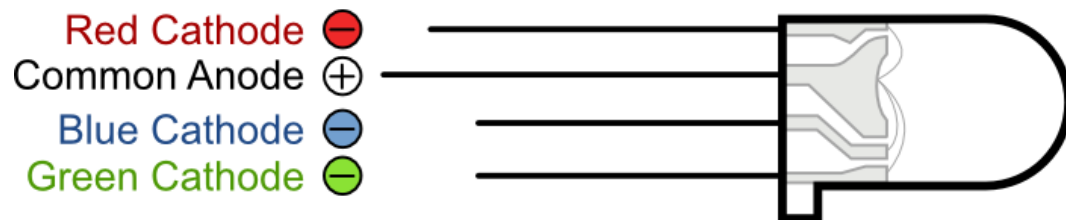
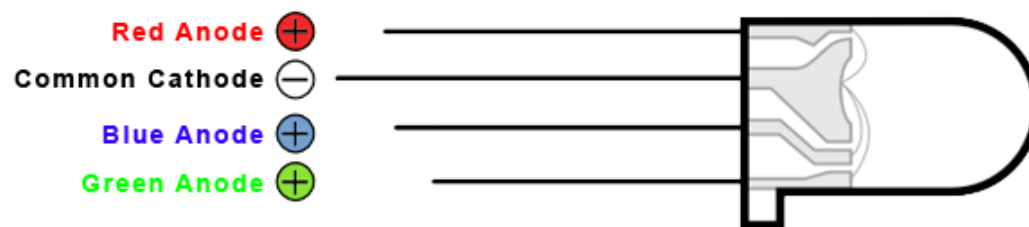
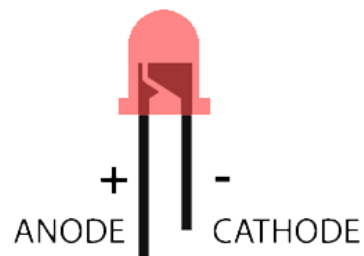
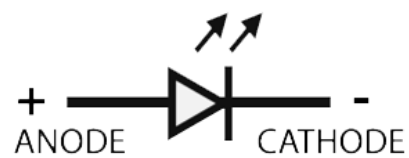
Basics [cont.]

- Try to make an LED pin blink in a pattern on a pin of your choice



Basics [cont.]

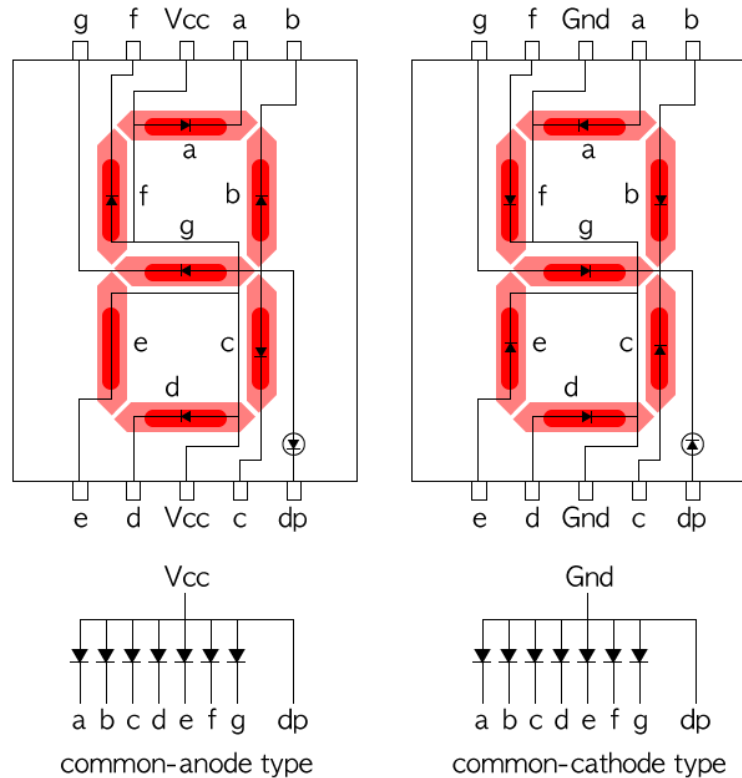
● LEDs



Basics [cont.]

