

# API를 이용한 디지털 입출력 , PWM 제어

마이크로프로세서 종합 설계. 7주차.

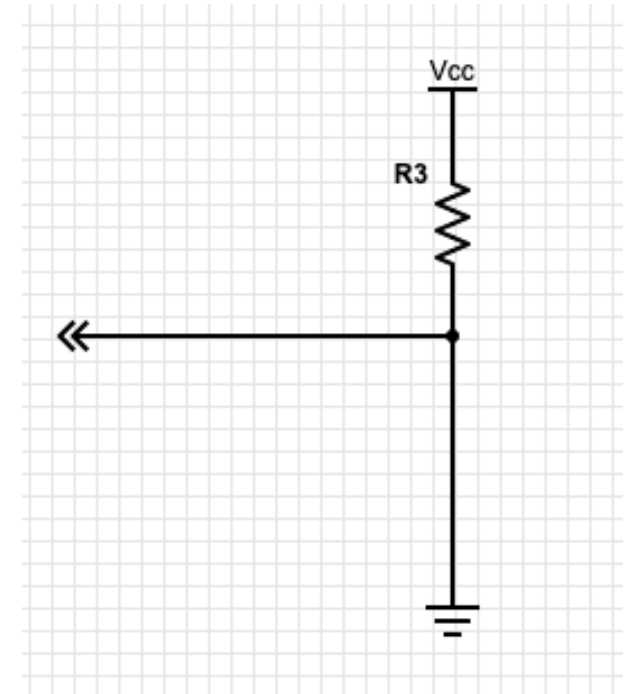
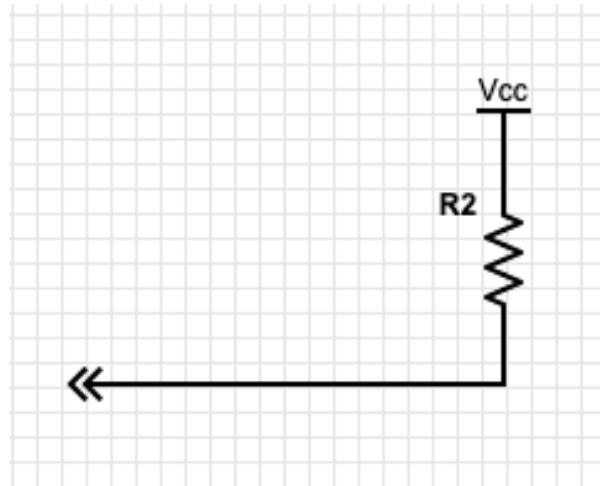
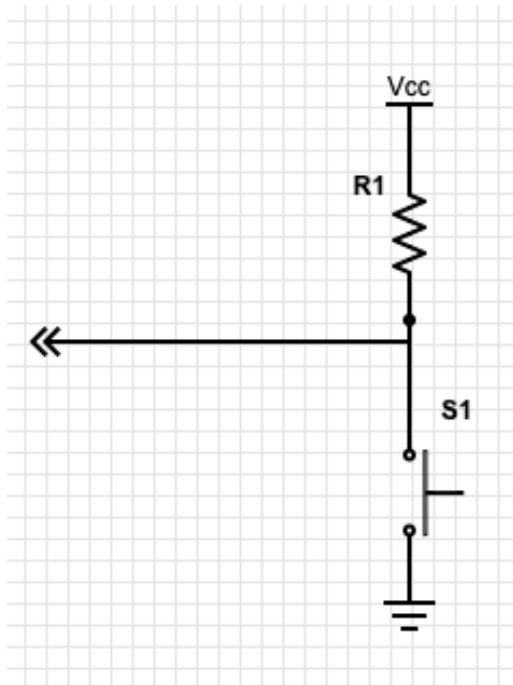


# 마이크로프로세서와 C언어 – 반복문

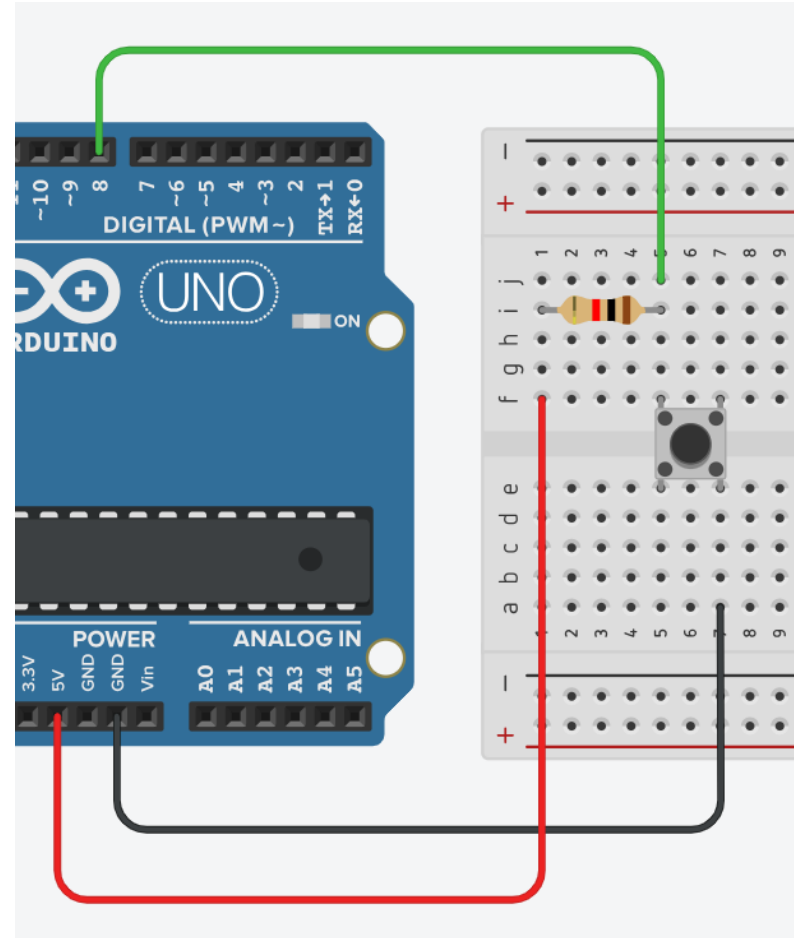
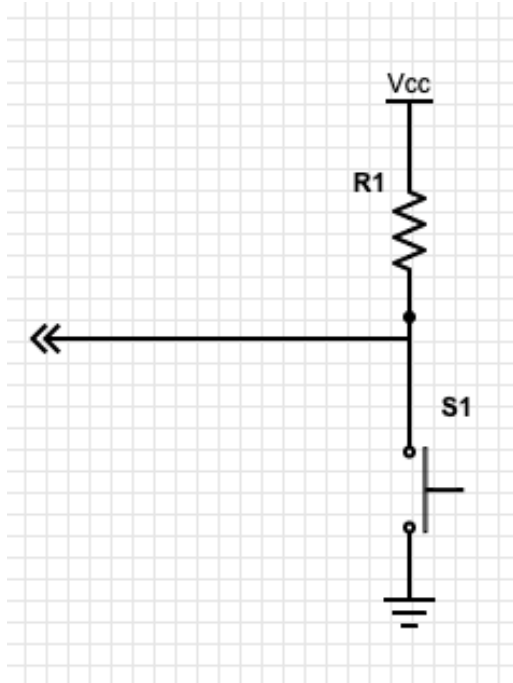
- 0~9까지 반복 표시하는 세그먼트 코드를 반복문을 이용하면

```
for( 초기화 ; 조건 ; 증감(변화량) )  
{  
    반복해야 하는 명령 ;  
}
```

