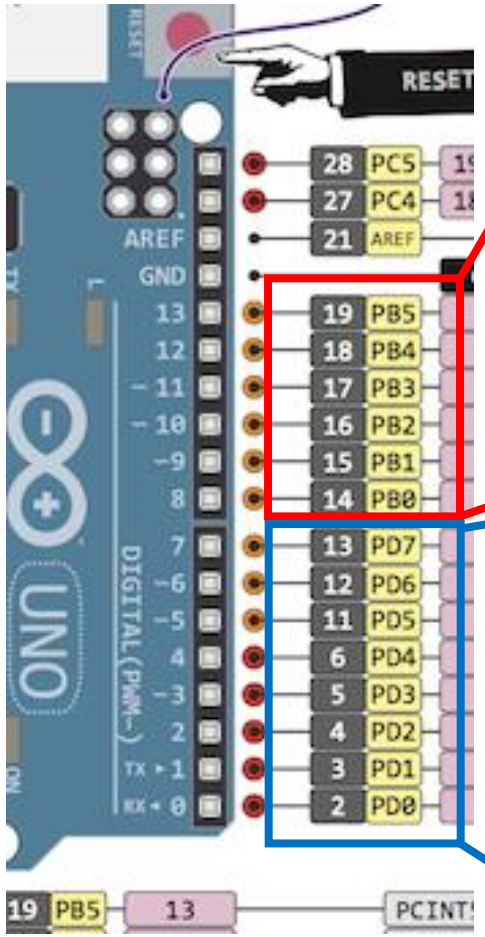
아두이노 C언어
- 함수와 세그먼트제어 -

마이크로프로세서 종합 설계. 5주차.

IO 포트 관련 레지스터

- Port



13.4.2 PORTB – The Port B Data Register

Bit	7	6	5	4	3	2	1	0	
0x05 (0x25)	PORTB7	PORTB6	PORTB5	PORTB4	PORTB3	PORTB2	PORTB1	PORTB0	PORTB
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	

13.4.3 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	DDRB
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	

13.4.4 PINB – The Port B Input Pins Address

Bit	7	6	5	4	3	2	1	0	
0x03 (0x23)	PINB7	PINB6	PINB5	PINB4	PINB3	PINB2	PINB1	PINB0	PINB
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

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	PORTD
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	

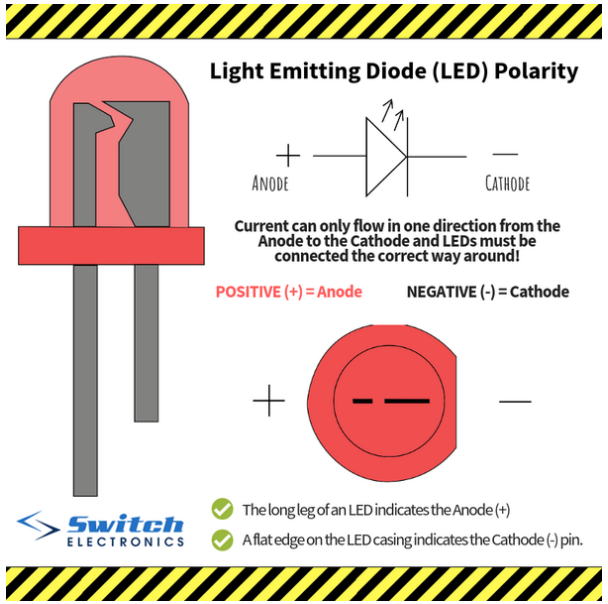
13.4.9 DDRD – The Port D Data Direction Register

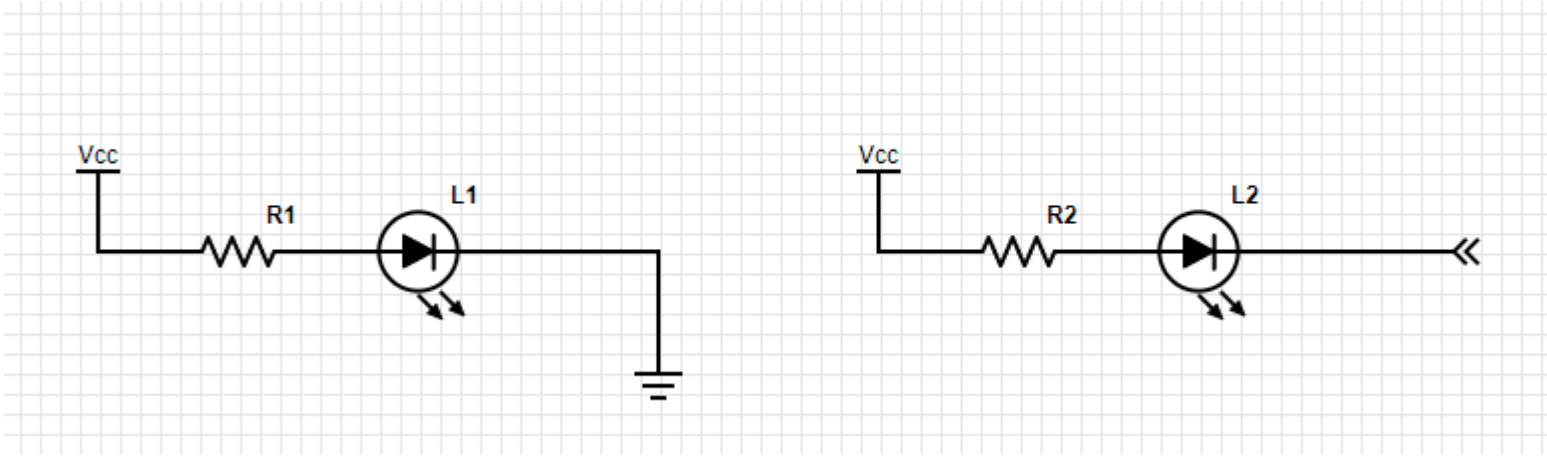
Bit	7	6	5	4	3	2	1	0	
0x0A (0x2A)	DDD7	DDD6	DDD5	DDD4	DDD3	DDD2	DDD1	DDD0	DDRD
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	

13.4.10 PIND – The Port D Input Pins Address

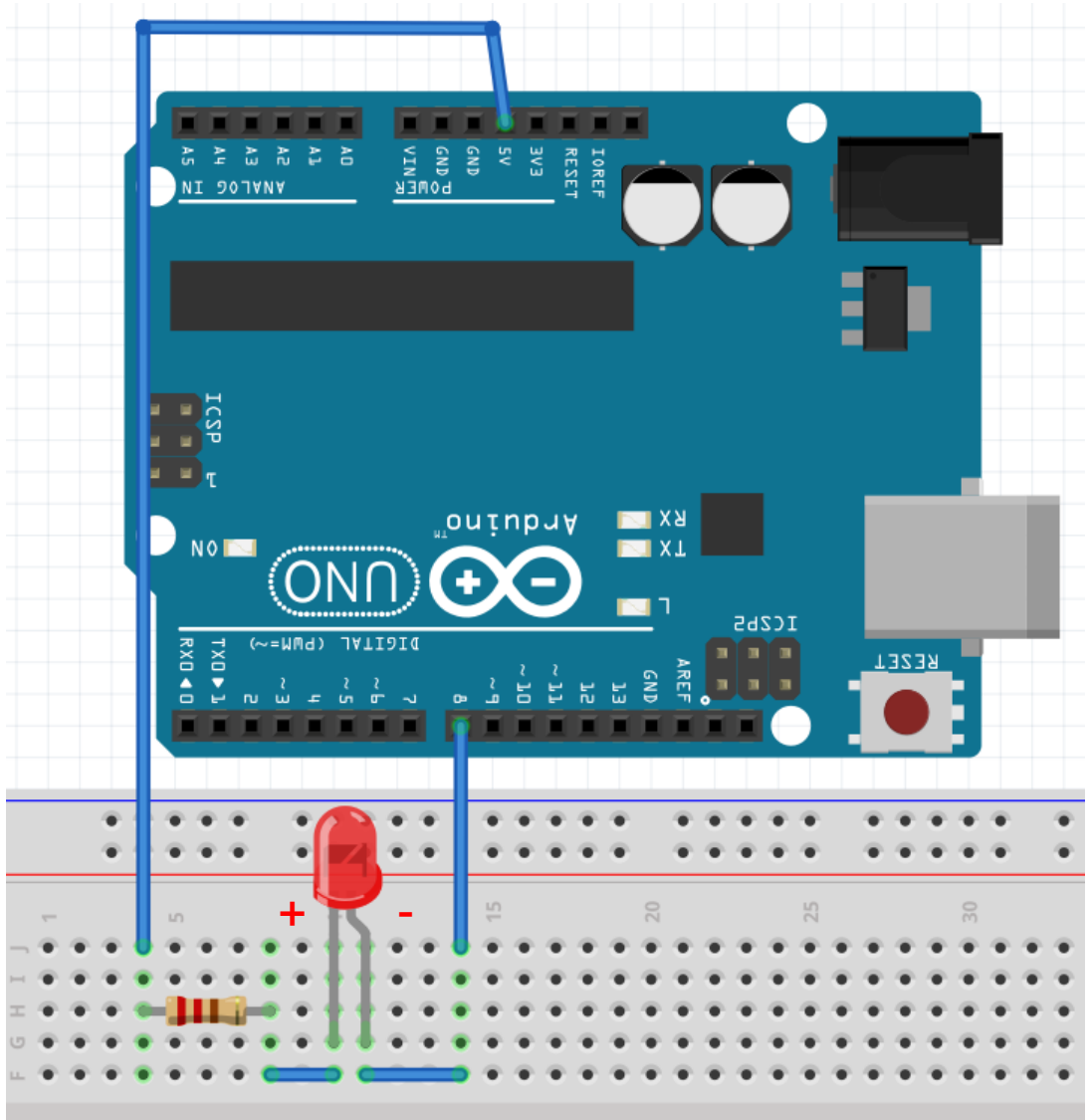
Bit	7	6	5	4	3	2	1	0	
0x09 (0x29)	PIND7	PIND6	PIND5	PIND4	PIND3	PIND2	PIND1	PIND0	PIND
Read/Write	R	R	R	R	R	R	R	R	
Initial Value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

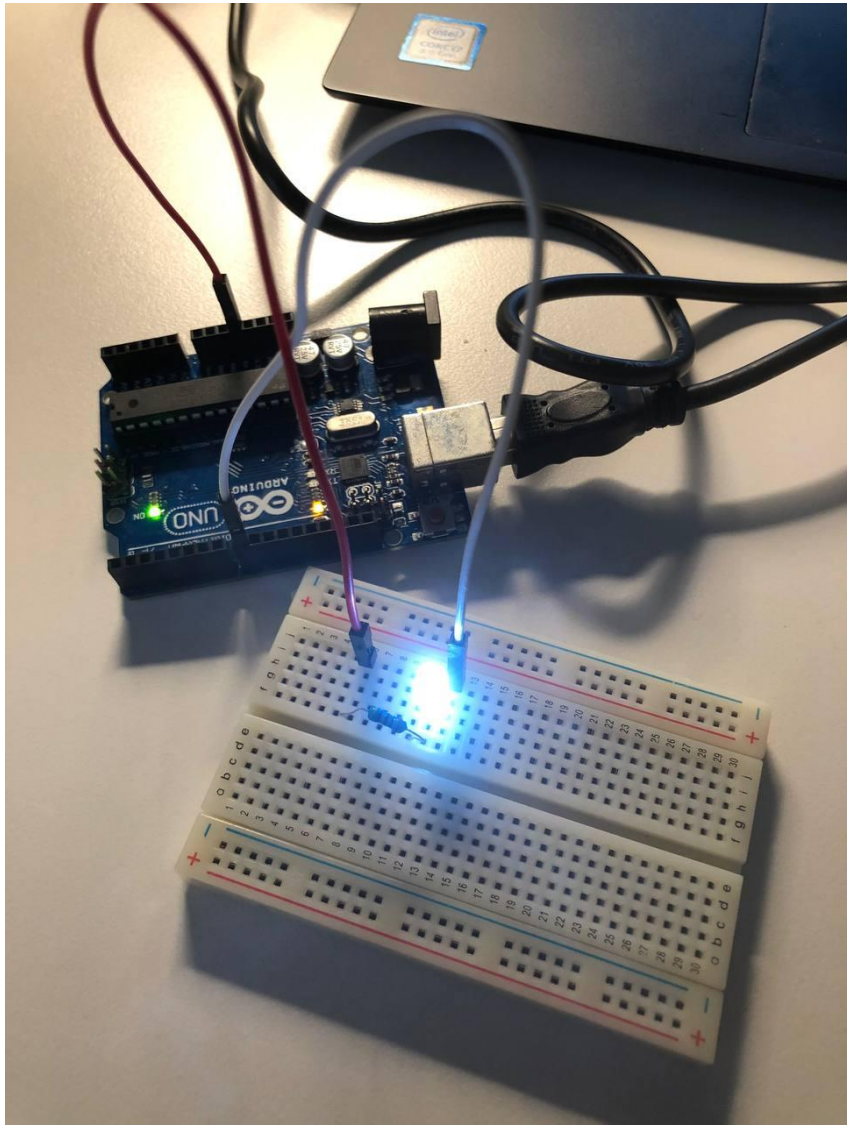
LED


Light Emitting Diode (LED) Polarity
+
ANODE
—
CATHODE
Current can only flow in one direction from the Anode to the Cathode and LEDs must be connected the correct way around!
POSITIVE (+) = Anode
NEGATIVE (-) = Cathode
+
—
Switch ELECTRONICS
The long leg of an LED indicates the Anode (+)
A flat edge on the LED casing indicates the Cathode (-) pin.