● FND(Flexible Numeric Display) - 7segment

- Display device for displaying Arabic numerals using a LED / a LCD



Functions

● pinMode()

- Configures the specified pin to behave either as an input or an output

- Syntax

- pinMode(pin, mode)

- pin: the pin number
 - mode: INPUT, OUTPUT

- Example

```
void setup() {  
    pinMode(13, OUTPUT);    // sets the digital pin as output  
    pinMode(12, INPUT);     // sets the digital pin as input  
}
```


Functions [cont.]

● digitalWrite()

- Write a value to a digital pin

- Syntax

- digitalWrite(pin, value)

- pin: the pin number
 - value: HIGH or LOW

- Example

```
void loop() {  
    digitalWrite(13, HIGH)    // sets the LED on  
    delay(1000)              // waits for a second  
}
```

Functions [cont.]

● delay()

- Pauses the program for the amount of time (in milliseconds) specified as parameter
 - (There are 1000 milliseconds in a second.)
- Syntax
 - delay(ms)
 - ms: the number of milliseconds to pause (*unsigned long*)
- Example

```
void loop() {  
    digitalWrite(13, HIGH);    // sets the LED on  
    delay(1000);              // waits for a second  
}
```

Functions [cont.]

● digitalRead()

- Reads the value from a specified digital pin, either HIGH or LOW
- Syntax
 - digitalRead(pin)
 - pin: the number of the digital pin you want to read (*int*)
- example

```
void setup() {  
    pinMode(13, OUTPUT);    // sets the digital pin as output  
    pinMode(12, INPUT);    // sets the digital pin as input  
}  
  
void loop() {  
    int value = digitalRead(12);    // read the input pin  
    digitalWrite(13, value);    // sets the LED on/off by value  
}
```

Functions [cont.]

