Relay
(Controlling an external output like the Fan)

// John Wright 2017
// January 19, 2017
// Controlling/cycling a Relay on and off

int Relay = 2;  // Where device is connected on-board

void setup()
{
  pinMode(Relay, OUTPUT);  // Set the pin direction to output
}

void loop()
{
  digitalWrite(2, HIGH);   // Click relay coil on
  delay(1000);             // 1 sec
  digitalWrite(2, LOW);    // Click relay coil off
  delay(2000);             // 2 sec
}
Relay
(Controlling an external output like the Fan)

https://youtu.be/y3j6EuRbGCY
“As you learned earlier in this chapter, most servos have a minimum pulse width limit around 1.0ms and a maximum limit around 2.0ms, although the actual minimum and maximum pulse widths may vary between the various servo brands. Therefore, when programming servos it is important to keep the range of the values sent to the analogWrite() function between 127 and 255, which corresponds to a pulse width of 1000μs and 2000μs, respectively!”
Servo Motor via analogWrite()

//Chris Odom, 2016

byte servoPin = 3;  // for this sketch, the servo MUST be a in a PWM pin!
void setup()
{
  pinMode(servoPin, OUTPUT);
}
void loop()
{
  testServoAnalogW();
  while(true);  // pause loop indefinitely. loop runs just once.
}
void testServoAnalogW()
{
  analogWrite(servoPin, 255);  // servo will spin CCW fast
}
Servo Motor via digitalWrite()

//Chris Odom, 2016 Ch 18 Vol2
//Edited and expanded by John Wright, 2017
// because this module uses digitalWrite (not analogWrite) to
// control the servos, you can attach the servos to ANY pins (not just PWM pins)!

const int leftServo = 0;
const int rightServo = 1;

// servo direction constants
const int left_forward_fast = 2000; // CCW
const int left_stop = 1500; // Center position
const int left_backward_fast = 1000; // CW
const int right_forward_fast = 1000; // CW
const int right_stop = 1500; // Center position
const int right_backward_fast = 2000; // CCW
int x = 0;
int y = 0;
void setup()
{
    pinMode(leftServo, OUTPUT);
    pinMode(rightServo, OUTPUT);
    delayMicroseconds(50);  // Required for some reason
}

void loop()  // This is your Main Program that is calling subroutines
{
    forwardStepFast();
    delay(100);
    backwardStepFast();
    delay(100);
}
Servo Motor via `digitalWrite()`

From Chris Odems’s Ch 18 Vol 2 text

Figure xxx. A graphical representation of a train of 1000µs-pulses generated with `digitalWrite()` and `delay()` commands within a loop. A necessary delay of 20ms (20,000µs) separates each pulse to give time for the servo to rotate. Each pulse turns the servo's shaft rapidly clockwise.
Servo Motor via digitalWrite()

//***********************************************************
void forwardStepFast()  // This is like a subroutine for forward
{
    for (int x = 0 ; x < 100 ; x++) //This is a For-Loop see page 285 Vol 1
    {
        servoMove(leftServo, left_forward_fast);
        servoMove(rightServo, right_forward_fast);
        delay(20); // This value changes speed of motor, do not set < 20ms
    }
}
/************************************************
* void backwardStepFast() // This is a subroutine for backwards
* {
*     for (int y = 0 ; y < 100 ; y++)
*     {
*         servoMove(leftServo, left_backward_fast);
*         servoMove(rightServo, right_backward_fast);
*         delay(20); // This value changes speed of motor, do not set < 20ms
*     }
* }
Servo Motor via digitalWrite()

一直没有简单地定义一个单步与一个伺服

void servoMove(byte servoPin, int pulseWidth)
{
    digitalWrite(servoPin, HIGH); // create the rising edge of the pulse
    delayMicroseconds(pulseWidth); // set pulse width in microsec
    digitalWrite(servoPin, LOW); // create the falling edge of the pulse
}
Servo Motor via `digitalWrite()`

https://youtu.be/0UQoa6u3cKg
“Using analogWrite() to spin a servomotor is sometimes the perfect function to use. This is true, for example, when perpetual motion is called for or when the motion is time-based. Here, one line of code will cause the servo to spin forever. This is quite handy when you need a siren, or flashing lights, or merry-go-rounds, or floor scrubbers – something that you want to start and then forget about.”
When to use analogWrite() and when to use digitalWrite() to Control Servos
by Chris Odom
Physical Computing & Robotics with the Arduino IDE Vol 2

“However, analogWrite() is not well-suited for step-based events, such as
blinking the LED five times. In my experience, driving the wheels of a robot
lends itself to a more step-based operation. For example, when your robot
is traversing a tabletop it should scan for the table’s edge with every step,
rather than some arbitrary time interval!

Another reason I’m not fond of using analogWrite() to drive a servo is the
lack of resolution and precision. In the above function, changeSpeedsAnalogW(), I showed how a wide range of values yielded
identical servo speeds. Servos are not terribly precise devices in the best of
circumstances, but using analogWrite() for high-precision motion is not
advisable.

Another of the main drawbacks of using analogWrite() to program servos
is the fact that the servo must be connected to one the PWM pins on your
development board. Often when working on large projects, the
microcontroller’s signal pins get consumed by a wide array of sensors,
actuators, and motors and finding a free PWM pin can be problematic.”
Good Luck!
This is Engineering!

https://www.youtube.com/watch?v=nFbWXuR_2Ow