Arduino: RGB LEDs
Diagrams & Code

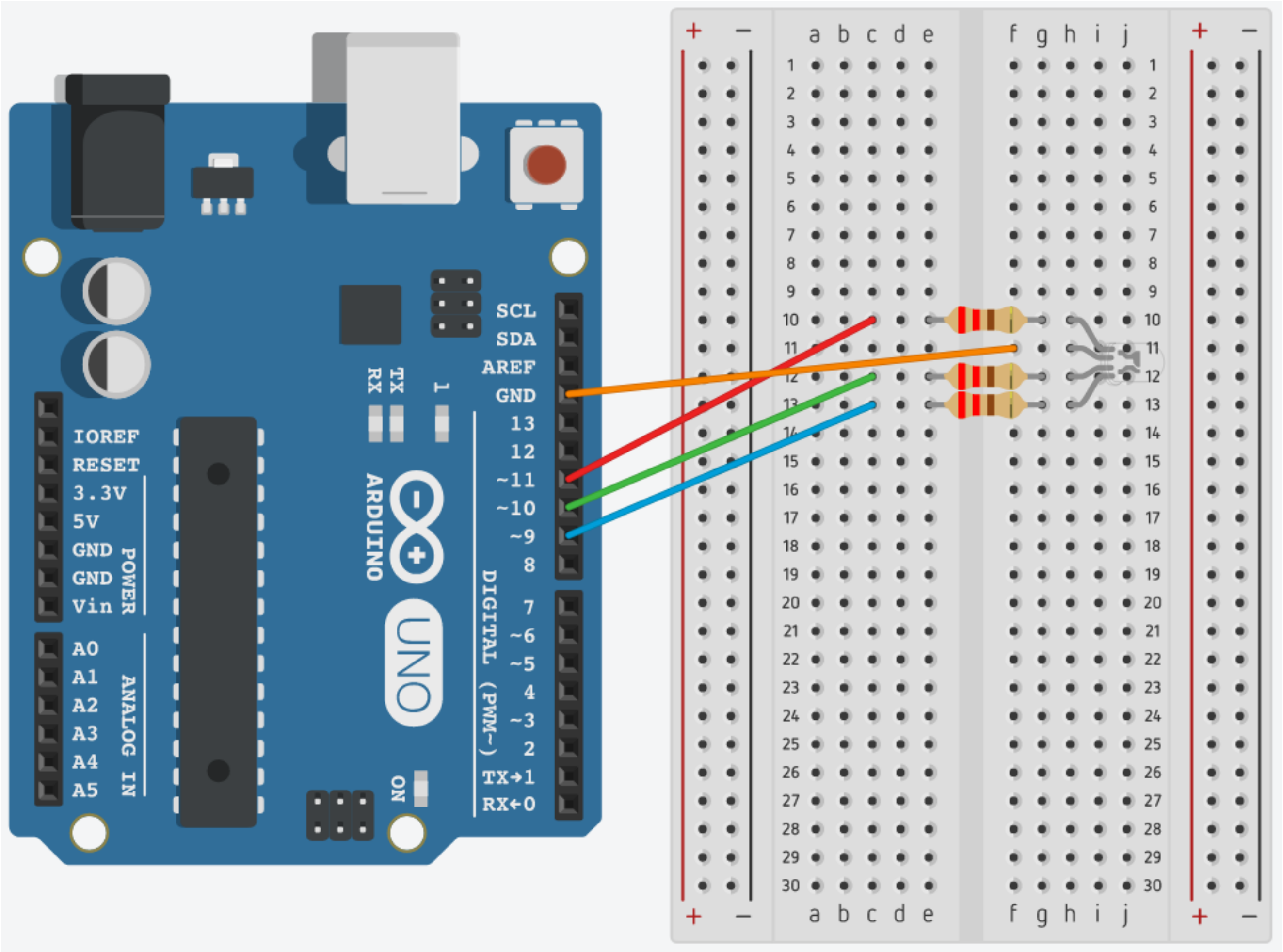
Brown County Library

Projects 01 & 02: Blinking RGB LED & Smooth Transition

Components needed:

- Arduino Uno board
- breadboard
- RGB LED (common **cathode**)
    - If you have a common anode RGB LED, look at the common anode instructions and code beginning on page 10 of this document.
- 4 jumper wires
- 3 220 ohm resistors

Connect long PIN to ground



```
/*
RGB LED 01 : Blinking RGB LED
Source: Code modified from Adafruit Arduino - Lesson 3. RGB LED
(https://learn.adafruit.com/adafruit-arduino-lesson-3-rgb-leds)
For use with a common cathode RGB LED
*/

int redPin = 11;          // red pin is connected to 11
int greenPin = 10;        // green pin is connected to 10
int bluePin = 9;          // blue pin is connected to 9

void setup() {
  pinMode(redPin, OUTPUT);      // set all three pins as outputs
  pinMode(greenPin, OUTPUT);
  pinMode(bluePin, OUTPUT);
}

void loop() {
  setColor(255, 0, 0);    // red
  delay(1000);            // wait one second
  setColor(0, 255, 0);    // green
  delay(1000);            // wait one second
  setColor(0, 0, 255);    // blue
  delay(1000);            // wait one second
}

void setColor(int red, int green, int blue) {
  // set the three pins:
  analogWrite(redPin, red);             // brightness of redPin
  analogWrite(greenPin, green);         // brightness of greenPin
  analogWrite(bluePin, blue);           // brightness of bluePin
}
```

Experimenting with more colors

Try adding different colors to your blinking pattern. You can copy and paste the code below into the loop function of Project 01 to create a loop of six blinking colors. Try finding a RGB color picker online (such as this one: http://www.rapidtables.com/web/color/RGB_Color.htm) to create your own colors.