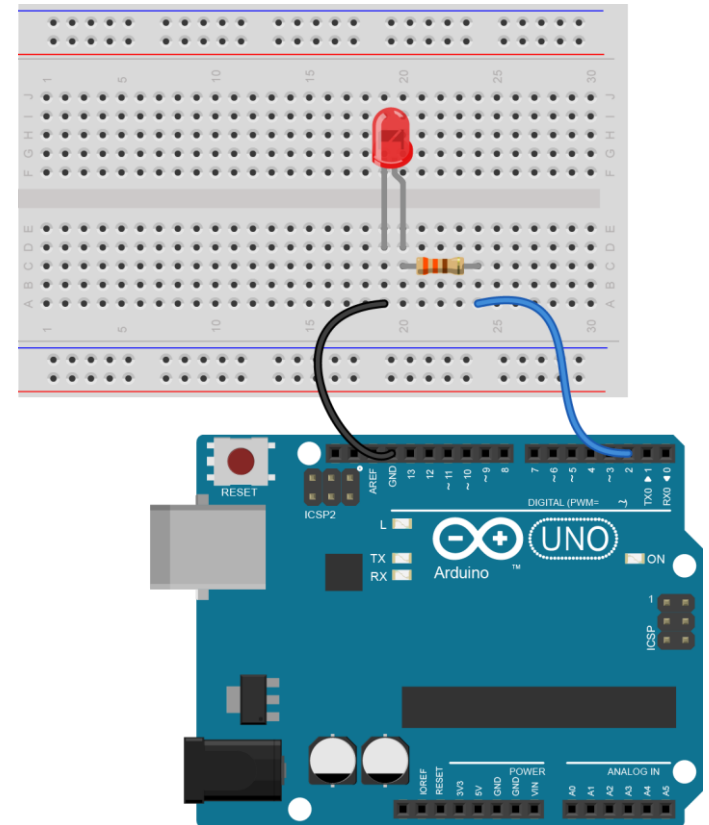
● **analogWrite(pin, value)**

- Writes an analog value (PWM wave) to a pin
- **This function works on pins 3, 5, 6, 9, 10, and 11**
- Syntax
 - analogWrite(pin, value)
 - pin: the pin to write to, value: the duty cycle: between 0 and 255
- example

```
void loop() {  
  for(int i=0;i<256;i++) {  
    analogWrite(3,i);  
    delay(10);  
  }  
}
```

Lab. 1 - GND

- Turn on LED to cross at 1 second interval (page 5)
- (page 5)
 - Reads the value from a specified digital pin, either **HIGH** or **LOW**.
 - turn the LED on (HIGH is the voltage level)
 - wait for a second
 - turn the LED off by making the voltage LOW
 - wait for a second



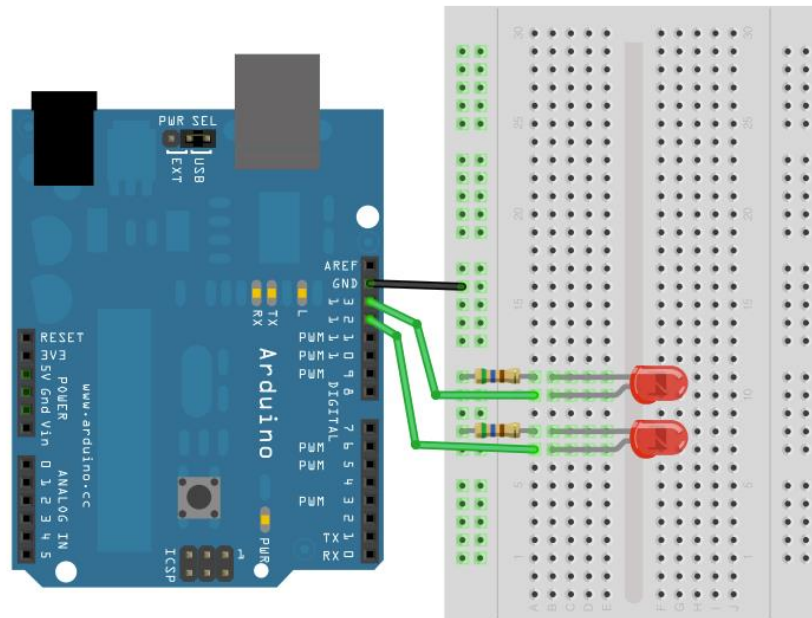
Lab. 2 - Blinking

- Turn on two LEDs to cross at 0.1 second interval
 - Turn on one LED → Turn off the LED after a period of time → Turn on the other LED
 - Define two variables for two output pins

Lab. 2 - Blinking [cont.]

● Circuit diagram:

- Prepare two LEDs and a 220Ω resistor
- Connect the anode of your blue and red LEDs to digital output Dpin 12, 13 on your board, respectively
- Connect a 220Ω resistor between the cathode and ground