Vcc
R1
L1
Vcc
R2
L2

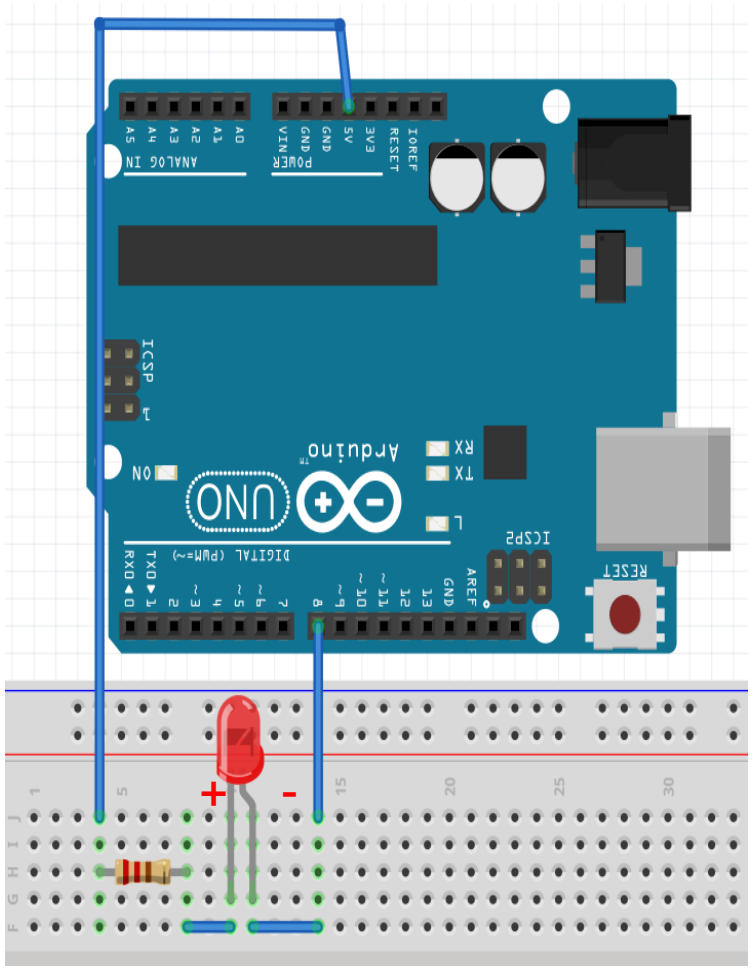
IO 포트 테스트

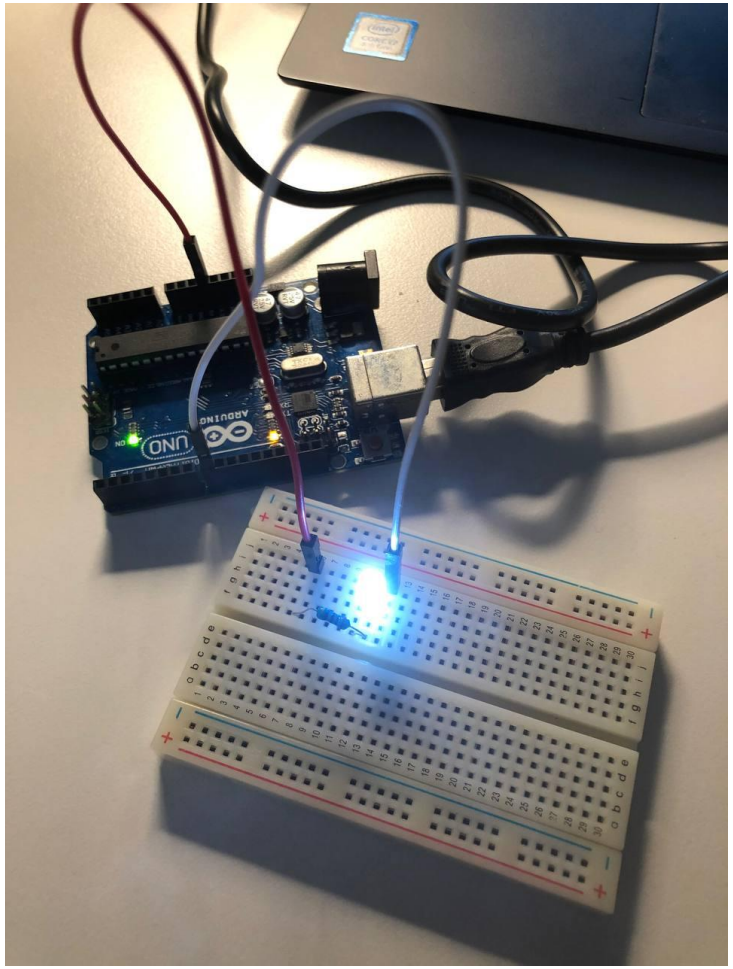




IO 포트 테스트

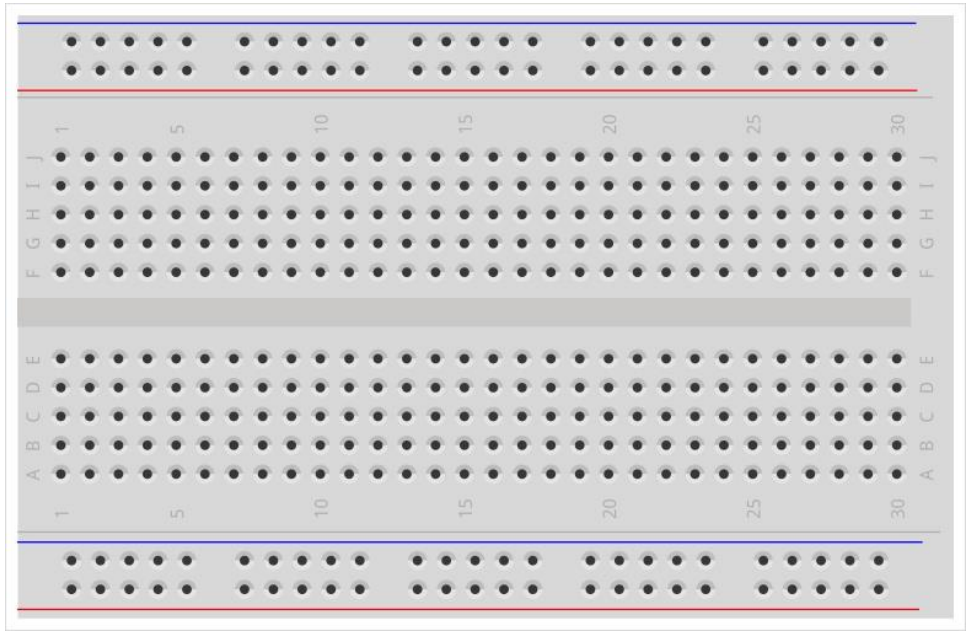
```
void setup()
{
  DDRB = B00000001 ;
  PORTB = B00000000 ;
}

void loop()
{
  PORTB = B00000001 ;
  delay(1000) ;
  PORTB = B00000000 ;
  delay(1000) ;
}
```