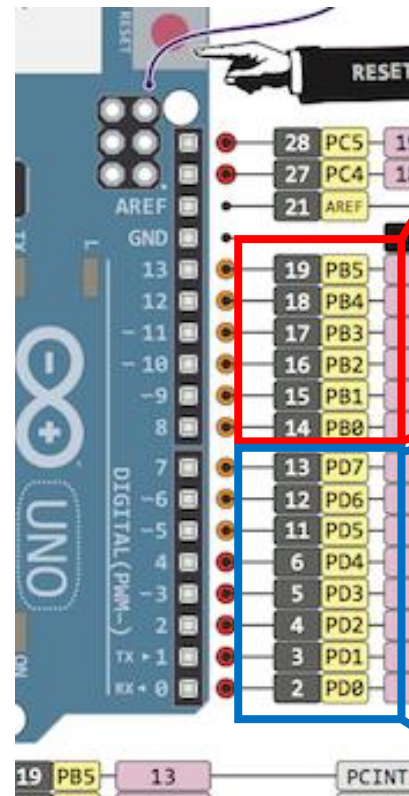
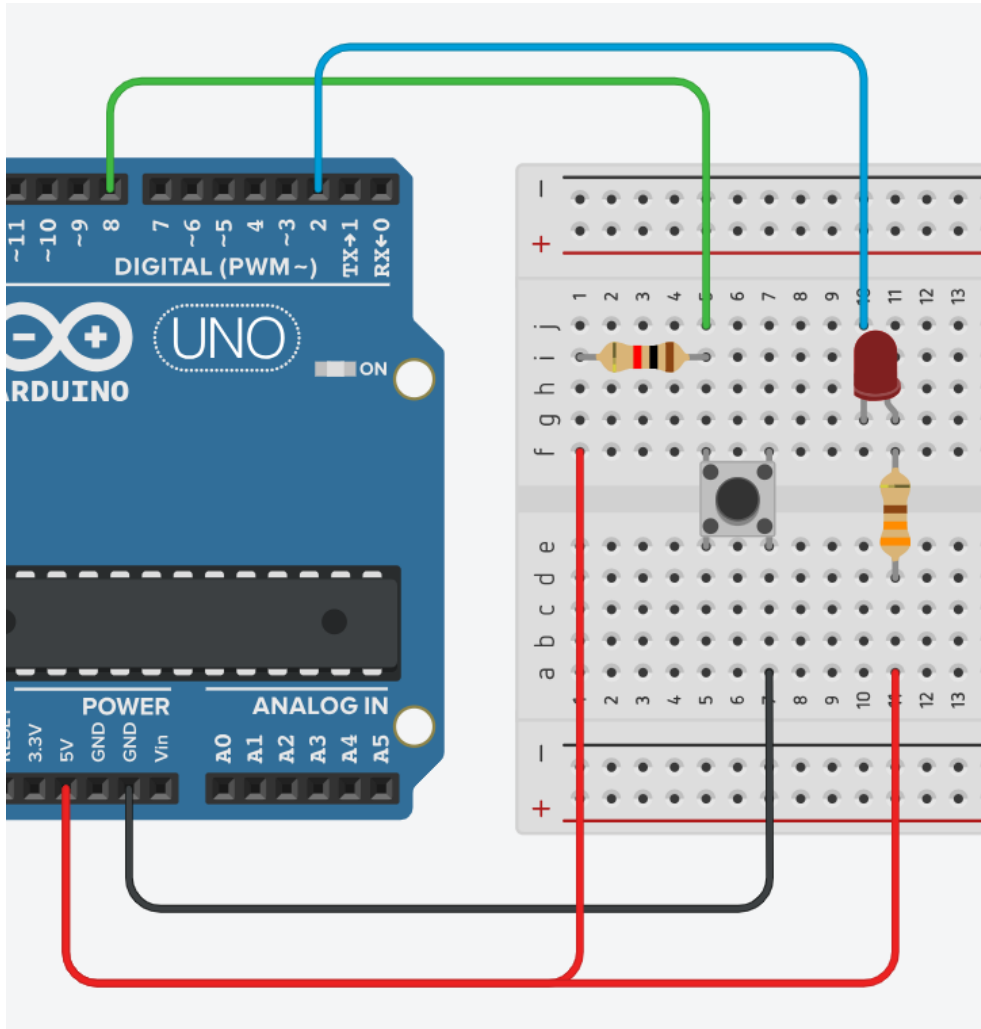
# 버튼 입력 실험(Digital Input)



# 버튼 입력 실험(Digital Input)



# 버튼 입력 실험(Digital Input)



### 13.4.2 PORTB – The Port B Data Register

[illegible]

### 13.4.3 DDRB – The Port B Data Direction Register

Bit	7	6	5	4	3	2	1	0
0x04 (0x24)	DDB7	DDB6	DDB5	DDB4	DDB3	DDB2	DDB1	DDB0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Initial Value	0	0	0	0	0	0	0	0

DDBS

#### 13.4.4 PINB – The Port B Input Pins Address

[illegible]

### 13.4.8 PORTD – The Port D Data Register

Bit	7	6	5	4	3	2	1	0
0x0B (0x2B)	PORTD7	PORTD6	PORTD5	PORTD4	PORTD3	PORTD2	PORTD1	PORTD0
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Initial Value	0	0	0	0	0	0	0	0

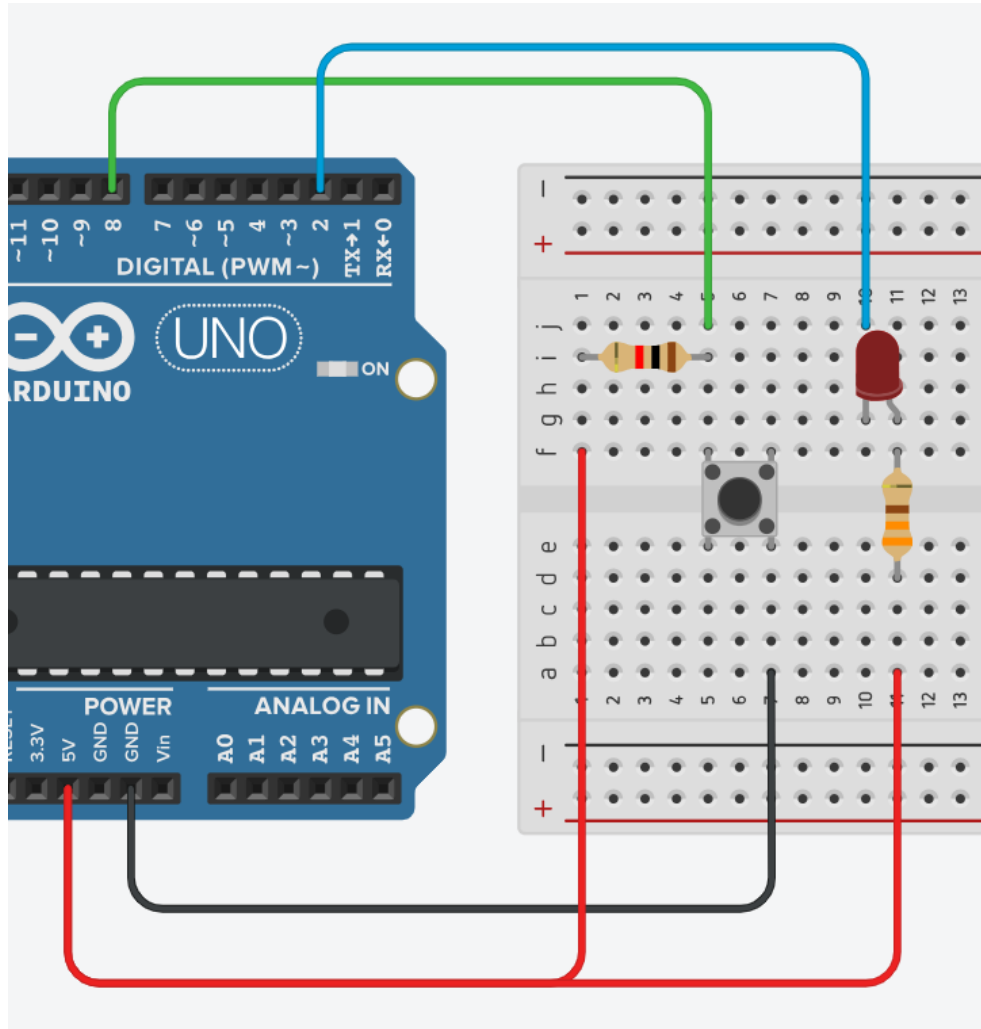
### 13.4.9 DDRD – The Port D Data Direction Register