Lab. 3 - Fading

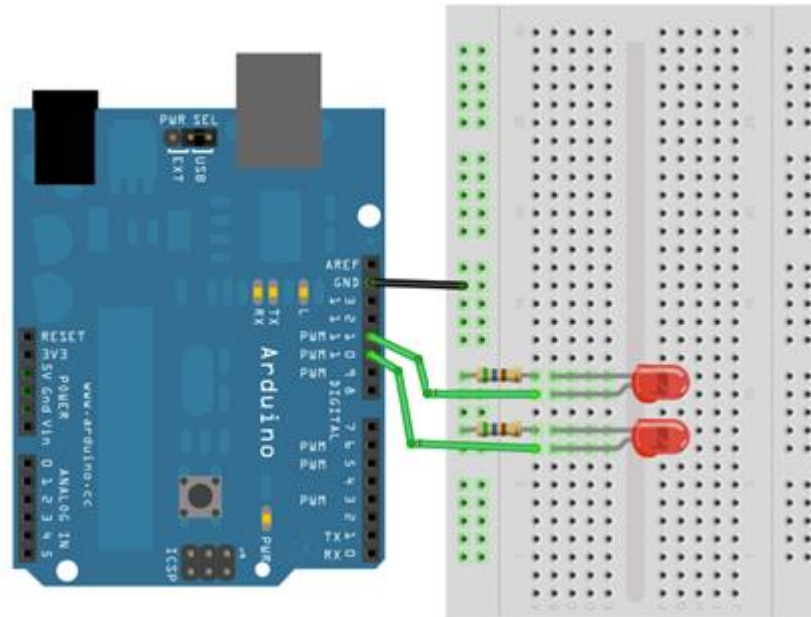
● Fade two LEDs to cross repeatedly

- While one LED is increasingly brighter, and another LED is to be getting darker
- Writes an analog value (PWM wave) to a pin
 - Value : 0~255

Lab. 3 – Fading [cont.]

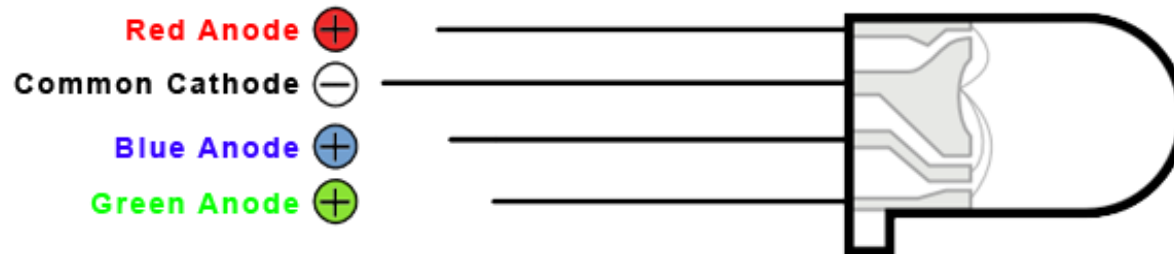
● Circuit diagram:

- Prepare two LEDs and a 220Ω resistor
- Connect the anode of your blue and red LEDs to digital output Dpin ~10, ~11 on your board, respectively
- Connect a 220Ω resistor between the cathode and ground



Lab. 4 - RGB LED

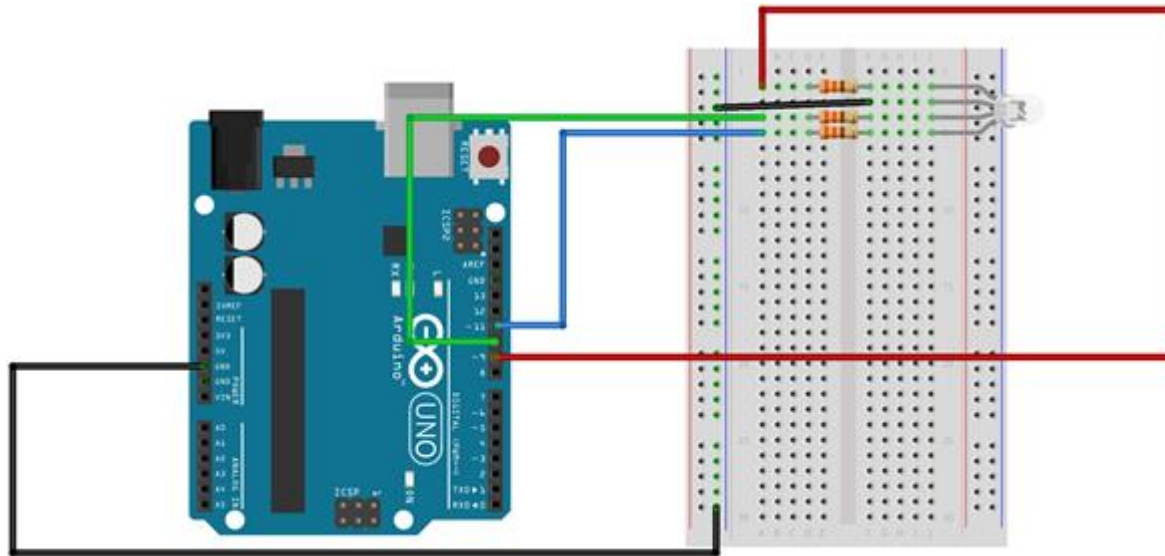
- Describe repeatedly different colors Using the RGB LED
 - Make functions for Red, Green, Blue, Make combinations of colors