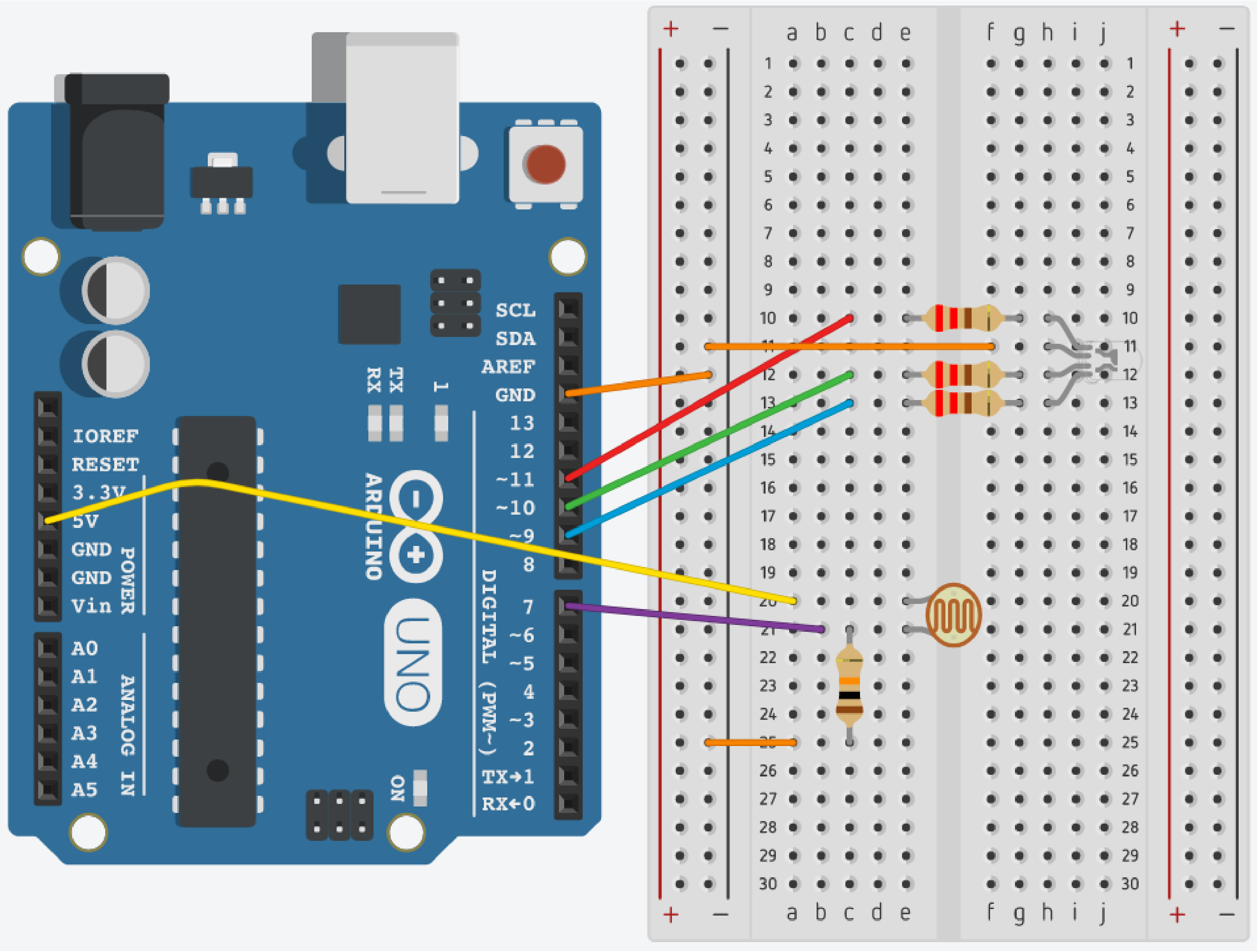
```
setColor(255, 0, 0); // red
delay(1000);
setColor(0, 255, 0); // green
delay(1000);
setColor(0, 0, 255); // blue
delay(1000);
setColor(255, 255, 0); // yellow
delay(1000);
setColor(255, 0, 255); // purple
delay(1000);
setColor(0, 255, 255); // aqua
delay(1000);
```

```
/*
RGB LED 02 : Smooth color transition
Source: Code adapted from project found here - forum.arduino.cc/index.php?topic=7933.0
*/
int pins[] = {11, 10, 9};   // an array of pins!  This is similar to int pin0 = 11; int pin1=10; int pin2=9;
long values[3];             // make an array of values but don't give them a value just yet
long current_values[3];     // make an array of current values, but don't give them a value yet

int short_delay;            // time between transition

void setup(){
        randomSeed(analogRead(0));      // get some unpredictable value to start off our random number generator
                                        // otherwise, we'd get the same random numbers each time (boring!)

        for (int i=0; i <3; i++) {      // pins 0 to less than 3
                values[i] = random(255);// pick a random number between 0 and 255 for a pin (red, green, or blue)
                current_values[i] = values[i];                  // make our current value the same
                analogWrite(pins[i], current_values[i]);        // set the LED to our initial choice
                values[i] = random(255);                        // pick a new random number for our next color
        }
}

void loop(){
        short_delay = random(3, 9);

        for (int i=0; i <3; i++) {
                if (values[i] > current_values[i]){             // if our new color is a larger number than our current color ...
                        current_values[i]++;                            // get just a little bit closer to the new color by
adding 1
                        analogWrite(pins[i], current_values[i]);        // set the LED to the new current color
                        delay(short_delay);                             // wait a little bit
                }

                if (values[i] < current_values[i]){             // if our new color is a smaller number than our current color ...
                        current_values[i]--;                    // get just a little bit closer to the new color by subtracting 1
                        analogWrite(pins[i], current_values[i]);                // set the LED to the new current color
                        delay(short_delay);                                     // wait a little bit
                }

                if (values[i] == current_values[i]){                    // if our new color and our current color are the same ...
                        analogWrite(pins[i], current_values[i]);        // make sure the LED is set to the new color
                        values[i] = random(255);                        // pick a new color
                }
        }
}
```

Projects 03: Mood Light

Components needed:

- Arduino Uno board
- breadboard
- RGB LED (common cathode)
- 8 jumper wires
- 3 220 ohm resistors
- 10k ohm resistor
- light dependent resistor (sometimes called a *photoresistor*)



```
/*
RGB LED 03 : Mood light with photoresistor
Source: Code adapted from project found here - forum.arduino.cc/index.php?topic=7933.0
*/

int pins[] = {11, 10, 9};     // an array of pins!  This is similar to int pin0 = 11; int pin1=10; int pin2=9;
long values[3];               // make an array of values but don't give them a value just yet
long current_values[3];       // make an array of current values, but don't give them a value yet

const int sensor = 7;  // the input pin where the sensor (photoresistor) is connected
int val = 0;           // val will be used to store the state of the input pin

int short_delay;              // time between transition

void setup(){
  randomSeed(analogRead(0));                  // get some unpredictable value to start off our random number
generator
                                      // otherwise, we'd get the same random numbers each time (boring!)

  for (int i=0; i <3; i++) {          // pins 0 to less than 3
    values[i] = random(255);                  // pick a random number between 0 and 255 for a pin (red, green,
or blue)
    current_values[i] = values[i];    // make our current value the same
    analogWrite(pins[i], current_values[i]);  // set the LED to our initial choice
    values[i] = random(255);                  // pick a new random number for our next color
  }
}

void loop(){

val = digitalRead(sensor);    // read input value and store it

  // Check whether the input is LOW (no light)
  if (val == LOW) {           // if so, turn RGB LED on

  short_delay = random(3, 9);

  for (int i=0; i <3; i++) {
    if (values[i] > current_values[i]){       // if our new color is a larger number than our current color ...
      current_values[i]++;                    // get just a little bit closer to the new color by adding 1
      analogWrite(pins[i], current_values[i]);  // set the LED to the new current color
      delay(short_delay);             // wait a little bit
    }

    if (values[i] < current_values[i]){       // if our new color is a smaller number than our current color ...
      current_values[i]--;            // get just a little bit closer to the new color by subtracting 1
      analogWrite(pins[i], current_values[i]);  // set the LED to the new current color
      delay(short_delay);                // wait a little bit
    }

    if (values[i] == current_values[i]){        // if our new color and our current color are the same ...
      analogWrite(pins[i], current_values[i]);  // make sure the LED is set to the new color
      values[i] = random(255);                  // pick a new color
    }
  }

  } else {           // or if the input is HIGH (there is light)
    digitalWrite(11, LOW);   // set the three LEDs to LOW
    digitalWrite(10, LOW);   // to turn them off
    digitalWrite(9, LOW);    // if you are using a common anode RGB LED, change these three lines to say HIGH
  }
}
```

Ideas to Build On

Set up a push button to turn your RGB LED on and off:
Hint: look at the button code from the Arduino at the Library event (Projects 2 and 3) – you'll need to combine that code with the RGB LED code

Use push buttons to control each of the three colors:
For example:

- https://create.arduino.cc/projecthub/re/rgb-led-button-controller-565267
- https://learn.adafruit.com/adafruit-arduino-lesson-7-make-an-rgb-led-fader?view=all

Hexadecimal Colors:
Try the bonus project on the next page!

Learn More

Want to learn more about how RGB LEDs work? Try these resources:

Adafruit Arduino Lesson 3. RGB LEDS
https://learn.adafruit.com/downloads/pdf/adafruit-arduino-lesson-3-rgb-leds.pdf

Sparkfun Inventor's Kit v.4. RGB Night Light
https://learn.sparkfun.com/tutorials/sparkfun-inventors-kit-experiment-guide---v40/circuit-1d-rgb-night-light

Bonus Project: Using Hexadecimal Colors instead of RGB

You can also insert hexadecimal colors into your code instead of using RGB. Use a color picker (such as this one: http://www.rapidtables.com/web/color/RGB_Color.htm) and instead use the combination of numbers and letters (for example, the color “sienna” is A0522D). Look at the line of code for sienna below to see an example of how to plug it in. The Arduino knows that it is a hex number because of the “0x” in front of the letters and numbers, so make sure to leave that in!

```
/*
RGB LED 01 : Blinking RGB LED
Source: Code modified from Adafruit Arduino - Lesson 3. RGB LED
        (https://learn.adafruit.com/adafruit-arduino-lesson-3-rgb-leds)
For use with a common cathode RGB LED
*/

int redPin = 11;    // red pin is connected to 11
int greenPin = 10;  // green pin is connected to 10
int bluePin = 9;    // blue pin is connected to 9

void setup() {
  pinMode(redPin, OUTPUT);      // set all three pins as outputs
  pinMode(greenPin, OUTPUT);
  pinMode(bluePin, OUTPUT);
}

void loop() {
  setColor(0x4B, 0x0, 0x82); // indigo
  delay(1000);
  setColor(0xA0, 0x52, 0x2D); // sienna
  delay(1000);
}

void setColor(int red, int green, int blue) {
  // set the three pins:
  analogWrite(redPin, red);     // brightness of redPin
  analogWrite(greenPin, green); // brightness of greenPin
  analogWrite(bluePin, blue);   // brightness of bluePin
}
```