[illegible]

#### 13.4.10 PIND – The Port D Input Pins Address

[illegible]

# 버튼 입력 실험(Digital Input)



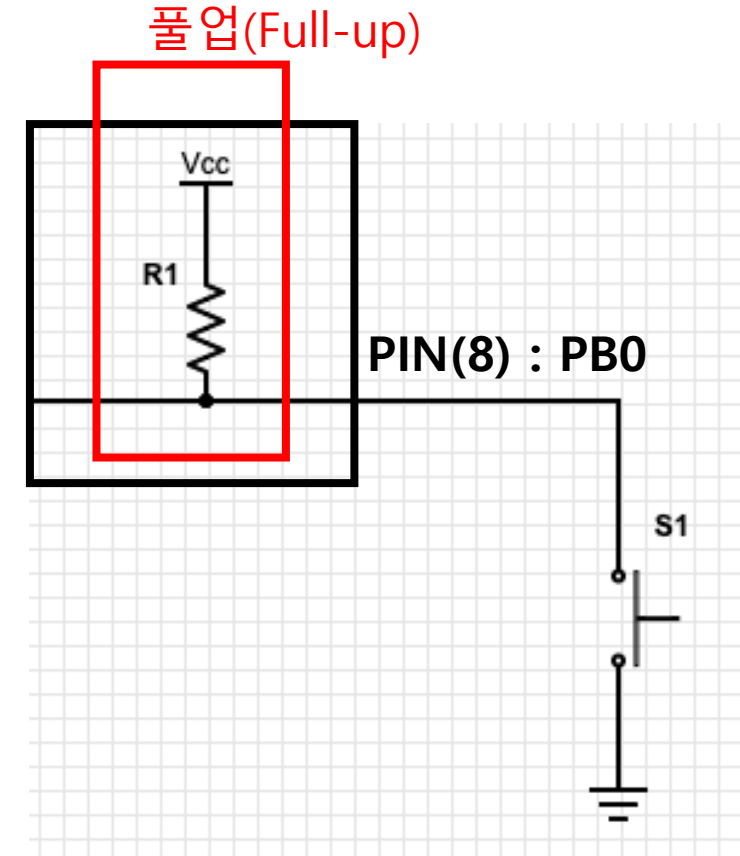
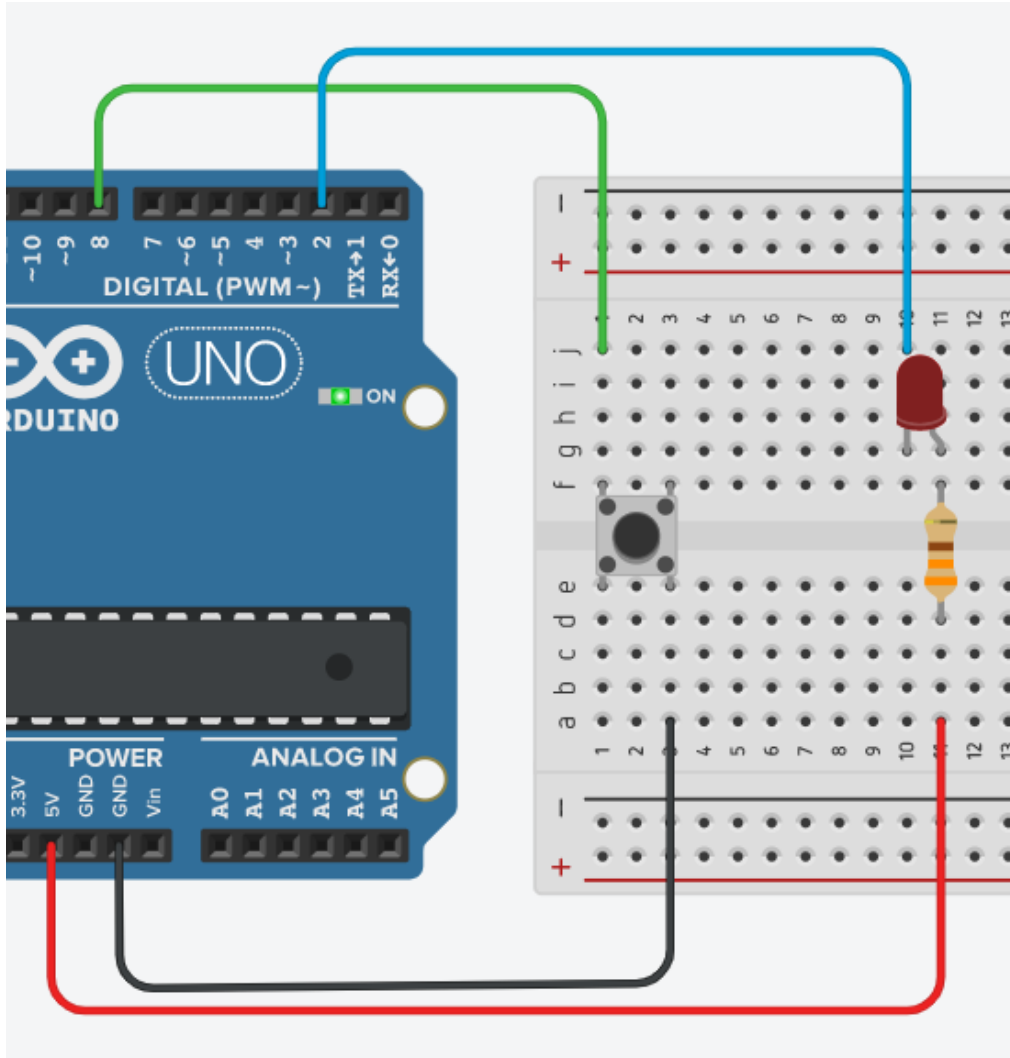
```
void setup()
{
  DDRB = B00000000 ;
  DDRD = B00000100 ;

  Serial.begin(9600) ;
}

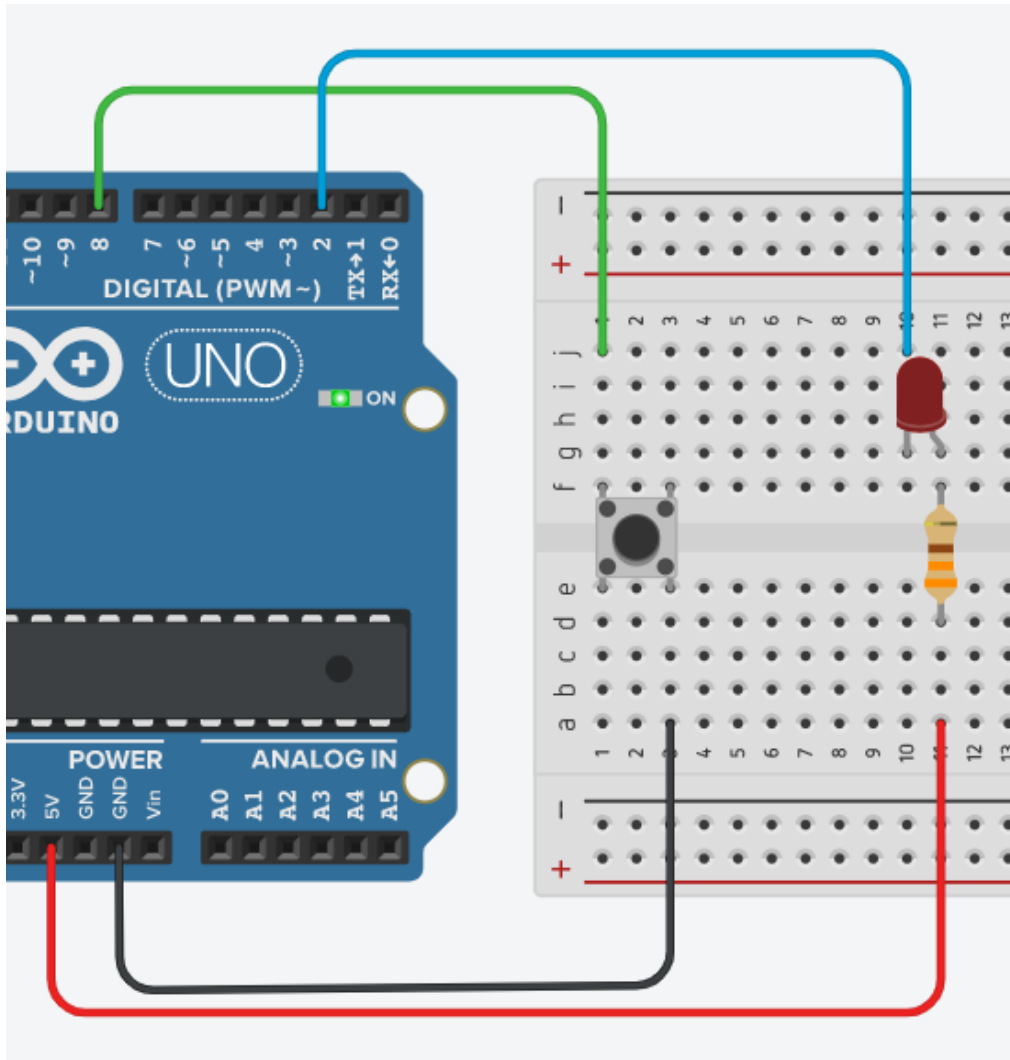
void loop()
{
  Serial.println(PINB) ;

  if( PINB == B00000001 )
  {
    //버튼이 눌리지 않음
    PORTD = B0000100 ;           //LED 꺼짐
  }
  else
  {
    //버튼이 눌림
    PORTD = B00000000 ;         //LED 켜짐
  }
}
```

# API를 이용한 디지털 입출력 실험



# API를 이용한 디지털 입출력 실험

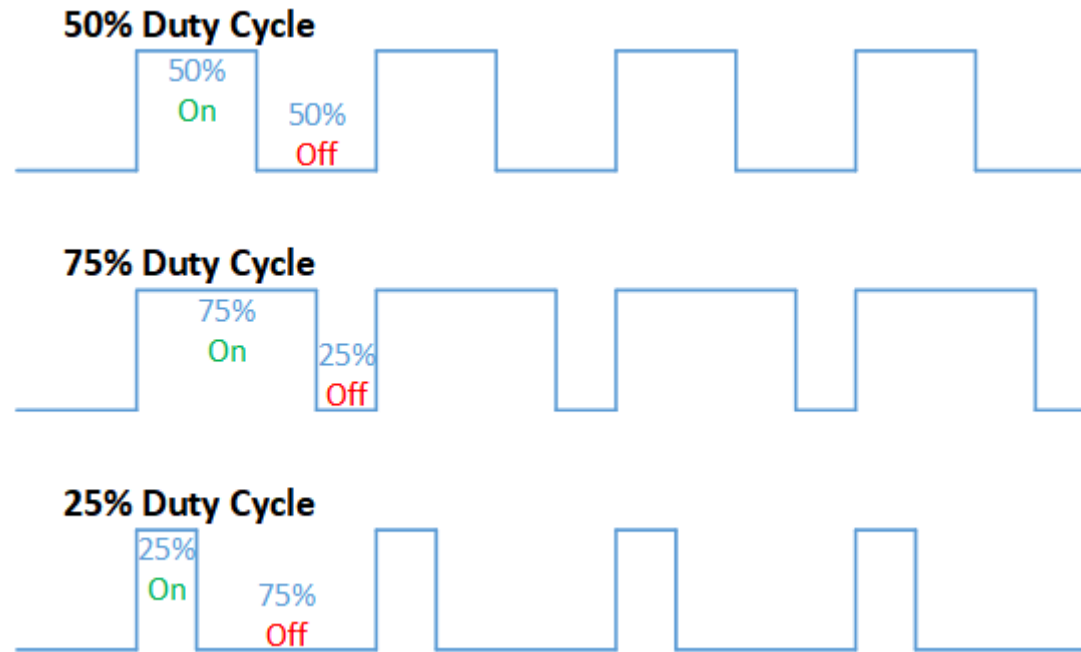


```
// C++ code
//
void setup()
{
    pinMode(8, INPUT_PULLUP);
    pinMode(2, OUTPUT);
}

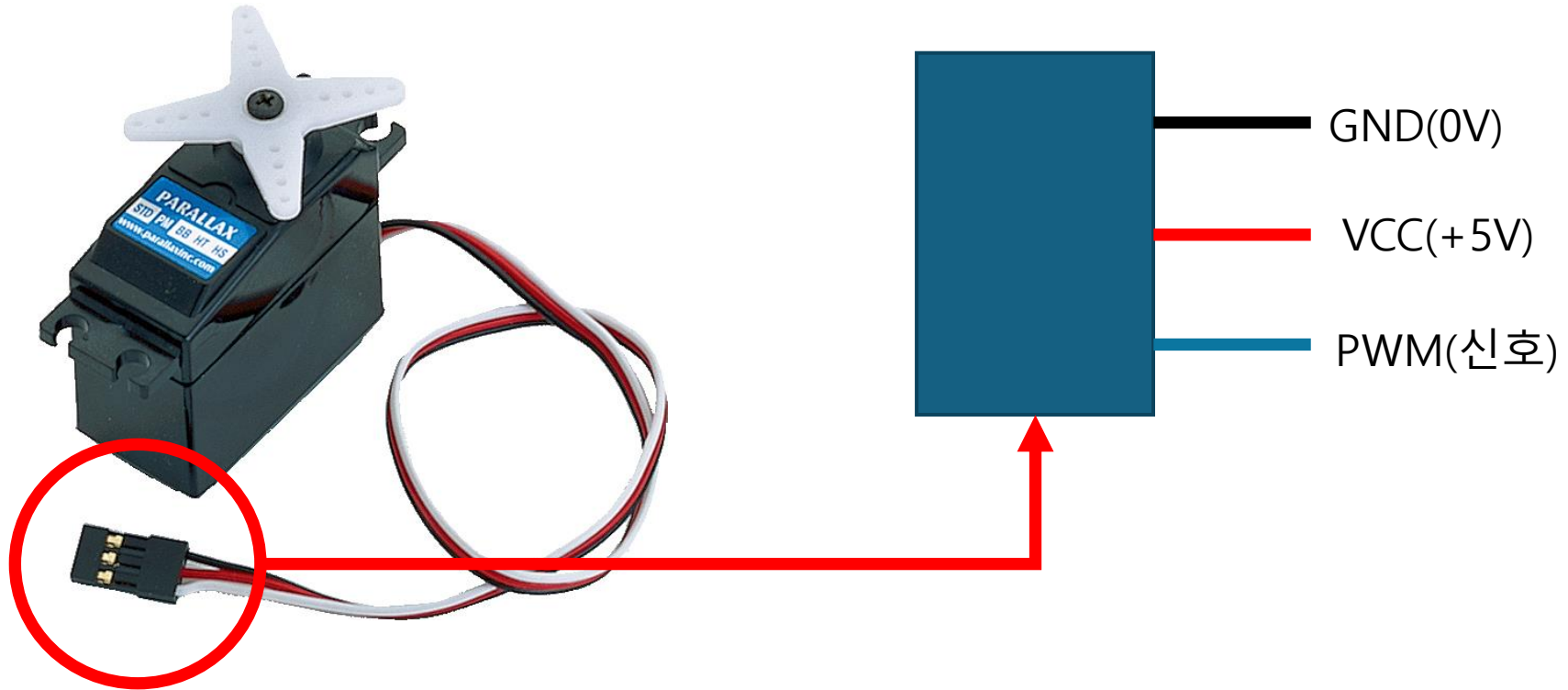
void loop()
{
    if( digitalRead (8) == LOW )
    {
        digitalWrite(2, LOW);
    }
    else
    {
        digitalWrite(2, HIGH);
    }
}
```



# PWM(Pulse Width Modulation)

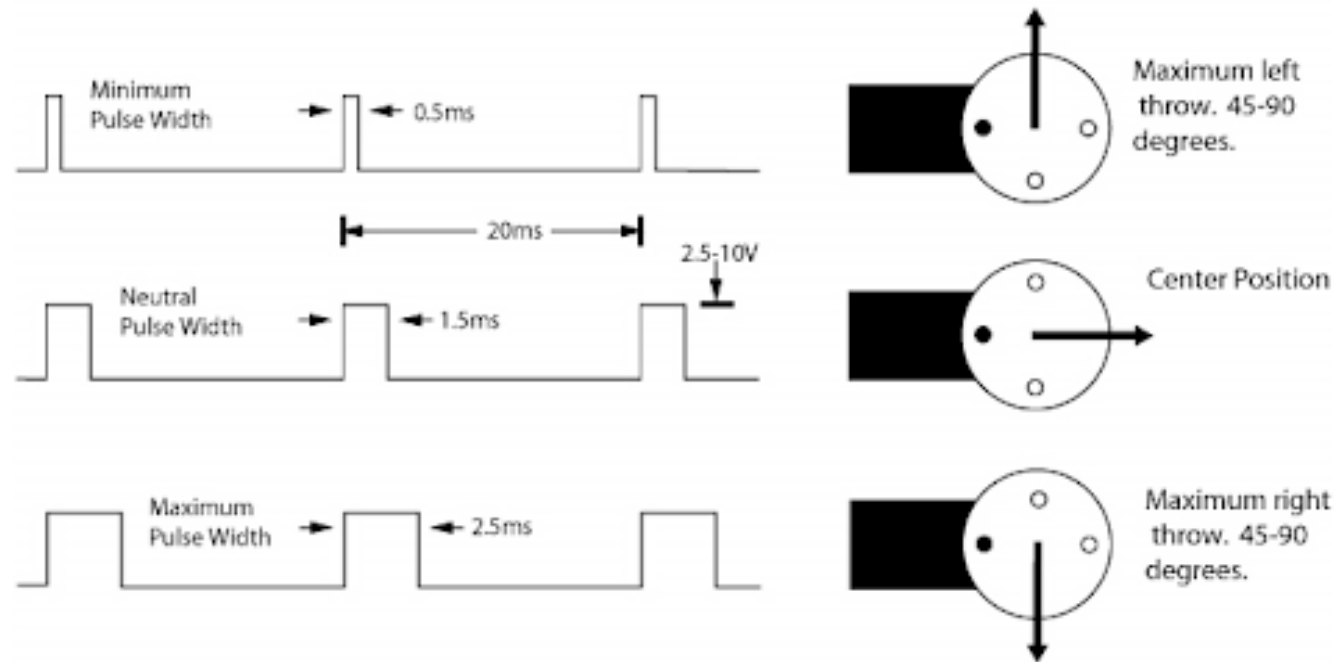


# RC 서보모터



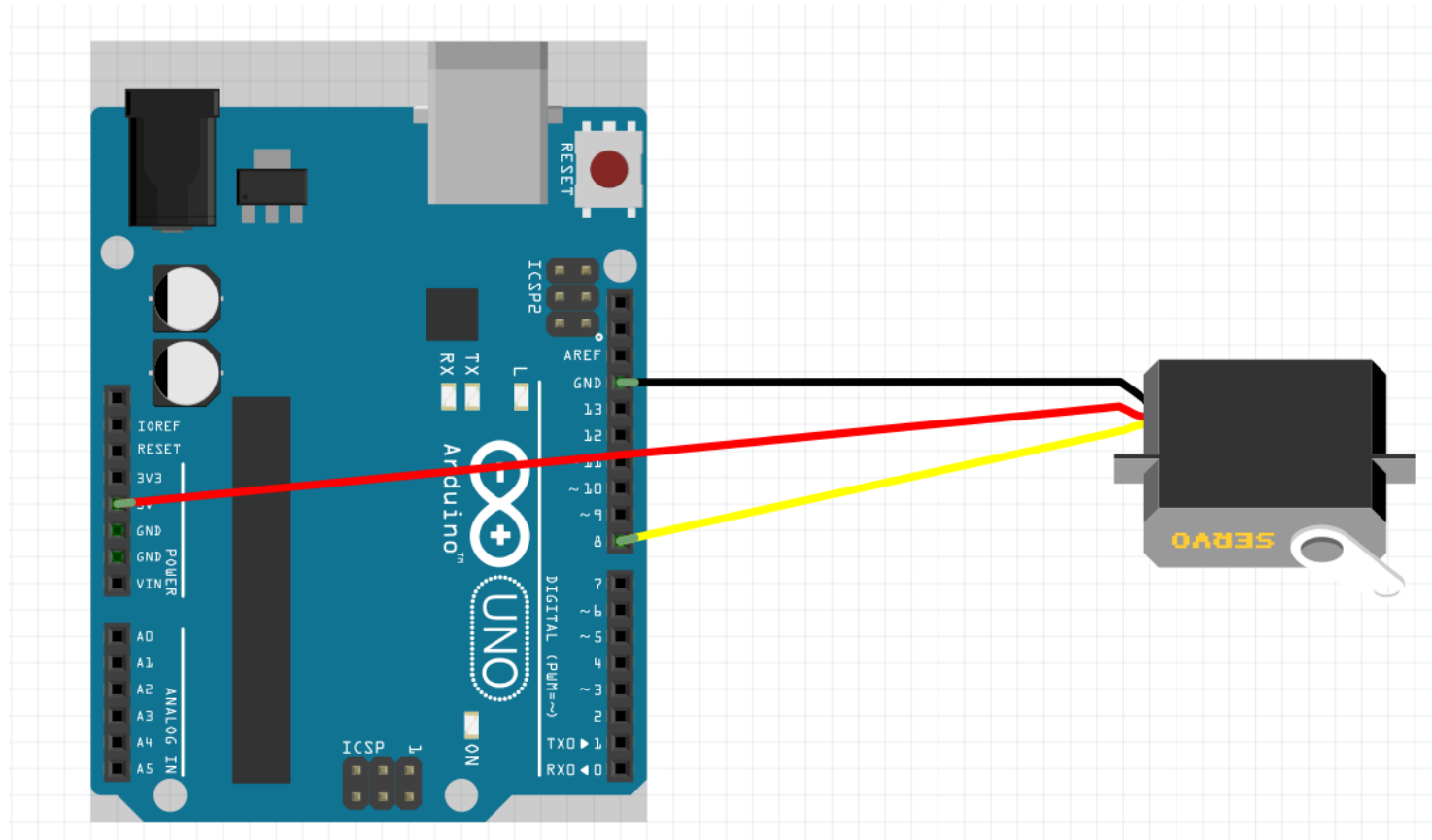
# PWM을 이용한 RC 서보모터 제어

## R/C Control Signal Theory



# 아두이노를 이용한 서보모터 제어

- 테스트 회로 구성



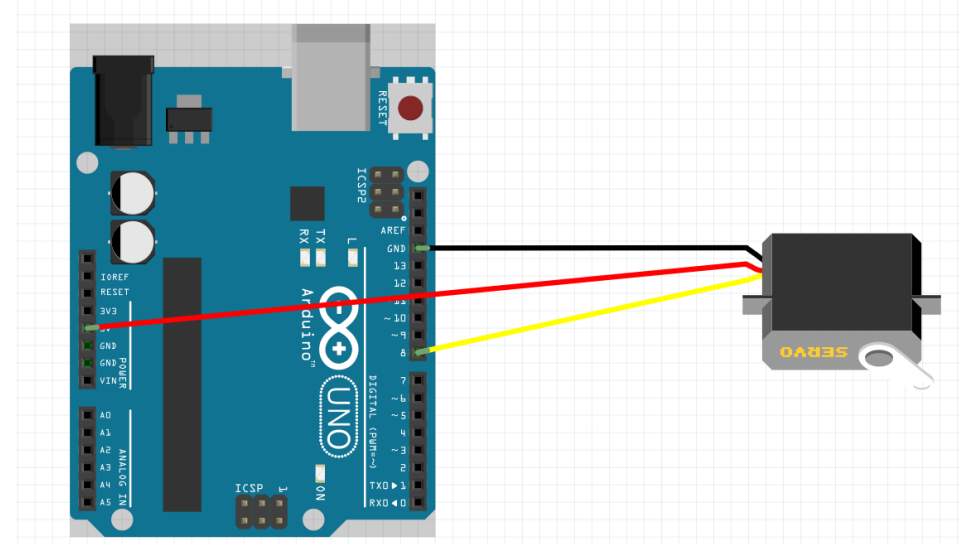
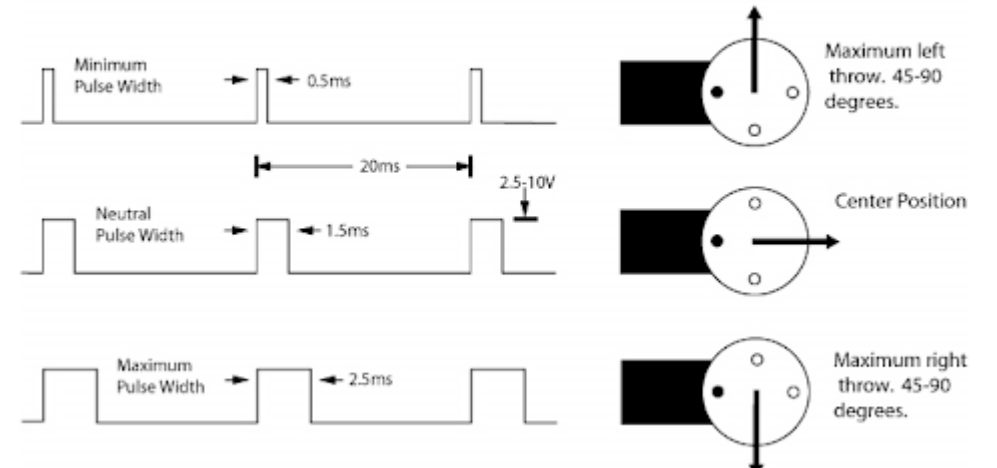
# 아두이노를 이용한 서보모터 제어

```
void setup()
{
  pinMode(8, OUTPUT);
}

void loop()
{
  digitalWrite(8, HIGH);
  delayMicroseconds(1400);

  digitalWrite(8, LOW);
  delayMicroseconds(20000-1400);
}
```

R/C Control Signal Theory



# 아두이노를 이용한 서보모터 제어

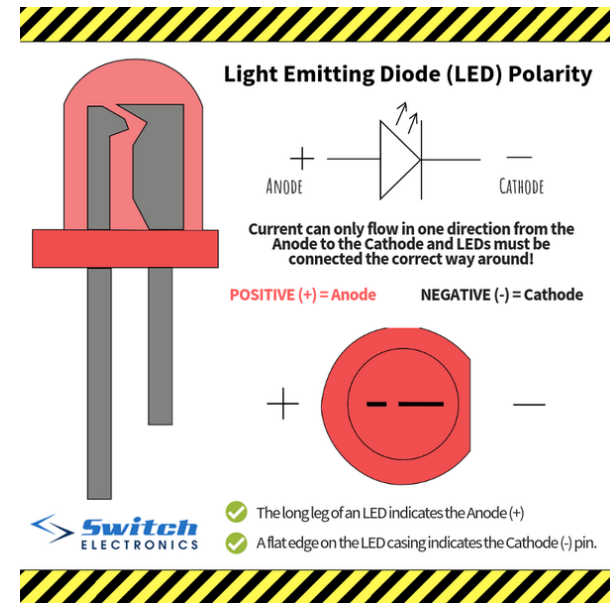
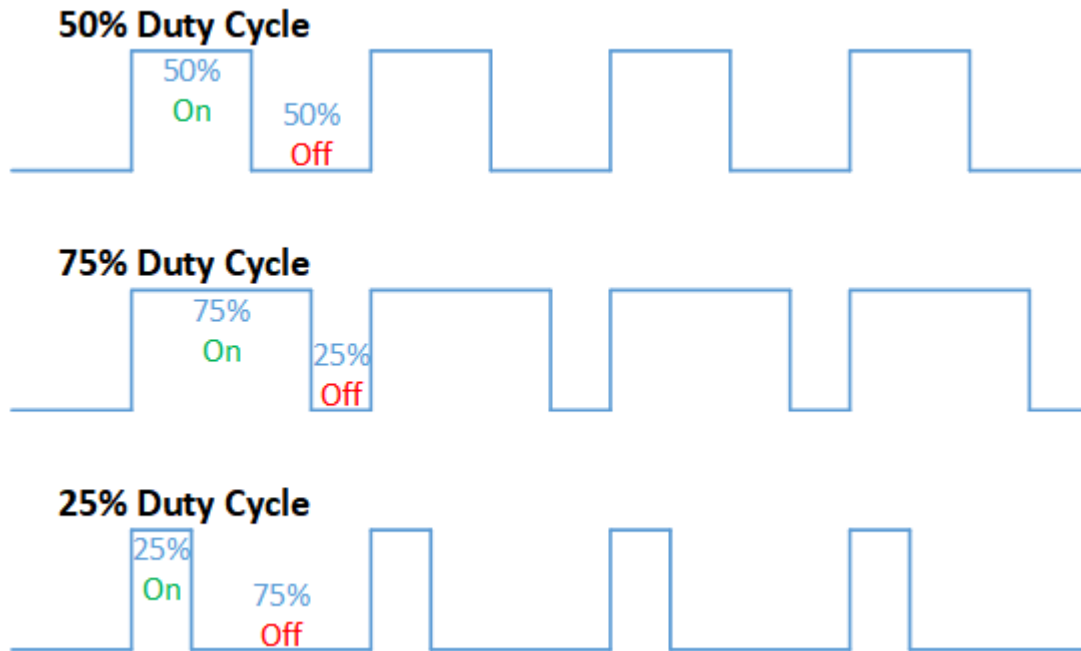
- 퀴즈

- 버튼을 누르는 동안에만 모터가 0도에 위치하고 그렇지 않으면 90도 (반대로) 이동시키는 코드를 작성하시오

- Hint

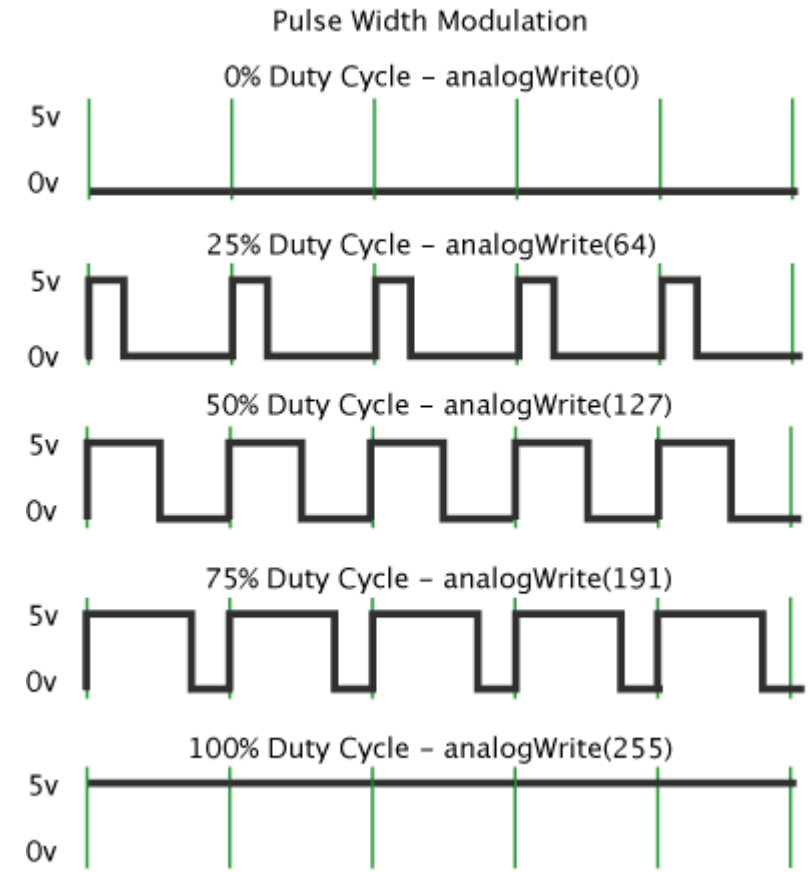
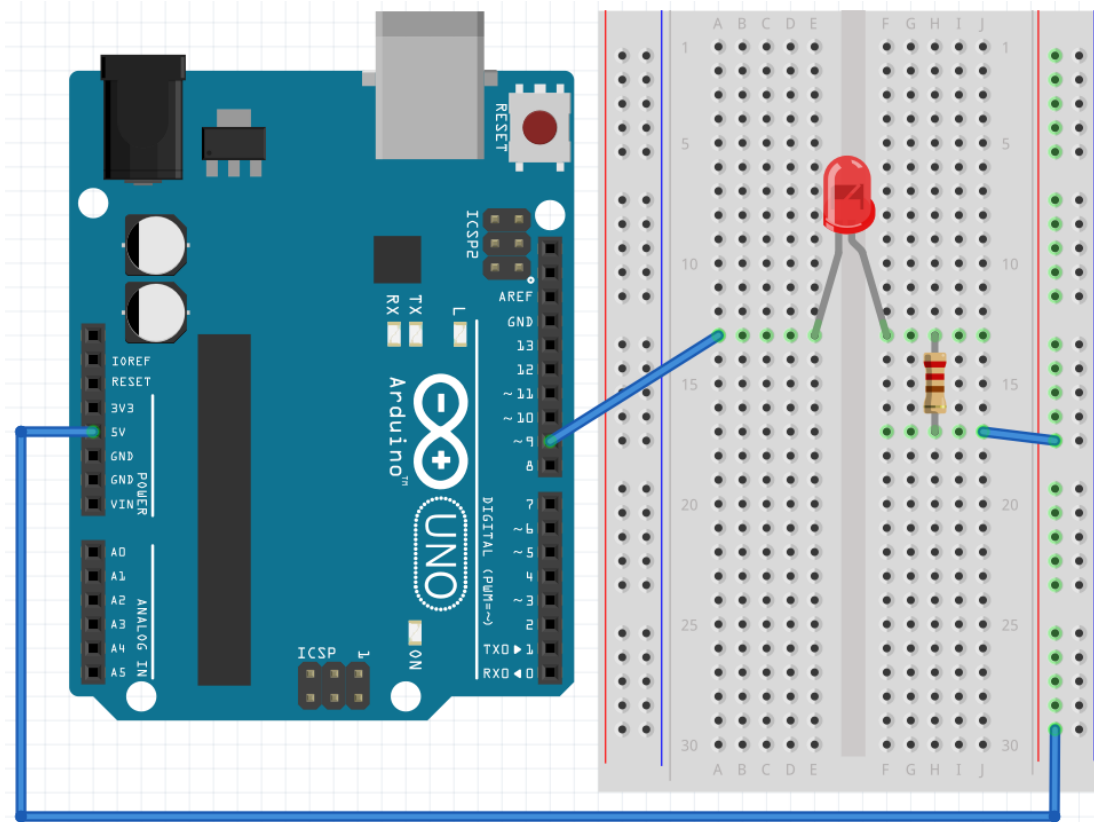
- pinMode(핀번호, INPUT\_PULLUP);
- if (digitalRead(핀번호) == LOW){} ~ else{}

# PWM을 이용한 LED 밝기 제어



# 아두이노를 이용한 LED 밝기 제어 예제

- 함수 : `analogWrite(핀번호, duty cycle)`



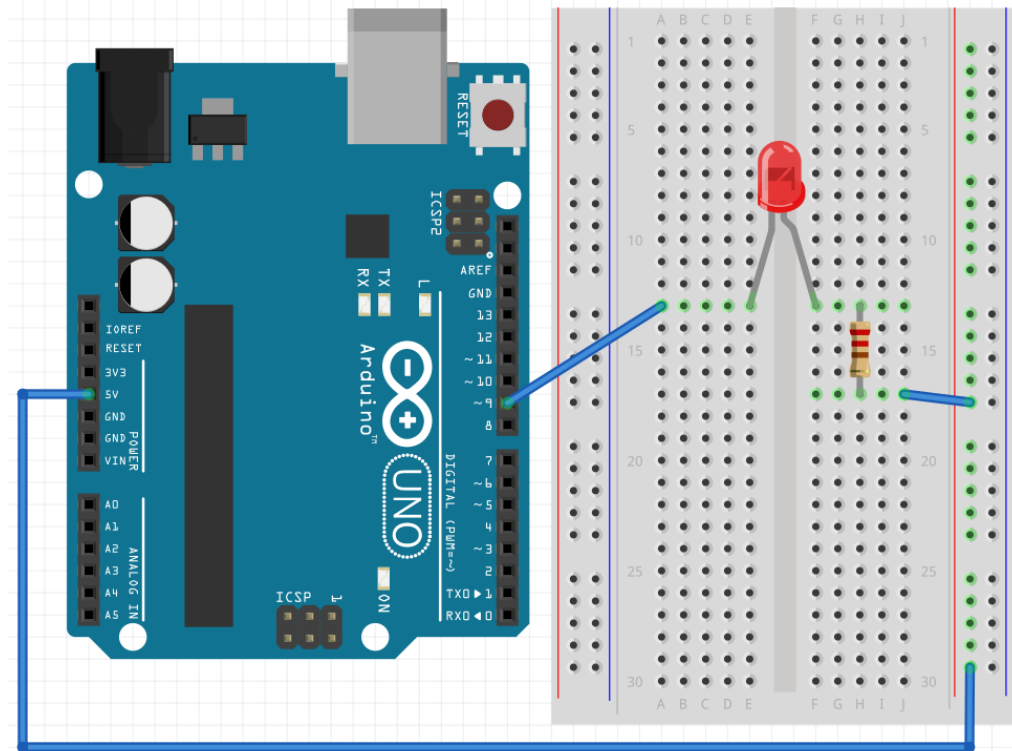


# 아두이노를 이용한 LED 밝기제어 예제

- 함수 : `analogWrite(핀번호, duty cycle)`

```
void setup() {  
  pinMode(9, OUTPUT); // 핀을 출력으로 설정  
}  
  
void loop() {  
  analogWrite(9, 0); //analogWrite 값은 0 부터 255까지  
}
```

```
void setup() {  
  pinMode(9, OUTPUT); // 핀을 출력으로 설정  
}  
  
void loop() {  
  analogWrite(9, 255); //analogWrite 값은 0 부터 255까지  
}
```



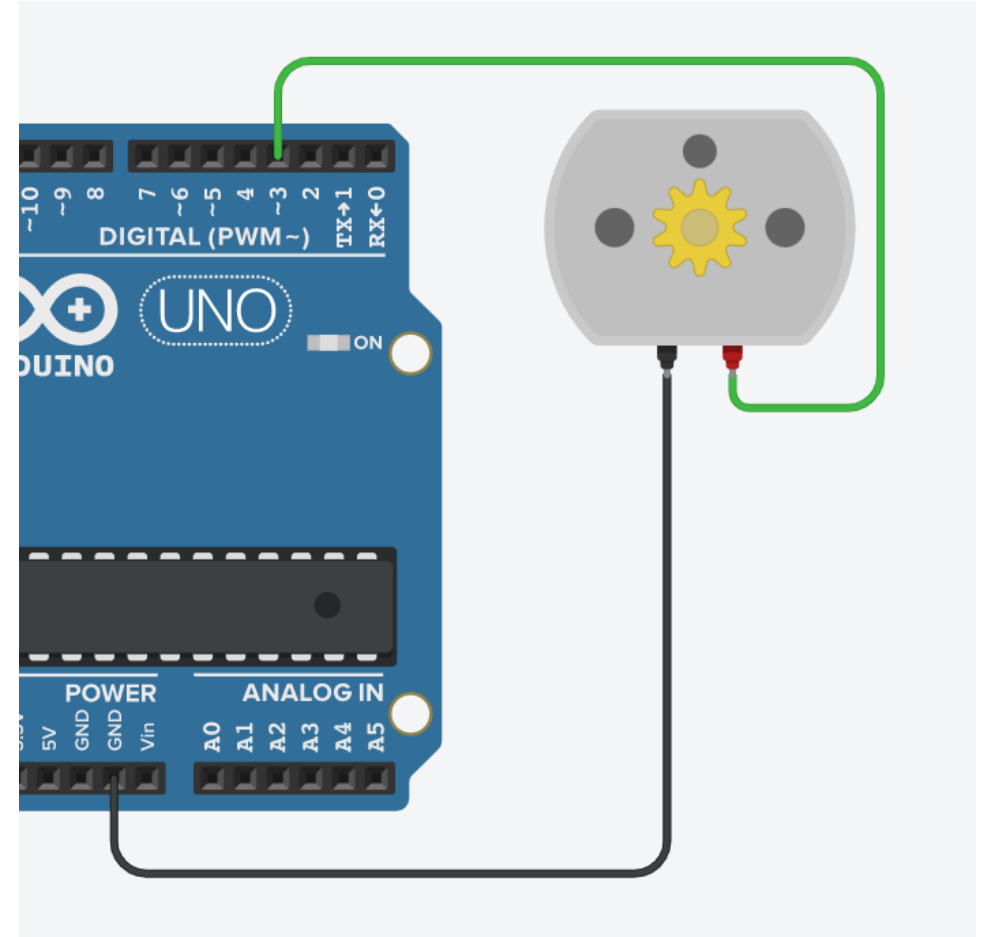
# analogWrite(PWM)을 이용한 DC모터 제어

```
void setup()
{
  pinMode(3, OUTPUT); // 핀을 출력으로 설정
}

void loop()
{
  analogWrite(3, 255); //analogWrite 값은 0 부터 255까지
}
```

```
void setup()
{
  pinMode(3, OUTPUT); // 핀을 출력으로 설정
}

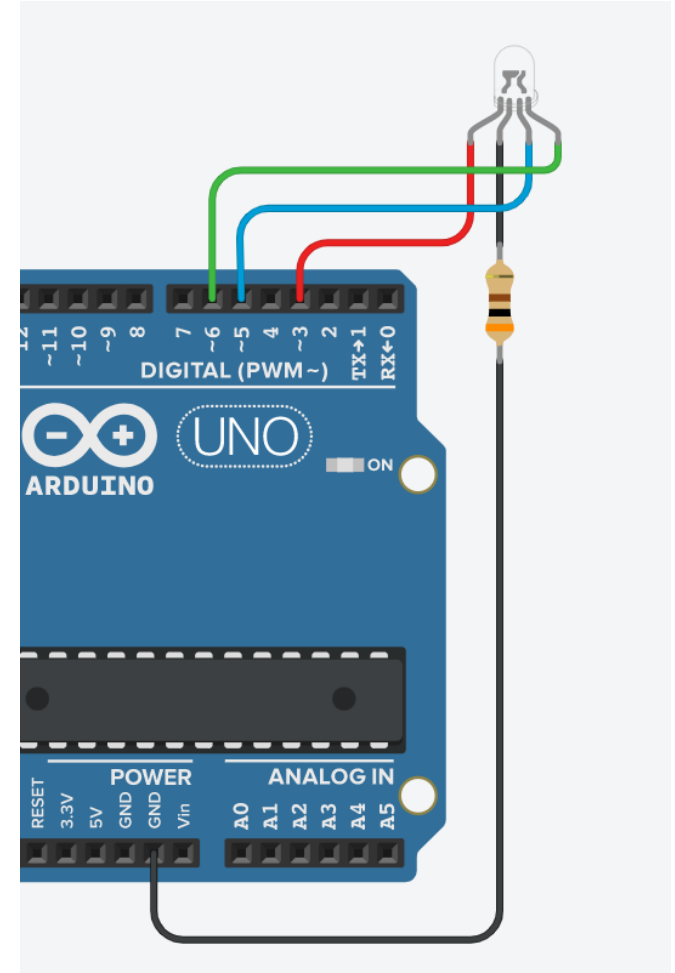
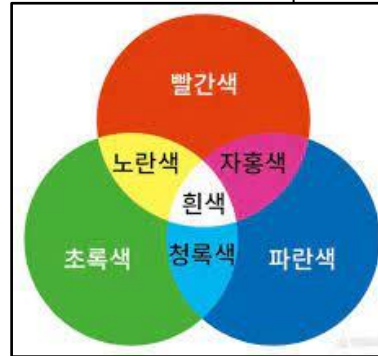
void loop()
{
  analogWrite(3, 128); //analogWrite 값은 0 부터 255까지
}
```



# analogWrite(PWM)을 이용한 RGB LED제어

```
void setup()
{
  pinMode(3, OUTPUT); // 핀을 출력으로 설정
  pinMode(5, OUTPUT); // 핀을 출력으로 설정
  pinMode(6, OUTPUT); // 핀을 출력으로 설정
}
```

```
void loop()
{
  analogWrite(3, 255); //analogWrite 값은 0 부터 255까지
  analogWrite(5, 255); //analogWrite 값은 0 부터 255까지
  analogWrite(6, 0); //analogWrite 값은 0 부터 255까지
}
```



# 아두이노를 이용한 LED 밝기제어 예제

```
void setup()
{
  pinMode(9, OUTPUT); // 핀을 출력으로 설정
}

void loop()
{
  for( int i=0 ; i<255 ; i++ )
  {
    analogWrite(9, i); //analogWrite 값은 0 부터 255까지
    delay(30) ;
  }

  for( int i=0 ; i<255 ; i++ )
  {
    analogWrite(9, 255-i); //analogWrite 값은 0 부터 255까지
    delay(30) ;
  }
}
```