Lab. 4 - RGB LED [cont.]

● Circuit diagram:

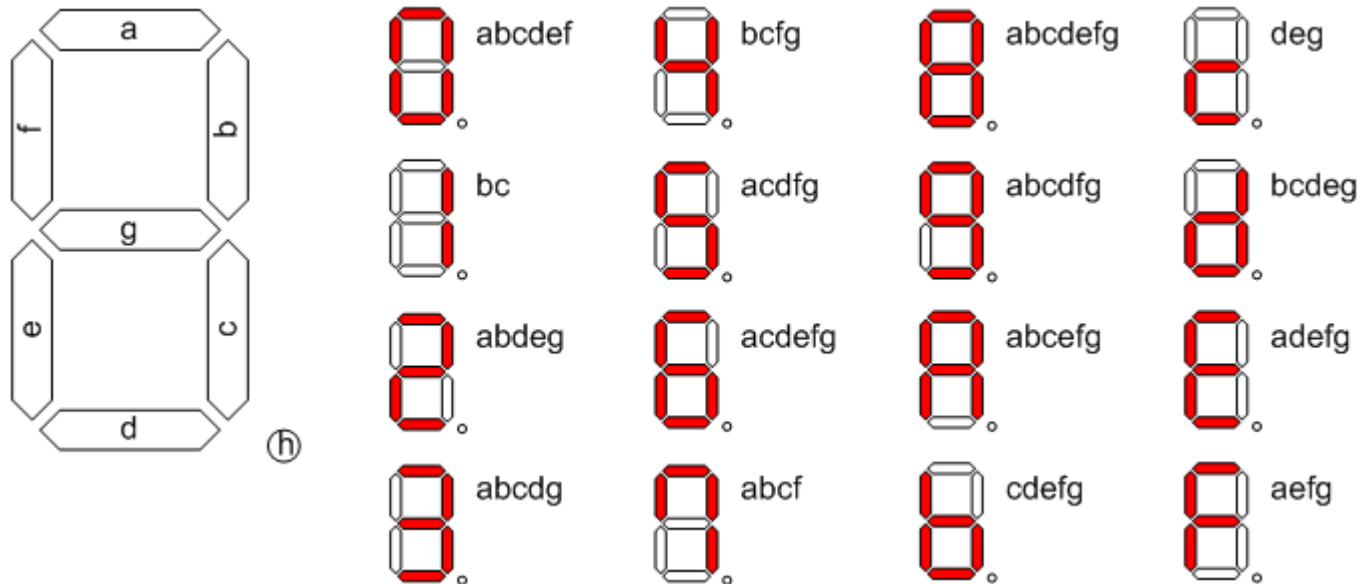
- RGB LED is consist of three anode pins and a cathode
- Connect each Anode pin 220 Ω to a resistor
- Connect each Anode with a resistor to Dpin 9, 10, 11, respectively



Lab. 5 - FND

● Make a countdown timer using FND

- value = LOW → a LED turns on



Lab. 5 - FND [cont.]

●Circuit diagram:

