Programming Tiny, Colorful Computers

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Getting Started

Start the Arduino IDE
Select Tools → Board → Arduino Nano

Arduino IDE with menu options showing "Board: Arduino Nano"
Getting Started Continued

Plug the USB cable into your board

Plug your board into your computer

*The board’s power light should be on*

Select Tools → Port → COM3

*Which COM port may vary; choose the one that is there*
Select File → Examples → 01. Basics → Blink
Upload the Sketch to the Board

Should say “Done uploading.” The user LED should blink
The Blink Example

// setup() runs once: when power is applied or after reset
void setup() {

    // Set the LED_BUILTIN pin to be an output.
pinMode(LED_BUILTIN, OUTPUT);
}

// loop() runs over and over again forever
void loop() {

digitalWrite(LED_BUILTIN, HIGH); // Turn the LED on ("HIGH")
delay(1000); // Wait for 1000 ms = 1s

digitalWrite(LED_BUILTIN, LOW); // Turn the LED off ("LOW")
delay(1000); // Wait a second
}
Each pin has a number (the pink boxes on “Nano pinout”)

Most pins can be either inputs or outputs

```cpp
pinMode(4, OUTPUT);  // Control the voltage on pin 4

pinMode(6, INPUT);   // Observe the voltage on pin 6

pinMode(19, INPUT_PULLUP); // Observe 19; “suggest” it be high

pinMode(LED_BUILTIN, OUTPUT); // Control pin 13, LED “L”
```
The input voltage to the board when it is running from external power. Not USB bus power.

The power sum for each pin's group should not exceed 100mA

Absolute MAX per pin 40mA recommended 20mA

Absolute MAX 200mA for entire package

Analog exclusively Pins

USB JACK
Mini Type B
Digital Input and Output

Digital: on or off, high or low voltage; nothing in between

digitalWrite(13, LOW); // Turn off the user LED

digitalWrite(13, HIGH); // Turn on the user LED

A digital read from a pin reports either HIGH or LOW

if (digitalRead(19) == LOW) {
    // Low voltage on pin 19, a "0"
}

if (digitalRead(19) == HIGH) {
    // High voltage on pin 19, a "1"
}
Connect the RGB LED and switch
Reacting to the switch

```cpp
const int switchpin = 19; // Marked "A5"

void setup() {
    pinMode(LED_BUILTIN, OUTPUT);
    pinMode(switchpin, INPUT_PULLUP); // HIGH unless pressed
}

void loop() {
    if (digitalRead(switchpin) == LOW) { // Switch pressed?
        digitalWrite(LED_BUILTIN, HIGH); // Yes: light LED
    } else {
        digitalWrite(LED_BUILTIN, LOW); // No: turn off LED
    }
}
```
Controlling the RGB LED

```c
const int redpin = 3, greenpin = 5, bluepin = 6;  // D3, D5, D6

void rgb(int r, int g, int b) {
    analogWrite(redpin, r);     // Set the red brightness
    analogWrite(greenpin, g);  // Set the green brightness
    analogWrite(bluepin, b);   // Set the blue brightness
}

void setup() {
    pinMode(redpin, OUTPUT);
    pinMode(greenpin, OUTPUT);
    pinMode(bluepin, OUTPUT);
}

void loop() {
    rgb(10,0,0);     delay(500);
    rgb(0,10,0);     delay(500);
    rgb(0,0,10);     delay(500);
}
```
Mood Lighting Control

```cpp
const int redpin = 3, greenpin = 5, bluepin = 6;  // D3, D5, D6
const int switchpin = 19;  // A5

int r = 0, g = 0, b = 0;  // Variables

void rgb(int r, int g, int b) {
    analogWrite(redpin, r);  // Set the red brightness
    analogWrite(greenpin, g); // Set the green brightness
    analogWrite(bluepin, b);  // Set the blue brightness
}

void setup() {
    pinMode(redpin, OUTPUT);
    pinMode(greenpin, OUTPUT);
    pinMode(bluepin, OUTPUT);
    pinMode(switchpin, INPUT_PULLUP);
    r = g = b = 0;  // Start with all colors off
    rgb(r, g, b);
}
```
void loop() {
  while (digitalRead(switchpin) == HIGH) {} // Wait for press
  while (digitalRead(switchpin) == LOW) {
    // While still pressed...
    r = (r + 1) % 12; // Add 1 to r; wrap around at 12
    rgb(r, g, b); // Display new color
    delay(200); // Wait a little
  }
  while (digitalRead(switchpin) == HIGH) {} 
  while (digitalRead(switchpin) == LOW) {
    g = (g + 1) % 12;
    rgb(r, g, b);
    delay(200);
  }
  while (digitalRead(switchpin) == HIGH) {} 
  while (digitalRead(switchpin) == LOW) {
    b = (b + 1) % 12;
    rgb(r, g, b);
    delay(200);
  }
}
Challenge Problems

- A traffic light
  Red, green, then briefly yellow
  Click to advance

- Reaction-time game
  Countdown with colors
  Press the button quickly
  Blink or color to indicate your speed

- Better mood light color control
  Cycle through “good” colors
  Separately cycle through brightness

- Morse code practice
  Display a color letter code (Red = R, Green = G, etc.)
  Expect player to enter Morse code for the letter
  Display score with blinks or color