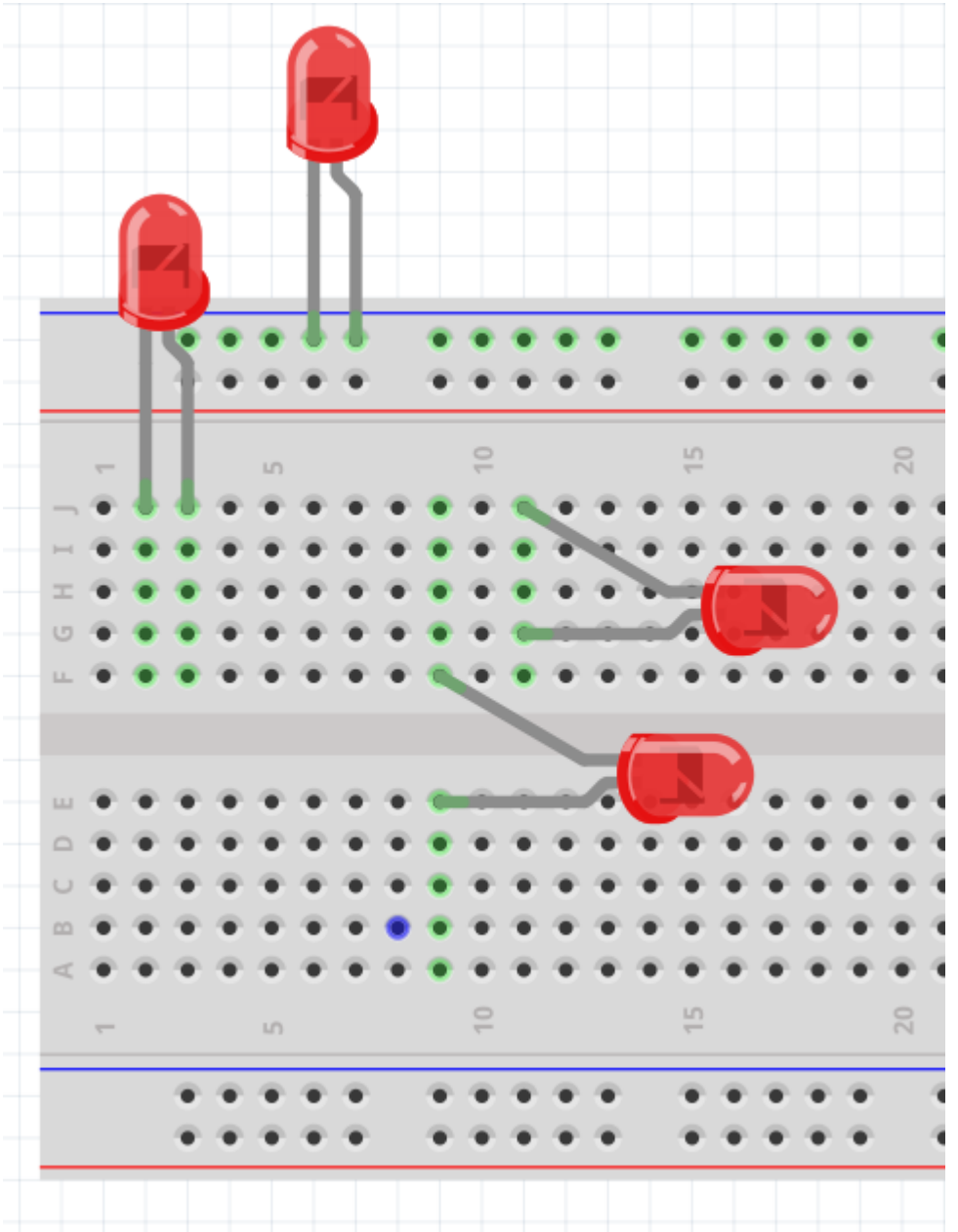




IO 포트 관련 레지스터

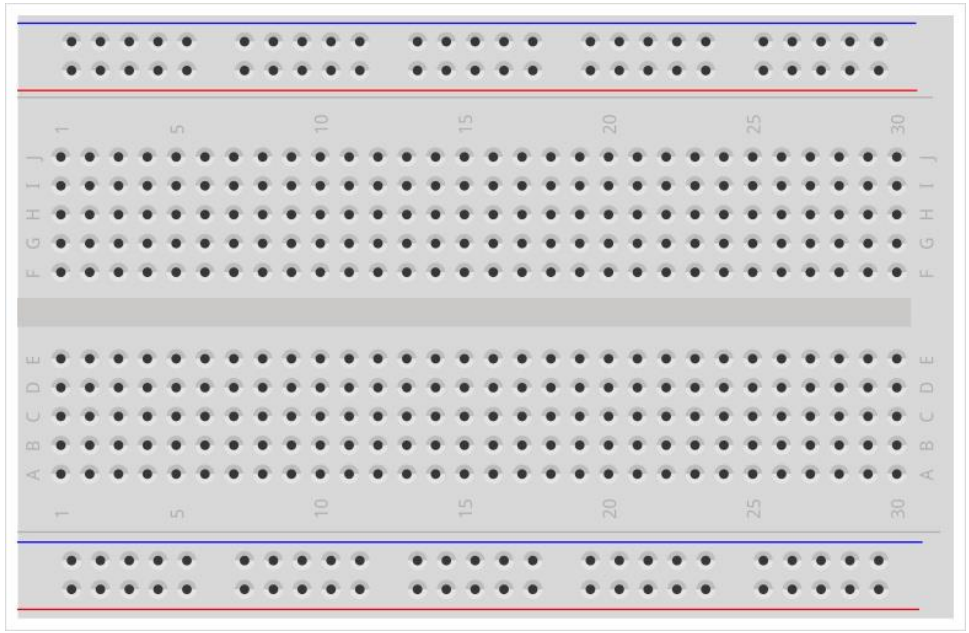
- 빵판 사용법(브레드보드)

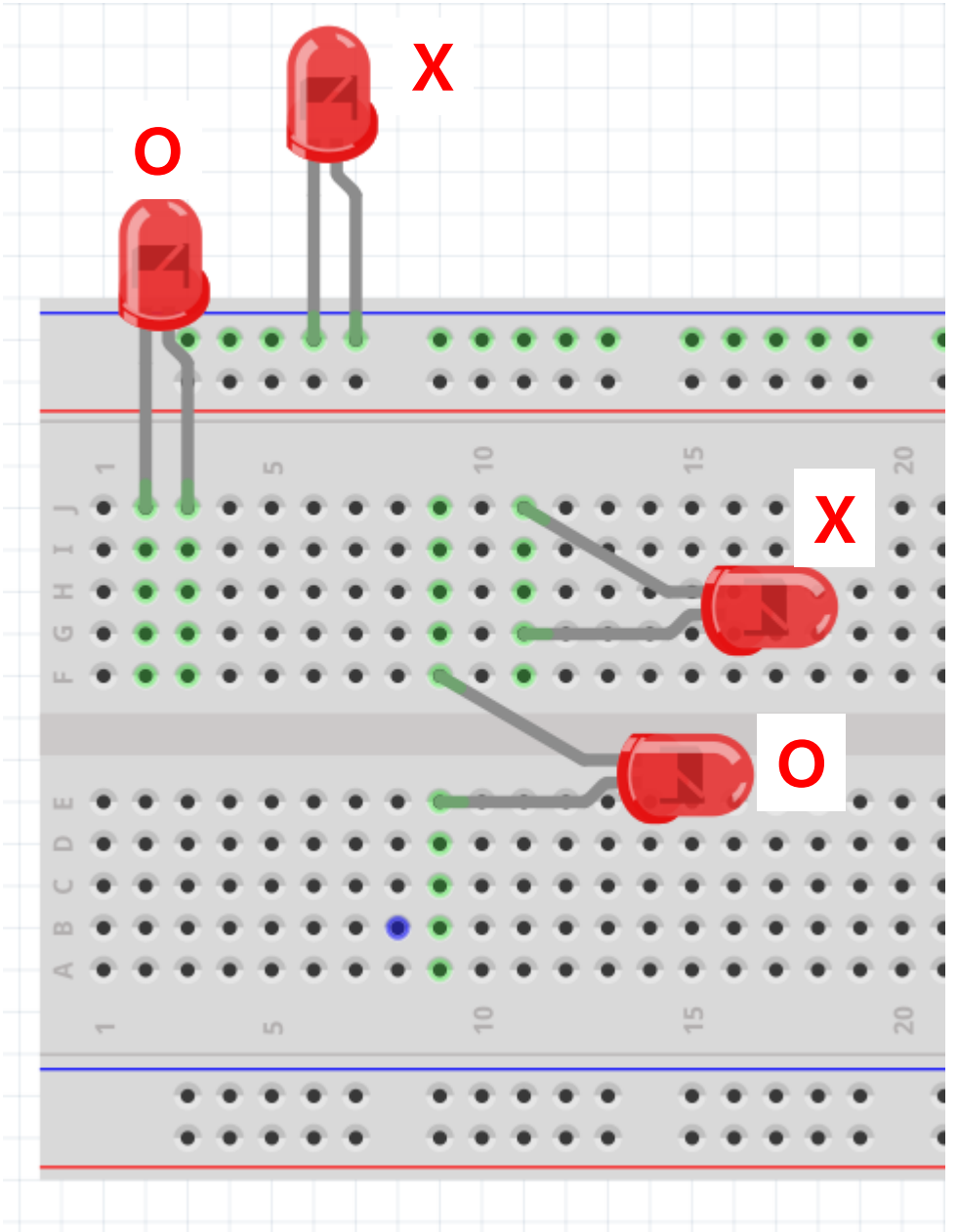




IO 포트 관련 레지스터

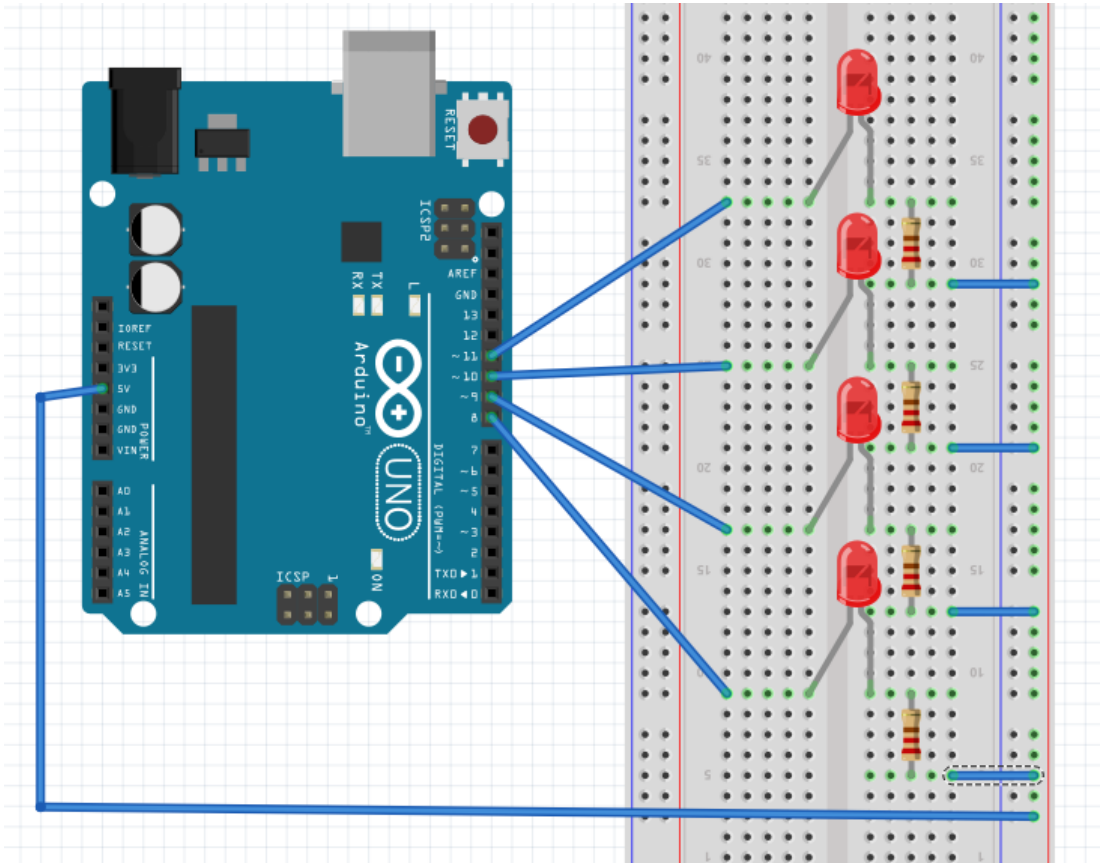
- 빵판 사용법(브레드보드)

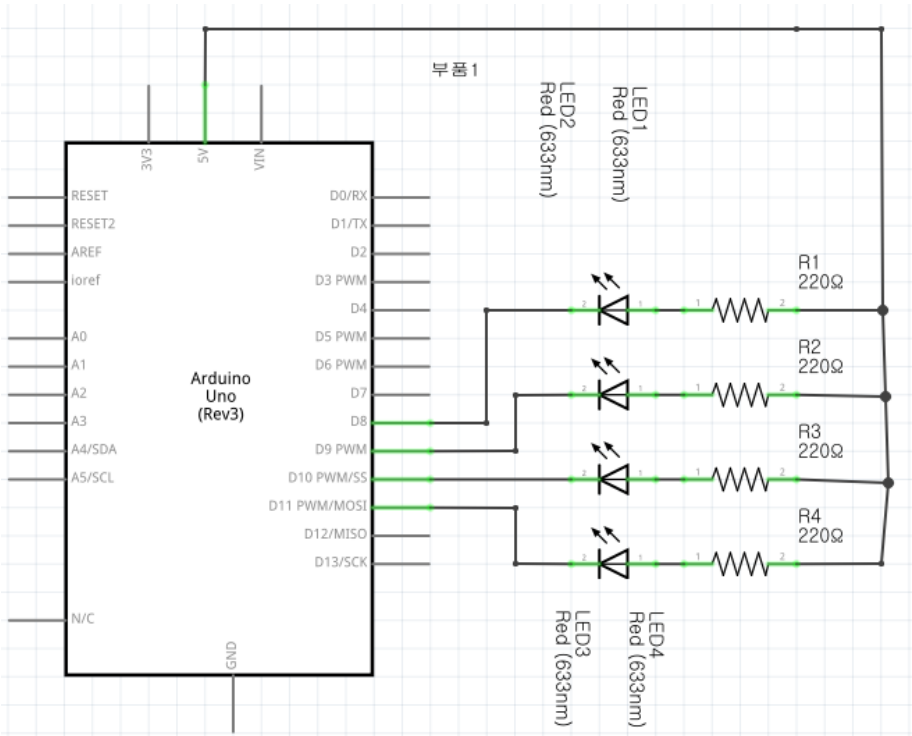




LED를 이용한 포트 제어 실험

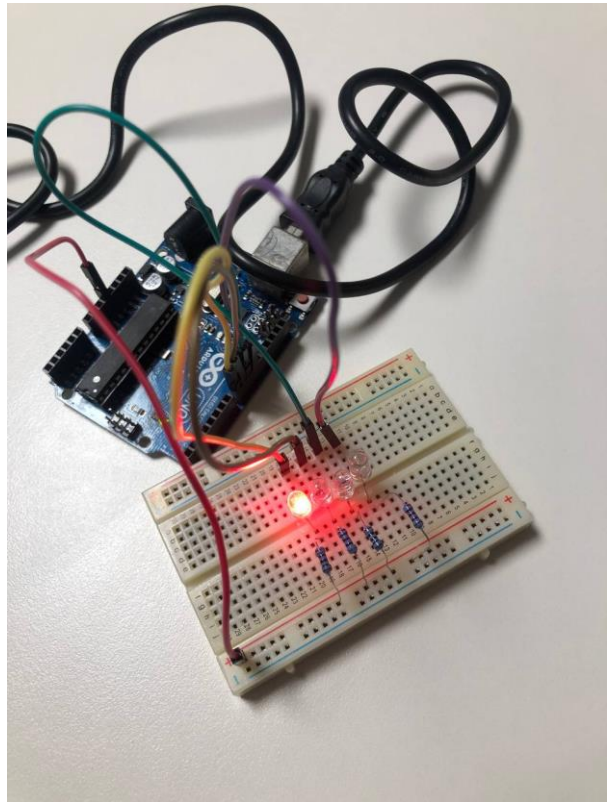
- 4개의 LED를 연결해서 포트를 제어 해보자.





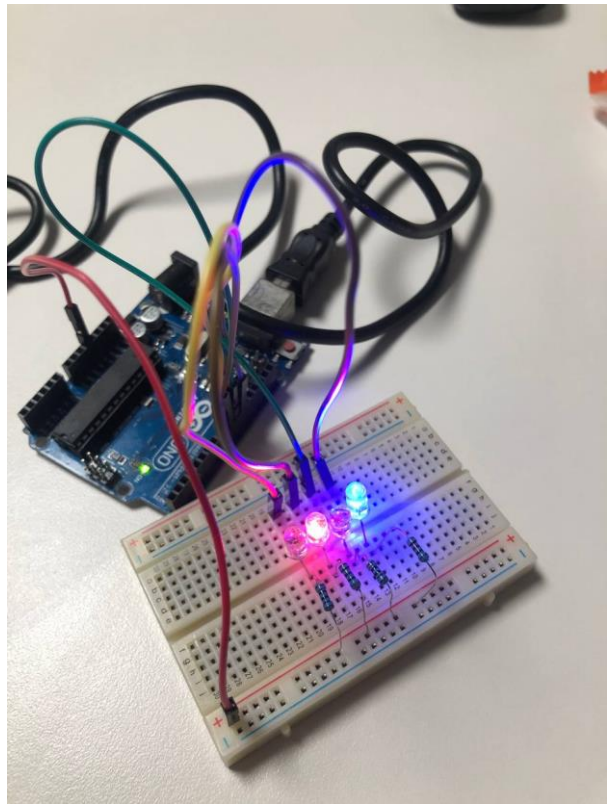
LED를 이용한 포트 제어 실험

```
void setup()
{
  DDRB = B00001111 ;
  PORTB = B00000000 ;
}

void loop()
{
  PORTB = B00001111 ;
  delay(1000) ;
  PORTB = B00000000 ;
  delay(1000) ;
}
```

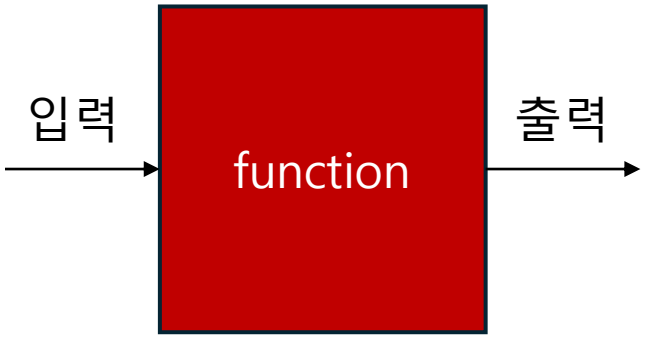


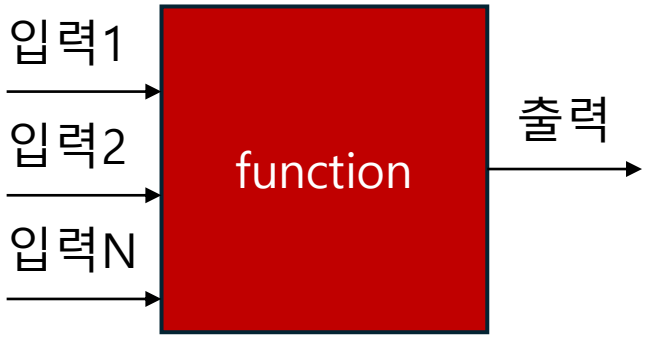
LED를 이용한 포트 제어 실험

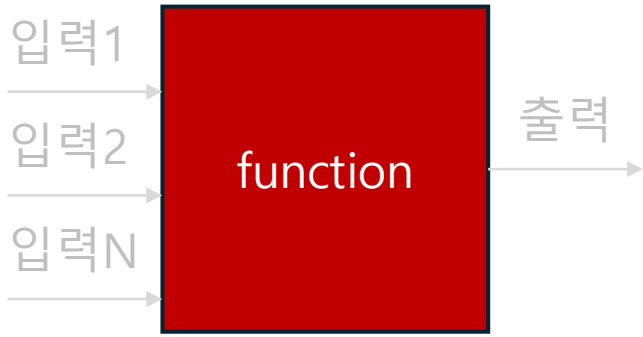
```
void setup()
{
  DDRB = 0x0F ;
  PORTB = 0x0A ;
}

void loop()
{
  PORTB = 0x0A ;
  delay(500) ;
  PORTB = 0x05 ;
  delay(500) ;
}
```



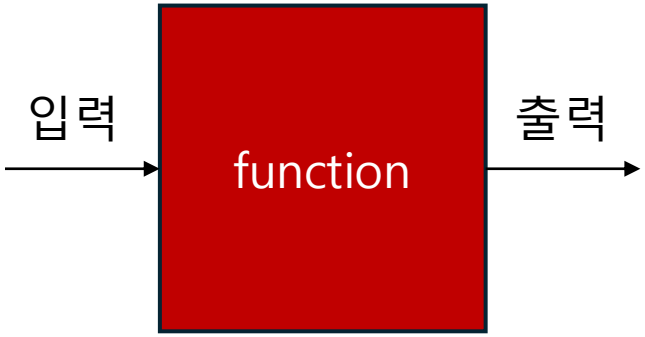
마이크로프로세서와 C언어 - 함수

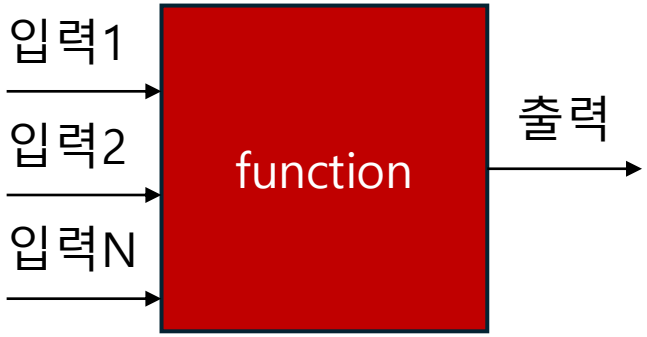


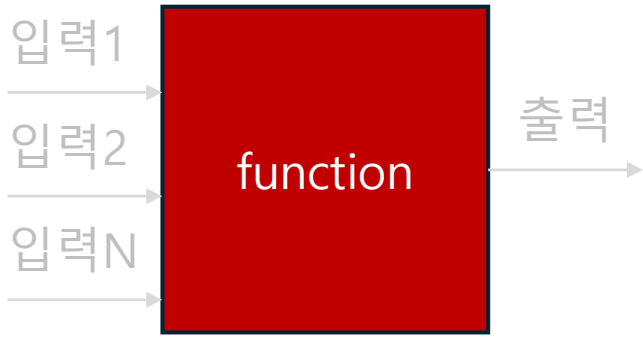




마이크로프로세서와 C언어 - 함수







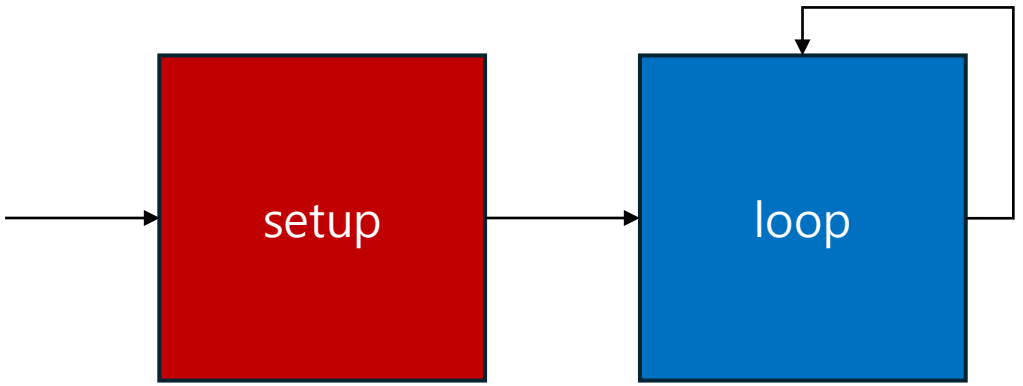

```
int function(int a)
{
    a = a + 10 ;
    return a ;
}
```

```
int function(int a, int b)
{
    int c = a + b ;
    return c ;
}
```

```
void function(void)
{
    //함수 명령
}
```

마이크로프로세서와 C언어 - 함수

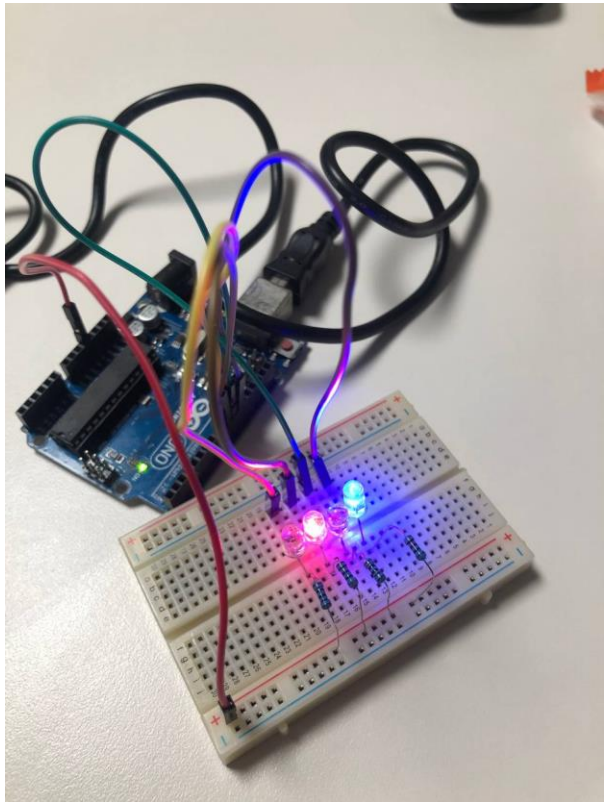
```
void setup()
{
    설정 ;
    초기화 ;
}

void loop()
{
    반복 기능 ;
}
```



LED를 이용한 포트 제어 실험

```
void setup()
{
  DDRB = 0x0F ;
  PORTB = 0x0A ;
}

void loop()
{
  PORTB = 0x0A ;
  delay(500) ;
  PORTB = 0x05 ;
  delay(500) ;
}
```

```
void LED(char value, int delay_value)
{
  PORTB = value ;
  delay(delay_value)
}

void setup()
{
  DDRB = 0x0F ;
  PORTB = 0x0A ;
}

void loop()
{
  LED(0x0A, 500) ;
  LED(0x05 , 500) ;
}
```