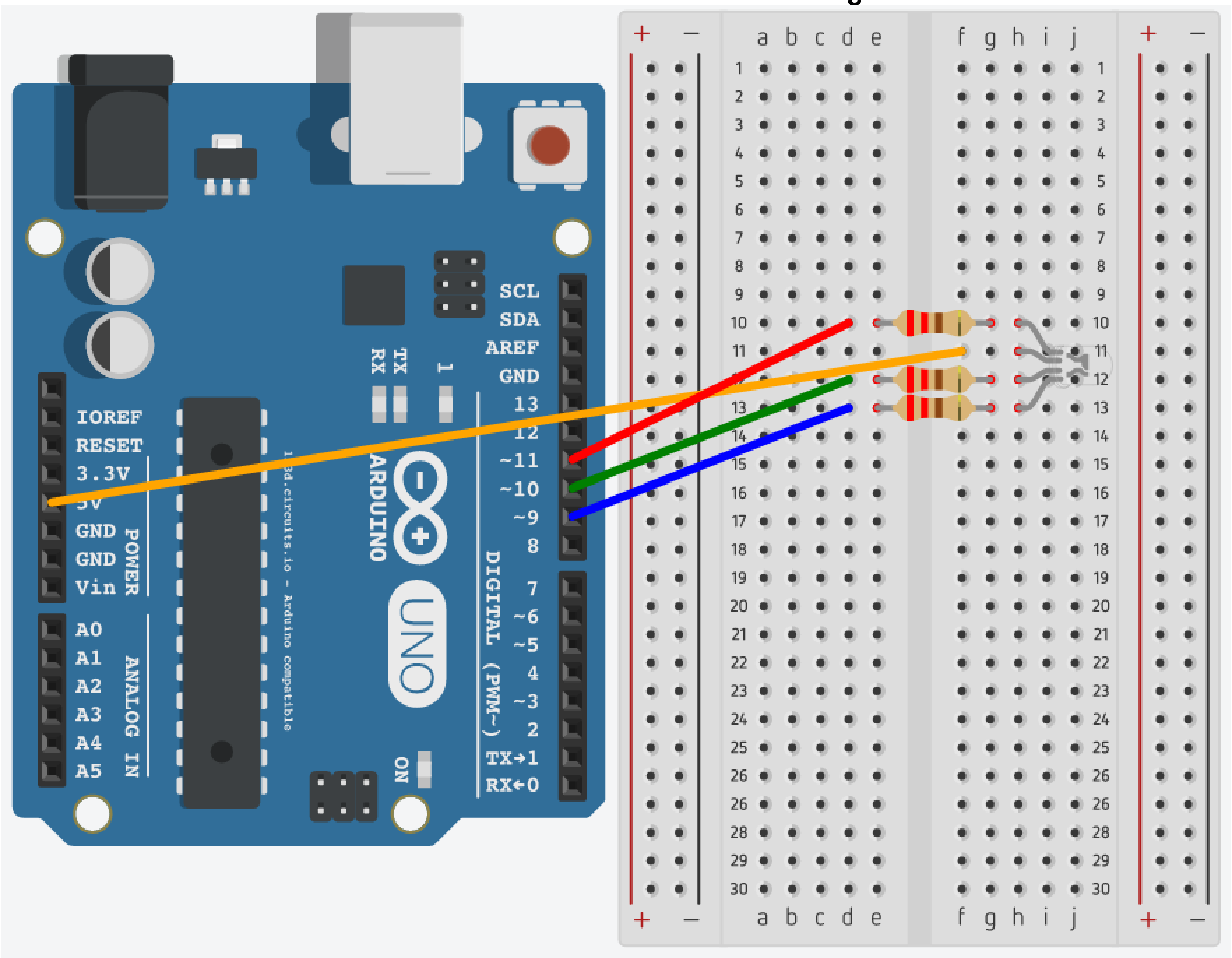
Diagrams & Code for Common Anode RGB LEDs

Projects 01 & 02: Blinking RGB LED & Smooth Transition

Components needed:

- Arduino Uno board
- breadboard
- RGB LED (common **anode**)
- 4 jumper wires
- 3 220 ohm resistors

Connect long PIN to 5 volts



```
/*
RGB LED 01 : Blinking RGB LED
Source: Code modified from Adafruit Arduino - Lesson 3. RGB LED
*/

int redPin = 11;
int greenPin = 10;
int bluePin = 9;

void setup() {
  pinMode(redPin, OUTPUT);
  pinMode(greenPin, OUTPUT);
  pinMode(bluePin, OUTPUT);
}

void loop() {
  setColor(255, 0, 0); // red
  delay(1000);
  setColor(0, 255, 0); // green
  delay(1000);
  setColor(0, 0, 255); // blue
  delay(1000);
}

void setColor(int red, int green, int blue) {
  // our LEDs consider 255 to be all the way off and 0 to be all the way on
  // since we're thinking about it the opposite way in our loop, subtract from 255
  // if you are using a common cathode RGB LED, erase the next 3 lines of code
  red = 255 - red;
  green = 255 - green;
  blue = 255 - blue;

  // set the three pins
  analogWrite(redPin, red);
  analogWrite(greenPin, green);
  analogWrite(bluePin, blue);
}
```

Experimenting with more colors

Try adding different colors to your blinking pattern. You can copy and paste the code below into the loop function of Project 01 to create a loop of six blinking colors. Try finding a RGB color picker online (such as this one: http://www.rapidtables.com/web/color/RGB_Color.htm) to create your own colors.

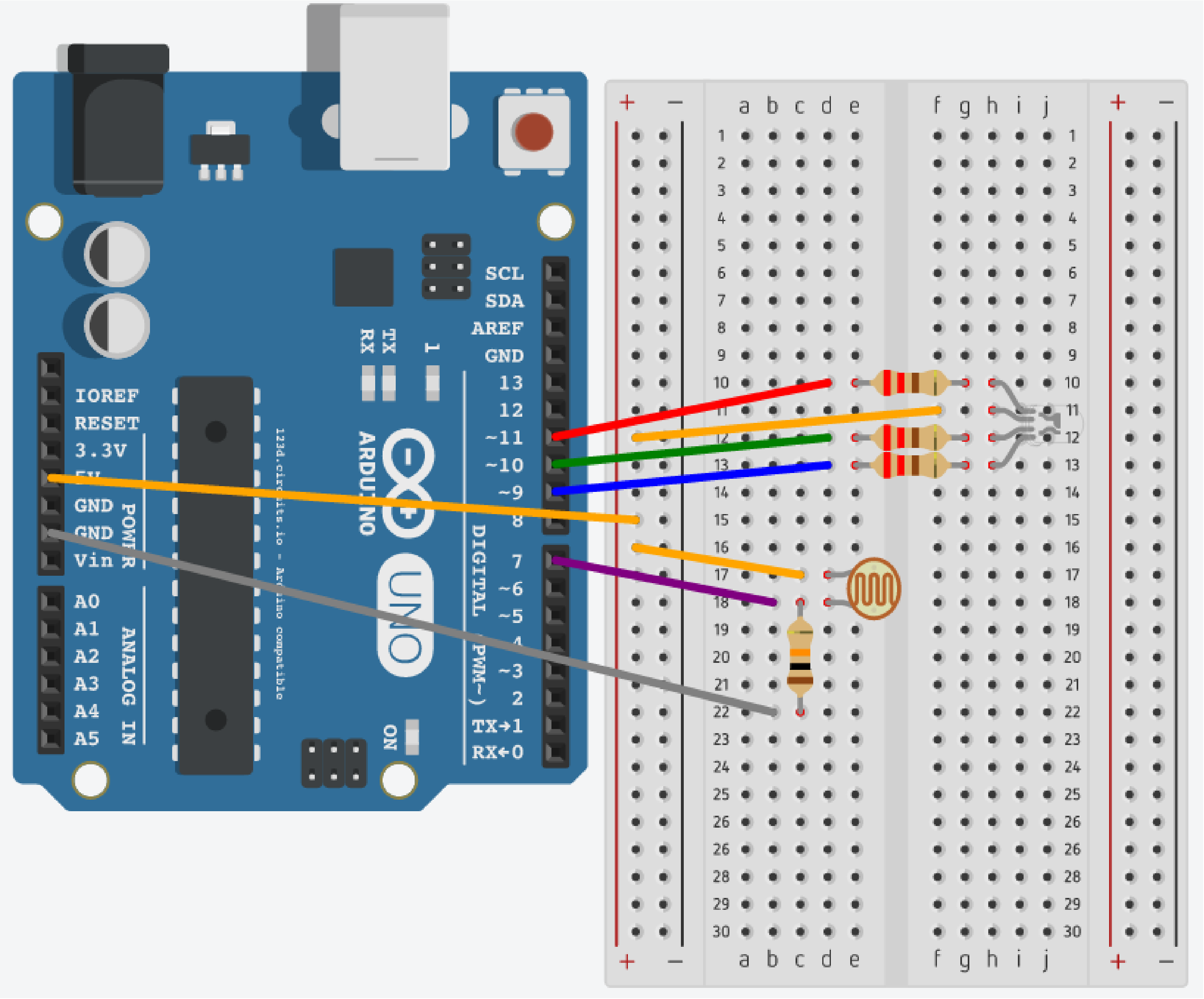
```
setColor(255, 0, 0); // red
delay(1000);
setColor(0, 255, 0); // green
delay(1000);
setColor(0, 0, 255); // blue
delay(1000);
setColor(255, 255, 0); // yellow
delay(1000);
setColor(255, 0, 255); // purple
delay(1000);
setColor(0, 255, 255); // aqua
delay(1000);
```

```
/*
RGB LED 02 : Smooth color transition
Source: Code adapted from project found here - forum.arduino.cc/index.php?topic=7933.0
*/

int pins[] = {11, 10, 9};           // an array of pins!  This is similar to int pin0 = 11; int pin1=10; int pin2=9;
long values[3];                     // make an array of values but don't give them a value just yet
long current_values[3];             // make an array of current values, but don't give them a value yet

int short_delay;                    // time between transition

void setup(){
        randomSeed(analogRead(0));  // get some unpredictable value to start off our random number generator
                                    // otherwise, we'd get the same random numbers each time (boring!)

for (int i=0; i <3; i++) {          // pins 0 to less than 3
        values[i] = random(255);          // pick a random number between 0 and 255 for a pin (red, green, or blue)
        current_values[i] = values[i];    // make our current value the same
        analogWrite(pins[i], current_values[i]);  // set the LED to our initial choice
        values[i] = random(255);                  // pick a new random number for our next color
        }
}

void loop(){
        short_delay = random(3, 9);

        for (int i=0; i <3; i++) {
                if (values[i] > current_values[i]){          // if our new color is a larger number than our current color ...
                        current_values[i]++;                 // get just a little bit closer to the new color by adding 1
                        analogWrite(pins[i], current_values[i]);  // set the LED to the new current color
                        delay(short_delay);                       // wait a little bit
                }

                if (values[i] < current_values[i]){          // if our new color is a smaller number than our current color ...
                        current_values[i]--;                 / get just a little bit closer to the new color by subtracting 1
                        analogWrite(pins[i], current_values[i]);  // set the LED to the new current color
                        delay(short_delay);                                       // wait a little bit
                }

                if (values[i] == current_values[i]){              // if our new color and our current color are the same ...
                        analogWrite(pins[i], current_values[i]);  // make sure the LED is set to the new color
                        values[i] = random(255);                  // pick a new color
                }
        }
}
```

Projects 03: Mood Light

Components needed:

- Arduino Uno board
- breadboard
- RGB LED (common cathode)
- 8 jumper wires
- 3 220 ohm resistors
- 10k ohm resistor
- light dependent resistor (sometimes called a *photoresistor*)



```
/*
RGB LED 03 : Mood light with photoresistor
Source: Code adapted from project found here - forum.arduino.cc/index.php?topic=7933.0
*/

int pins[] = {11, 10, 9};            // an array of pins!  This is similar to int pin0 = 11; int pin1=10; int pin2=9;
long values[3];                      // make an array of values but don't give them a value just yet
long current_values[3];              // make an array of current values, but don't give them a value yet

const int sensor = 7;                // the input pin where the sensor (photoresistor) is connected
int val = 0;                         // val will be used to store the state of the input pin

int short_delay;                      // time between transition

void setup(){
randomSeed(analogRead(0)); // get some unpredictable value to start off our random number generator
                              // otherwise, we'd get the same random numbers each time (boring!)

  for (int i=0; i <3; i++) {          // pins 0 to less than 3
    values[i] = random(255);     // pick a random number between 0 and 255 for a pin (red, green, or blue)
    current_values[i] = values[i];                    // make our current value the same
    analogWrite(pins[i], current_values[i]);      // set the LED to our initial choice
    values[i] = random(255);                          // pick a new random number for our next color
  }
}

void loop(){

val = digitalRead(sensor);   // read input value and store it

  // Check whether the input is LOW (no light)
  if (val == LOW) {           // turn RGB LED on

  short_delay = random(3, 9);

  for (int i=0; i <3; i++) {
    if (values[i] > current_values[i]){               // if our new color is a larger number than our current color ...
      current_values[i]++;                            // get just a little bit closer to the new color by adding 1
      analogWrite(pins[i], current_values[i]);   // set the LED to the new current color
      delay(short_delay);                             // wait a little bit
    }

    if (values[i] < current_values[i]){               // if our new color is a smaller number than our current color ...
      current_values[i]--;                            // get just a little bit closer to the new color by subtracting 1
      analogWrite(pins[i], current_values[i]);   // set the LED to the new current color
      delay(short_delay);                             // wait a little bit
    }

    if (values[i] == current_values[i]){           // if our new color and our current color are the same ...
      analogWrite(pins[i], current_values[i]);     // make sure the LED is set to the new color
      values[i] = random(255);                     // pick a new color
    }
  }

  } else {                         // or if the input is HIGH (there is light)
    digitalWrite(11, HIGH);        // set the three LEDs to HIGH (common anode RGB LEDs consider HIGH to be all
                                   the way off and LOW to be all the way on)
    digitalWrite(10, HIGH);        // so since we're thinking about it in the opposite way, setting the LEDs to HIGH
                                   turns them off
    digitalWrite(9, HIGH);         // if you are using a common cathode RGB LED, change these three lines to say
                                   LOW
  }
}
```

Bonus Project: Using Hexadecimal Colors instead of RGB

You can also insert hexadecimal colors into your code instead of using RGB. Use a color picker (such as this one: http://www.rapidtables.com/web/color/RGB_Color.htm) and instead use the combination of numbers and letters (for example, the color “sienna” is A0522D). Look at the line of code for sienna below to see an example of how to plug it in. The Arduino knows that it is a hex number because of the “0x” in front of the letters and numbers, so make sure to leave that in!

```
/*
RGB LED 01 with Hex Colors
Source: Code modified from Adafruit Arduino - Lesson 3. RGB LED
*/

int redPin = 11;
int greenPin = 10;
int bluePin = 9;

void setup() {
  pinMode(redPin, OUTPUT);
  pinMode(greenPin, OUTPUT);
  pinMode(bluePin, OUTPUT);
}

void loop() {
  setColor(0x4B, 0x0, 0x82); // indigo
  delay(1000);
  setColor(0xA0, 0x52, 0x2D); // sienna
  delay(1000);
}

void setColor(int red, int green, int blue) {
  // our LEDs consider 255 to be all the way off and 0 to be all the way on
  // since we're thinking about it the opposite way in our loop, subtract from 255
  // if you are using a common cathode RGB LED, erase the next 3 lines of code
  red = 255 - red;
  green = 255 - green;
  blue = 255 - blue;

  // set the three pins
  analogWrite(redPin, red);
  analogWrite(greenPin, green);
  analogWrite(bluePin, blue);
}
```