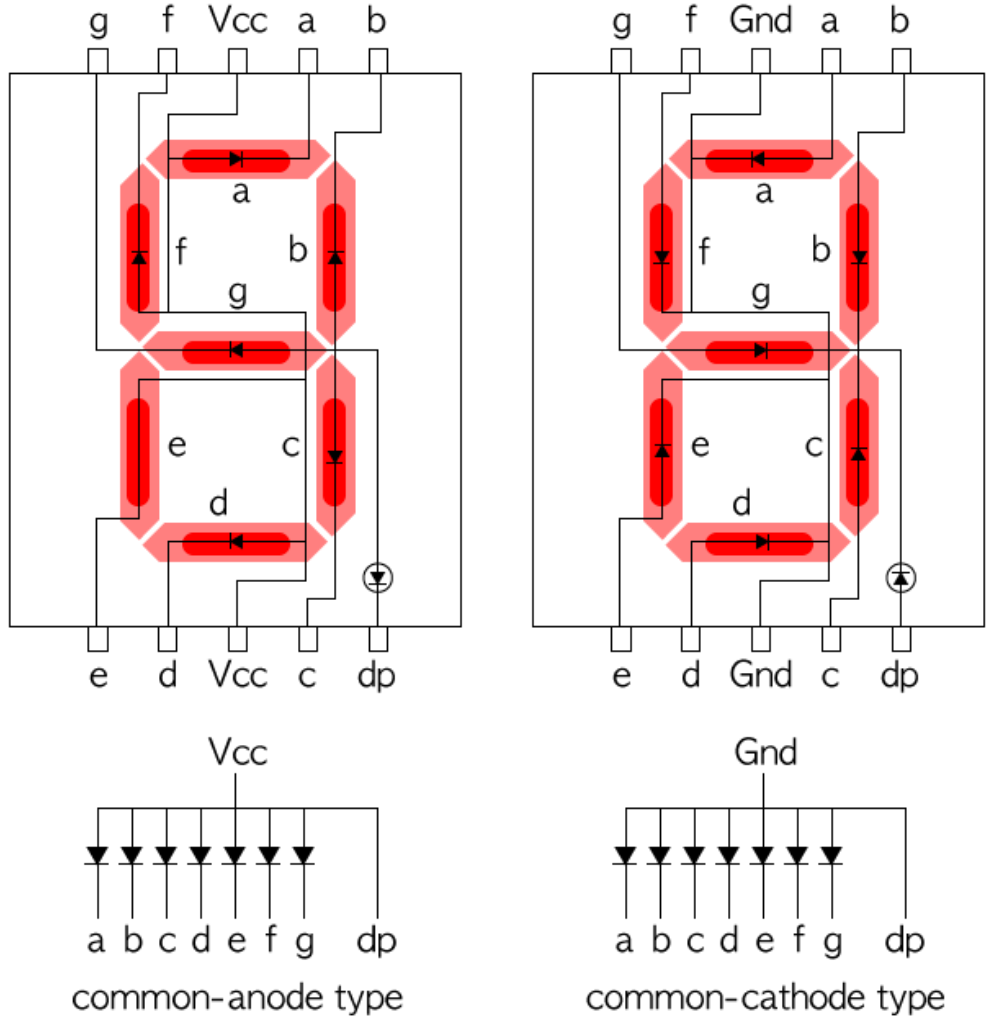


마이크로프로세서와 C언어 - 함수

```
int function_add(int a, int b)
{
   int c = a+b ;
   return c ;
}

void setup()
{
  Serial.begin(9600);
}

void loop()
{
  int result = function_add(1, 4) ;
  Serial.print("result = ") ;
  Serial.println(result) ;
}
```

LED를 이용한 포트 제어 실험

- 7-segment 실험

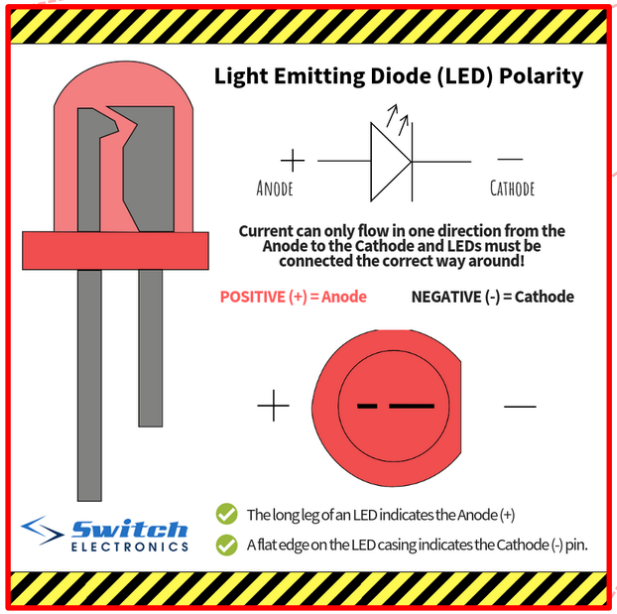


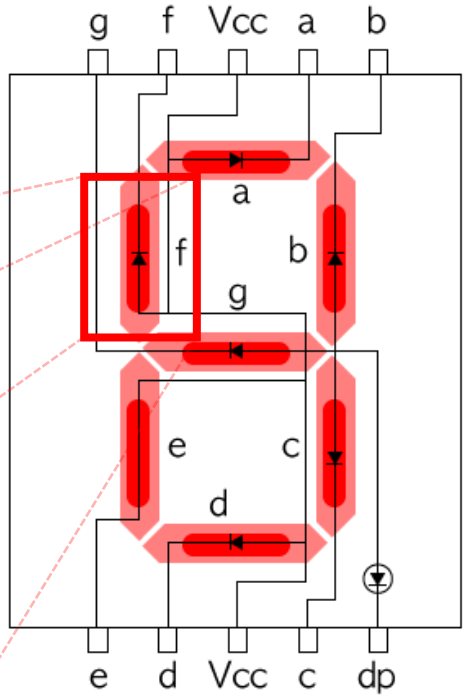
아두이노 C언어
- 조건문과 세그먼트제어 -

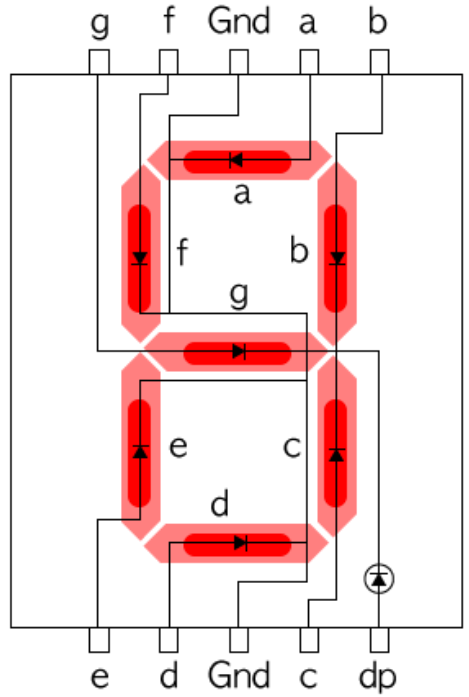
마이크로프로세서 종합 설계. 6주차.

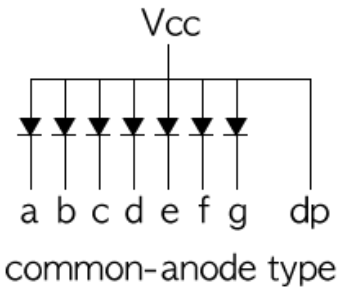
LED를 이용한 포트 제어 실험

- 7-segment 실험

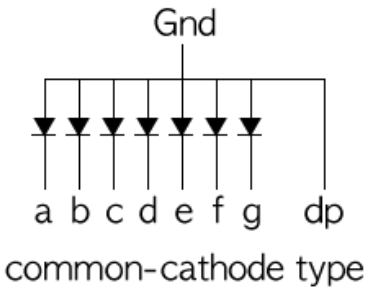








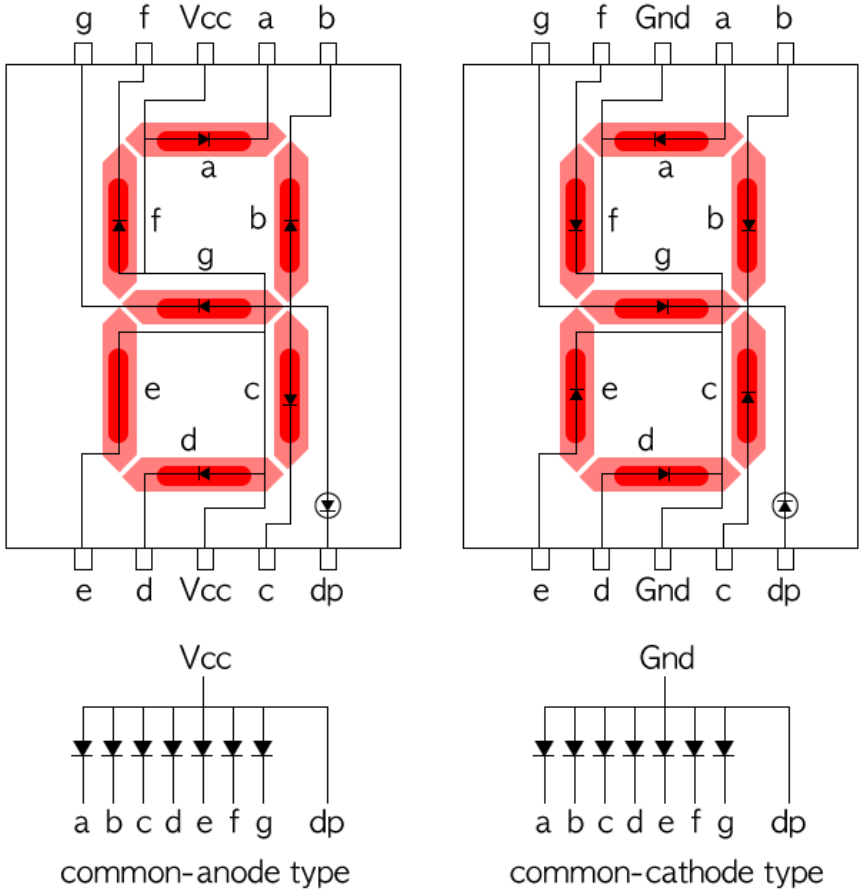
common-anode type



common-cathode type

LED를 이용한 포트 제어 실험

- 7-segment 실험



Common-anode type

0 = a(0) b(0) c(0) d(0) e(0) f(0) g(1) DP(1)

1 = a(1) b(0) c(0) d(1) e(1) f(1) g(1) DP(1)

2 = a(0) b(0) c(1) d(0) e(0) f(1) g(0) DP(1)

3 = a(0) b(0) c(0) d(0) e(1) f(1) g(0) DP(1)

4 = a(1) b(0) c(0) d(1) e(1) f(0) g(0) DP(1)

5 = a(0) b(1) c(0) d(0) e(1) f(0) g(0) DP(1)

6 = a(0) b(1) c(0) d(0) e(0) f(0) g(0) DP(1)

7 = a(0) b(0) c(0) d(1) e(1) f(0) g(1) DP(1)

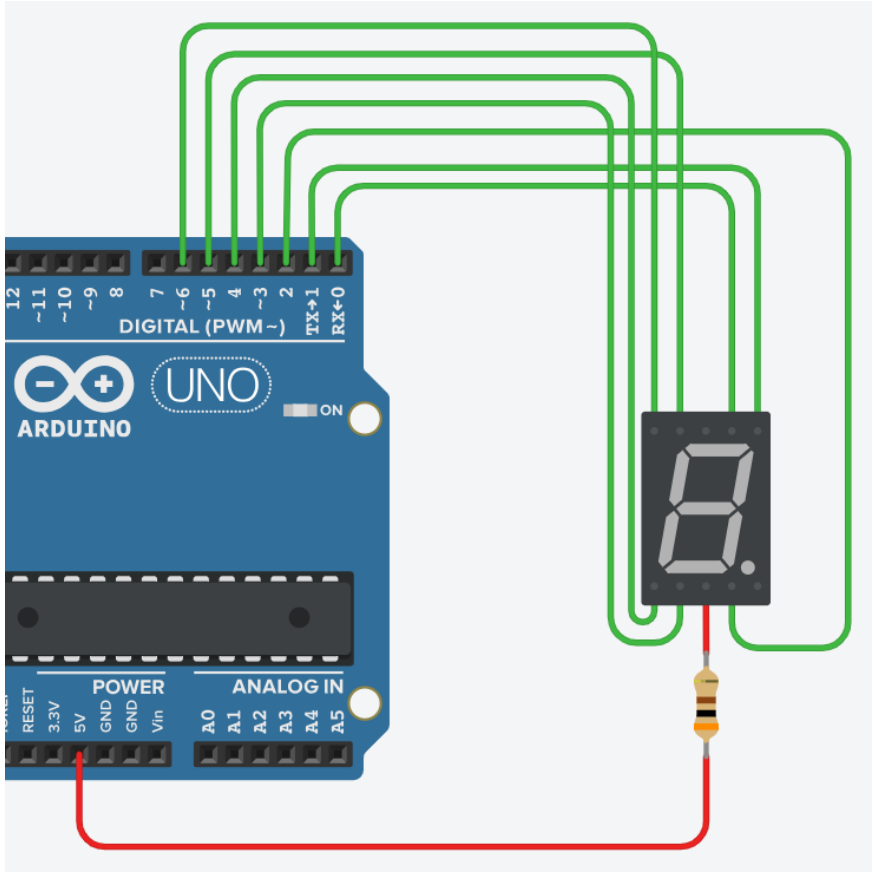
8 = a(0) b(0) c(0) d(0) e(0) f(0) g(0) DP(1)

9 = a(0) b(0) c(0) d(0) e(1) f(0) g(0) DP(1)

. = DP(0)

LED를 이용한 포트 제어 실험

- 7-segment 실험



a	→	PD0
b	→	PD1
c	→	PD2
d	→	PD3
e	→	PD4
f	→	PD5
g	→	PD6
DP	→	PD7

LED를 이용한 포트 제어 실험

- 7-segment 실험

0 = a(0) b(0) c(0) d(0) e(0) f(0) g(1) DP(1)

1 = a(1) b(0) c(0) d(1) e(1) f(1) g(1) DP(1)

2 = a(0) b(0) c(1) d(0) e(0) f(1) g(0) DP(1)

3 = a(0) b(0) c(0) d(0) e(1) f(1) g(0) DP(1)

4 = a(1) b(0) c(0) d(1) e(1) f(0) g(0) DP(1)

5 = a(0) b(1) c(0) d(0) e(1) f(0) g(0) DP(1)

6 = a(0) b(1) c(0) d(0) e(0) f(0) g(0) DP(1)

7 = a(0) b(0) c(0) d(1) e(1) f(0) g(1) DP(1)

8 = a(0) b(0) c(0) d(0) e(0) f(0) g(0) DP(1)

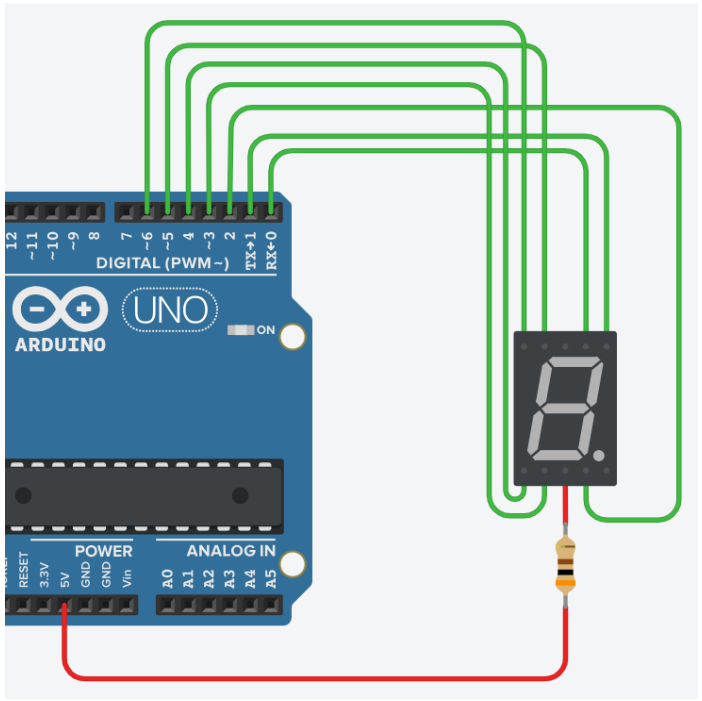
9 = a(0) b(0) c(0) d(0) e(1) f(0) g(0) DP(1)

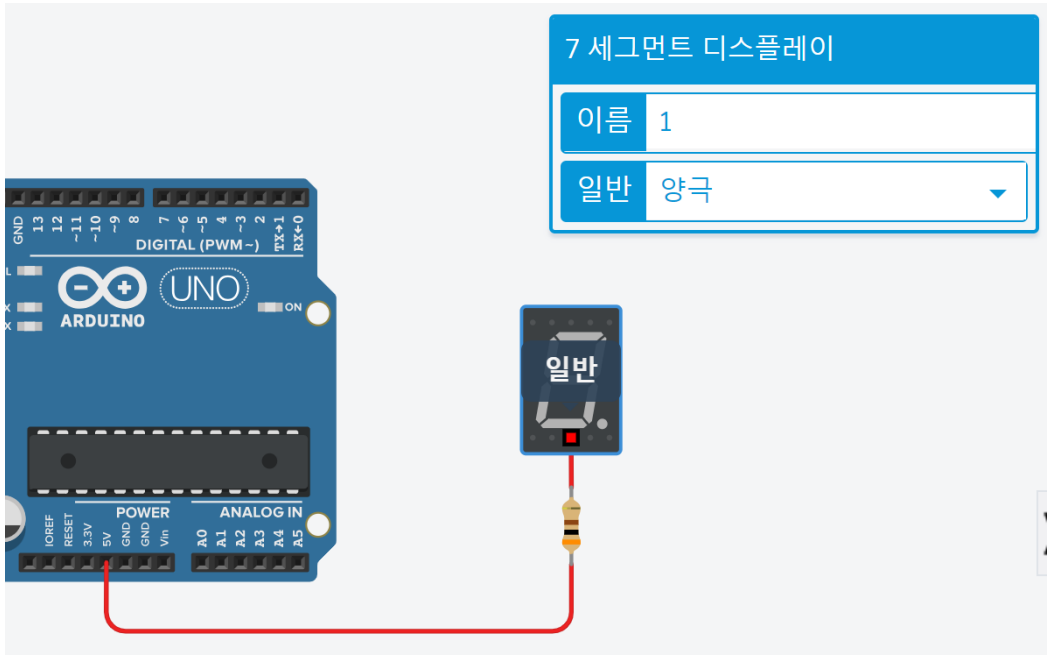
. = DP(0)

		a	b	c	d	e	f	g	DP
		PD0	PD1	PD2	PD3	PD4	PD5	PD6	PD7
0	→	0	0	0	0	0	0	1	1
1	→	1	0	0	1	1	1	1	1
2	→	0	0	1	0	0	1	0	1
3	→	0	0	0	0	1	1	0	1
4	→	1	0	0	1	1	0	0	1
5	→	0	1	0	0	1	0	0	1
6	→	0	1	0	0	0	0	0	1
7	→	0	0	0	1	1	0	1	1
0	→	0	0	0	0	0	0	0	1
9	→	0	0	0	0	1	0	0	1

LED를 이용한 포트 제어 실험

- 7-segment 실험



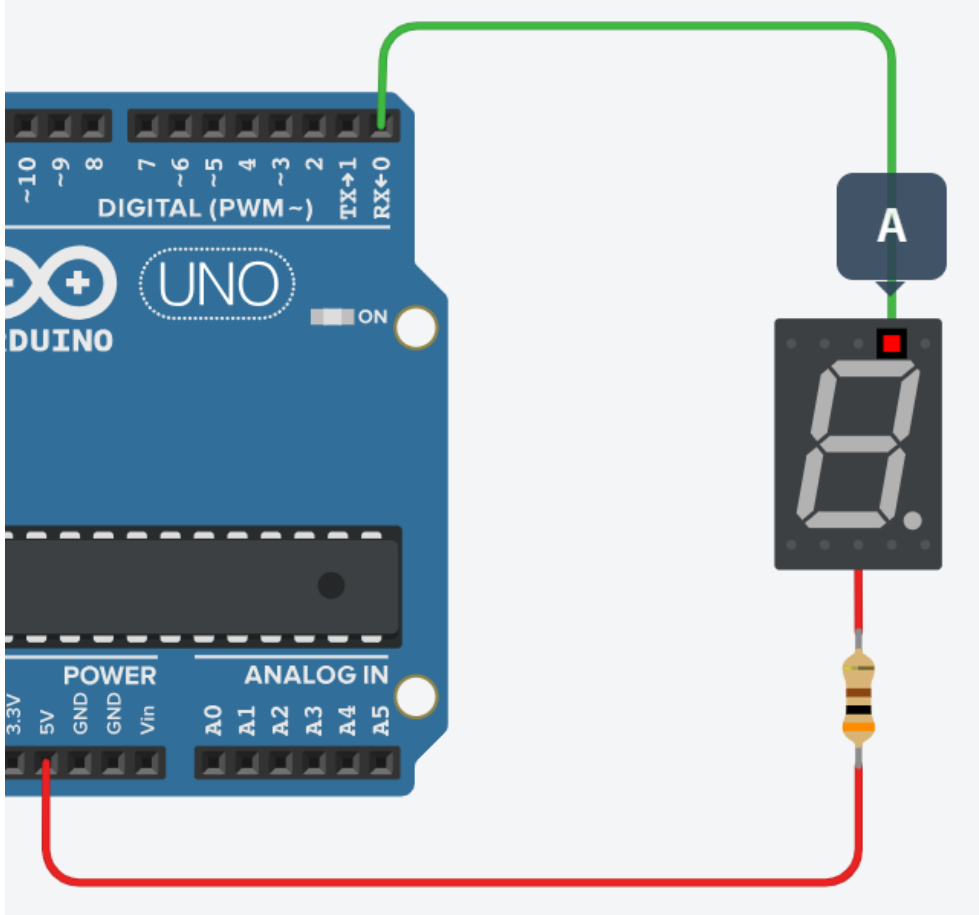


LED를 이용한 포트 제어 실험

- 7-segment 실험

```
void setup()
{
  DDRD = B00000001 ;
}

void loop()
{
 PORTD = B00000000 ;
}
```

```
void setup()
{
  DDRD = B00000001 ;
}

void loop()
{
 PORTD = B00000001 ;
}
```

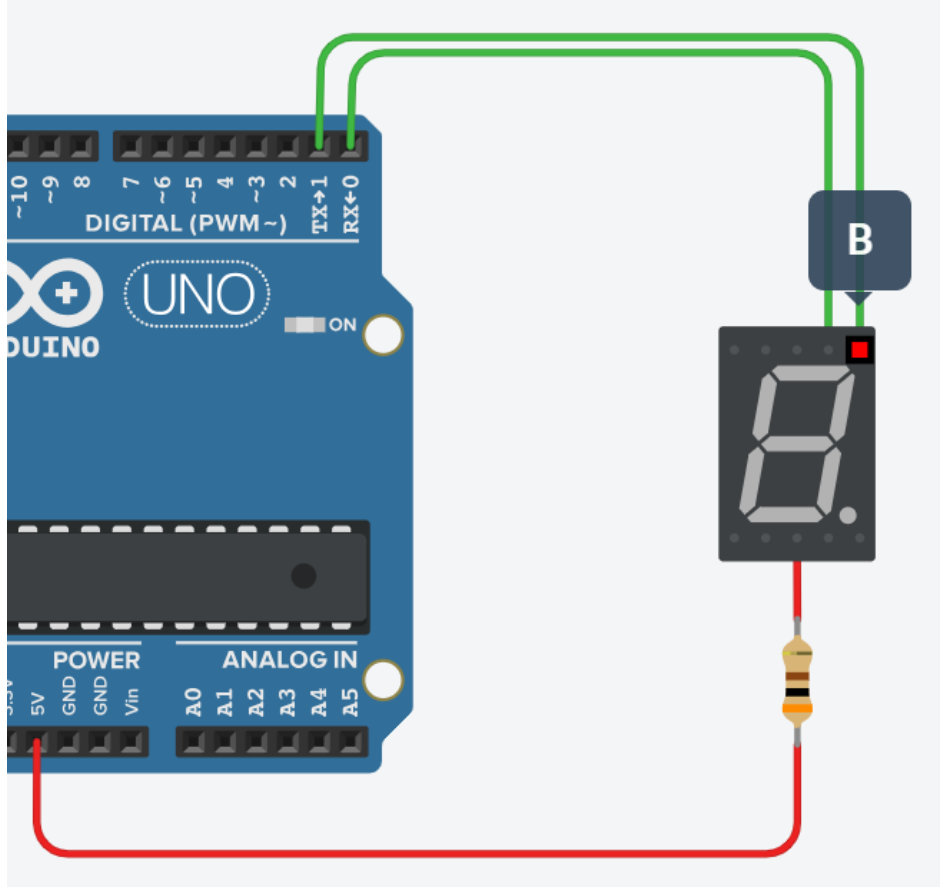


LED를 이용한 포트 제어 실험

- 7-segment 실험

```
void setup()
{
  DDRD = B00000011 ;
}

void loop()
{
 PORTD = B00000000 ;
}
```

```
void setup()
{
  DDRD = B00000011 ;
}

void loop()
{
 PORTD = B00000011 ;
}
```

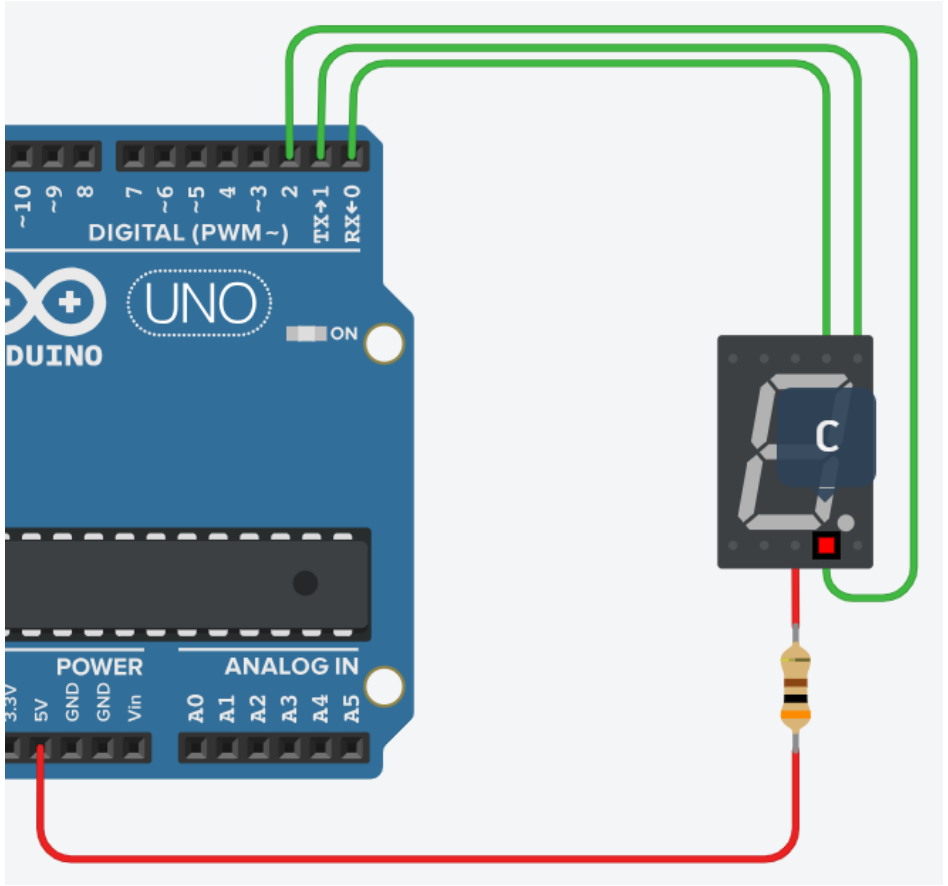


LED를 이용한 포트 제어 실험

- 7-segment 실험

```
void setup()
{
  DDRD = B00000111 ;
}

void loop()
{
 PORTD = B00000000 ;
}
```

```
void setup()
{
  DDRD = B00000111 ;
}

void loop()
{
 PORTD = B00000111 ;
}
```

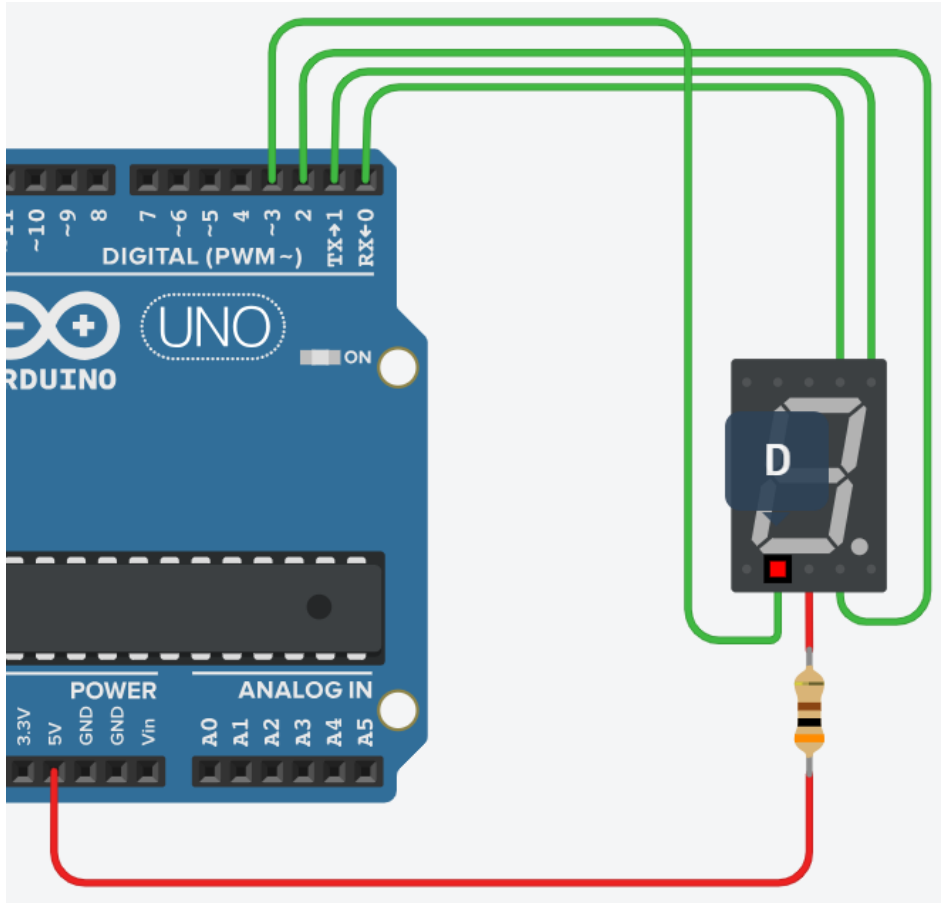


LED를 이용한 포트 제어 실험

- 7-segment 실험

```
void setup()
{
  DDRD = B00001111 ;
}

void loop()
{
 PORTD = B00000000 ;
}
```

```
void setup()
{
  DDRD = B00001111 ;
}

void loop()
{
 PORTD = B00001111 ;
}
```

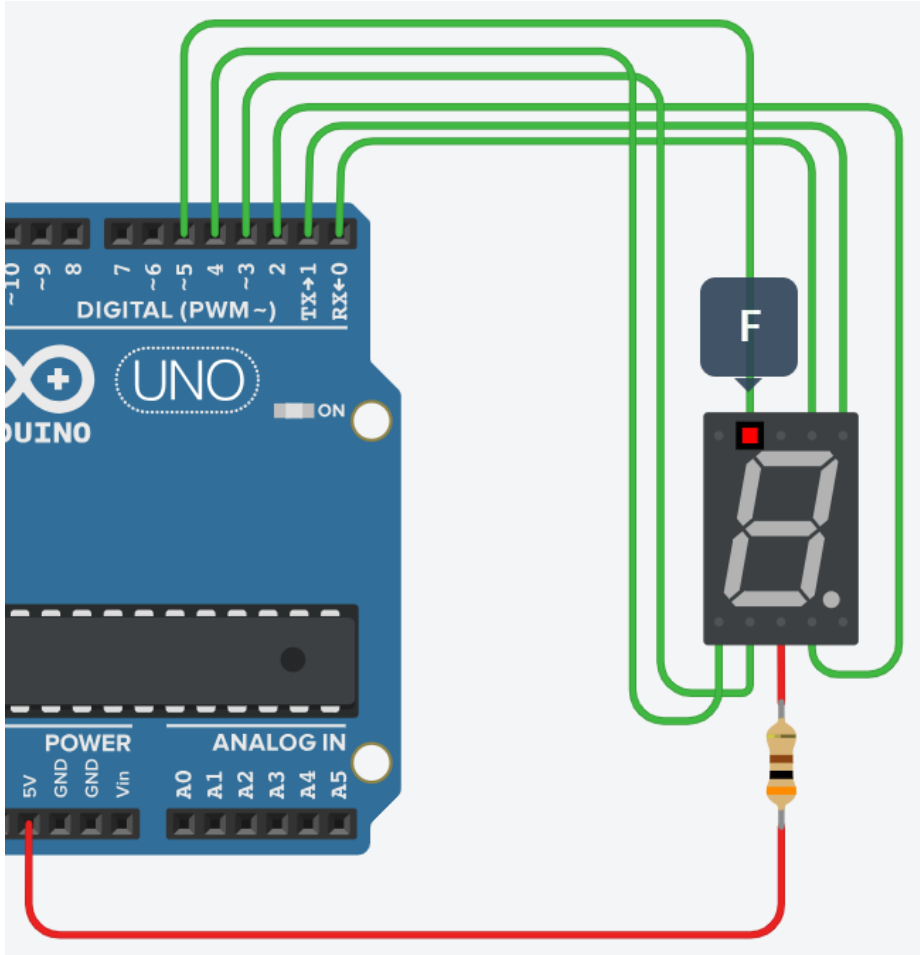


LED를 이용한 포트 제어 실험

- 7-segment 실험

```
void setup()
{
  DDRD = B00111111 ;
}

void loop()
{
 PORTD = B00000000 ;
}
```

```
void setup()
{
  DDRD = B00111111 ;
}

void loop()
{
 PORTD = B00111111 ;
}
```

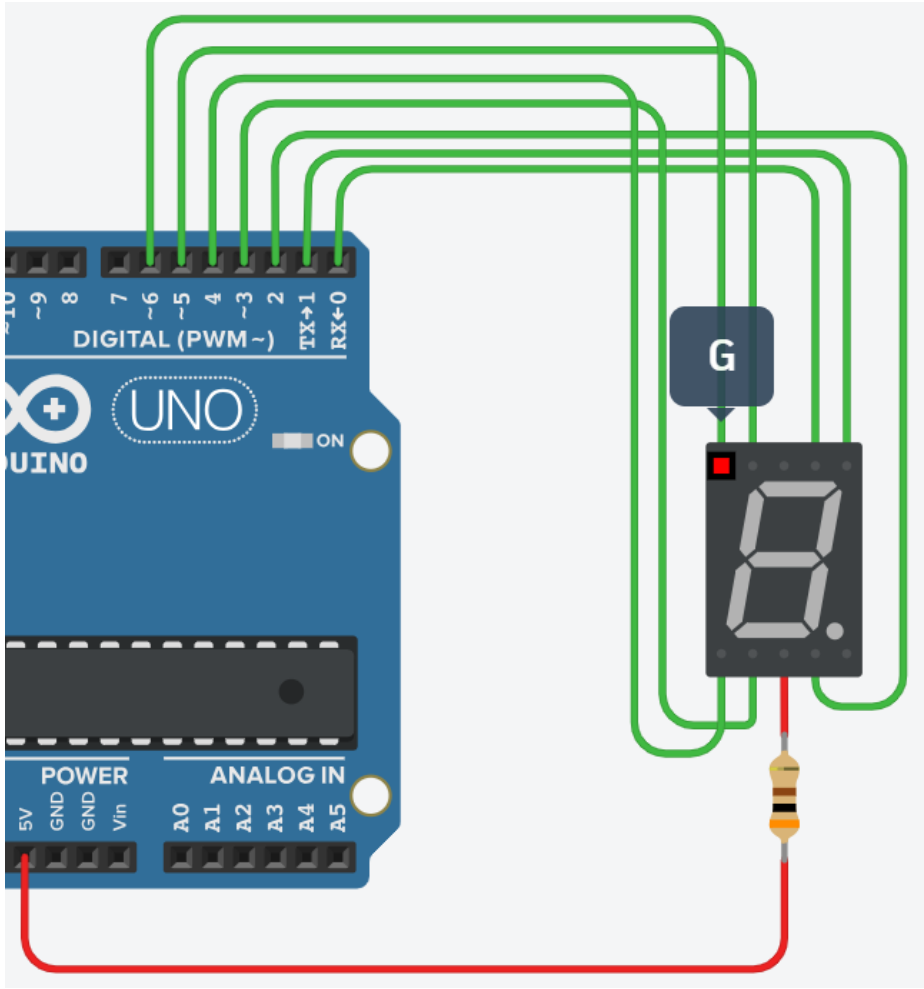


LED를 이용한 포트 제어 실험

- 7-segment 실험

```
void setup()
{
  DDRD = B01111111 ;
}

void loop()
{
 PORTD = B00000000 ;
}
```

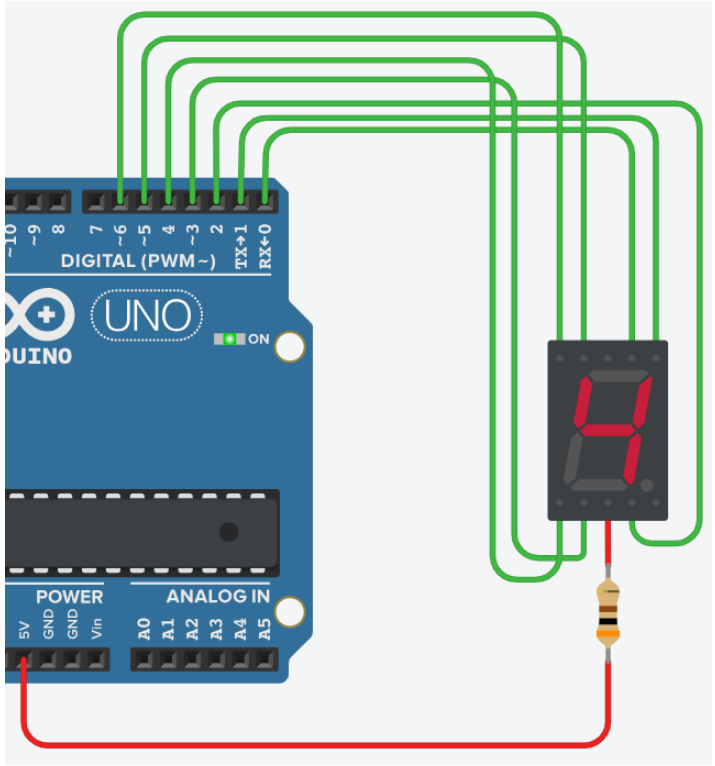
```
void setup()
{
  DDRD = B01111111 ;
}

void loop()
{
 PORTD = B01111111 ;
}
```



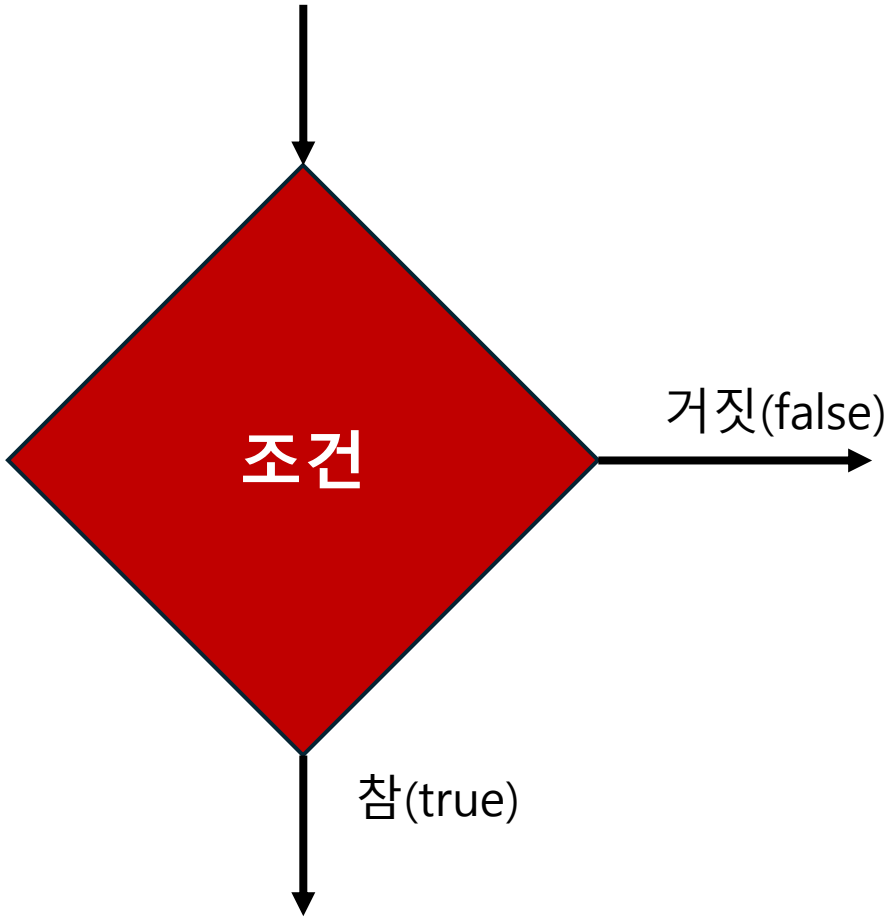
LED를 이용한 포트 제어 실험

- 7-segment 실험 QUIZ – 숫자 **4**를 표시 하시오.

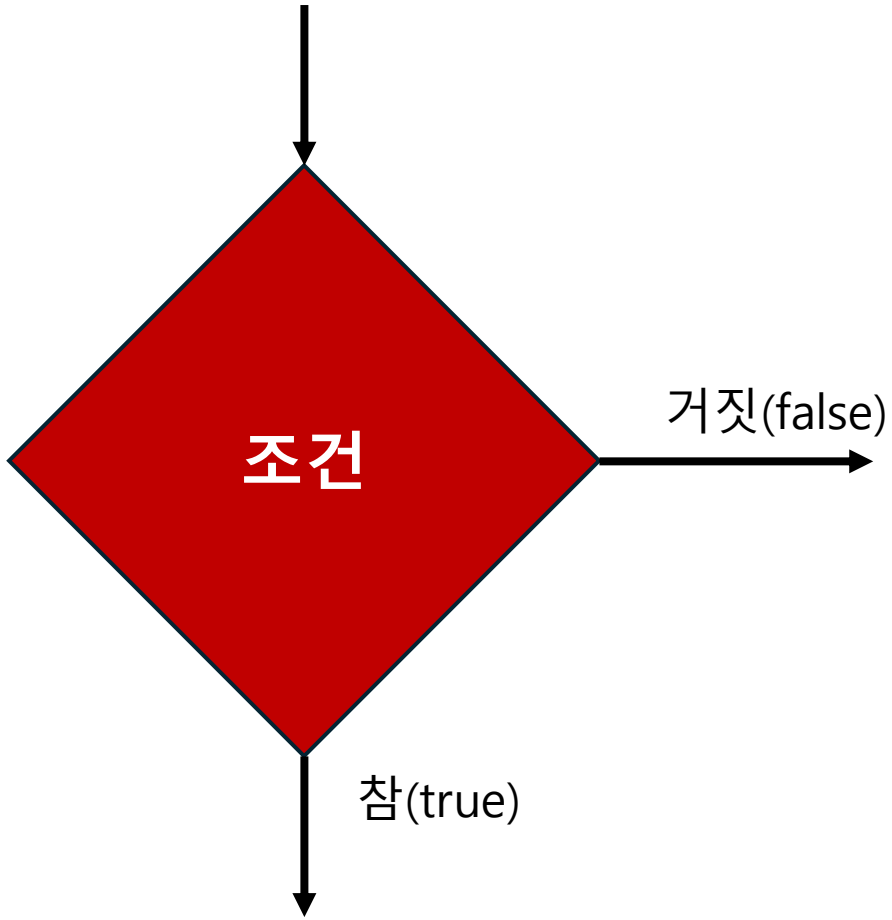
```
void setup()
{
  DDRD = B[_____________] ;
}

void loop()
{
 PORTD = B[_____________] ;
}
```



마이크로프로세서와 C언어 – 조건문 if

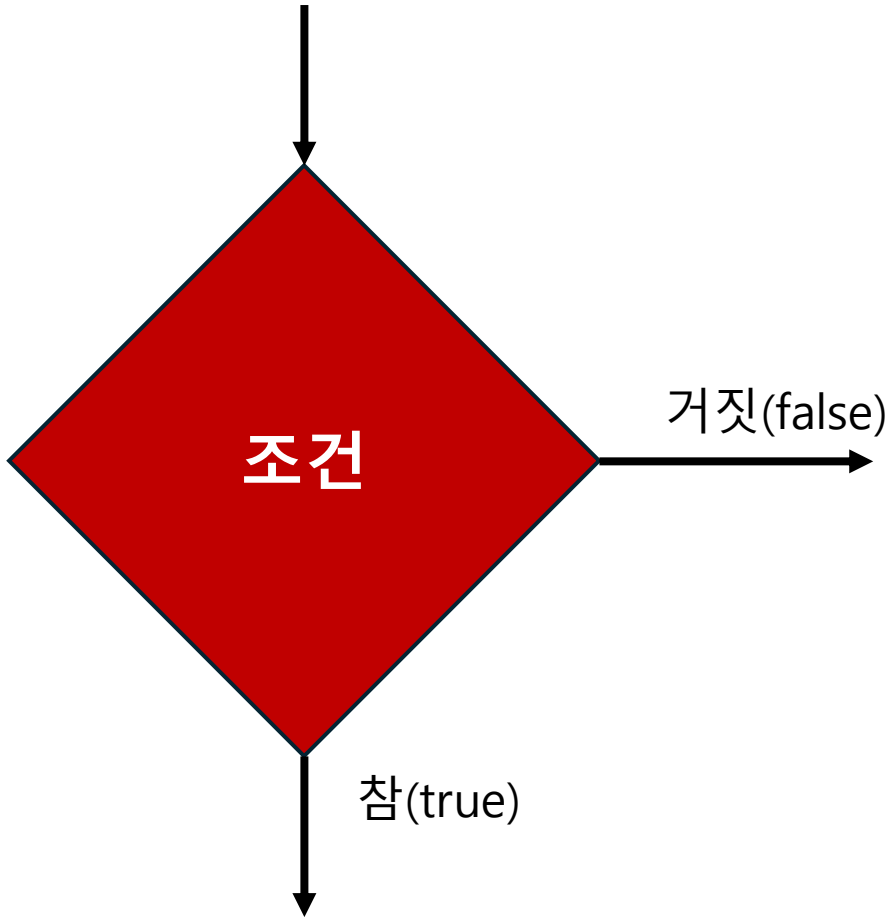


마이크로프로세서와 C언어 – 조건문 if




```
if( 조건 )
{
    //조건이 참(true)인 경우 실행 문
}
else
{
    //조건이 거짓(flase)인 경우 실행 문
}
```

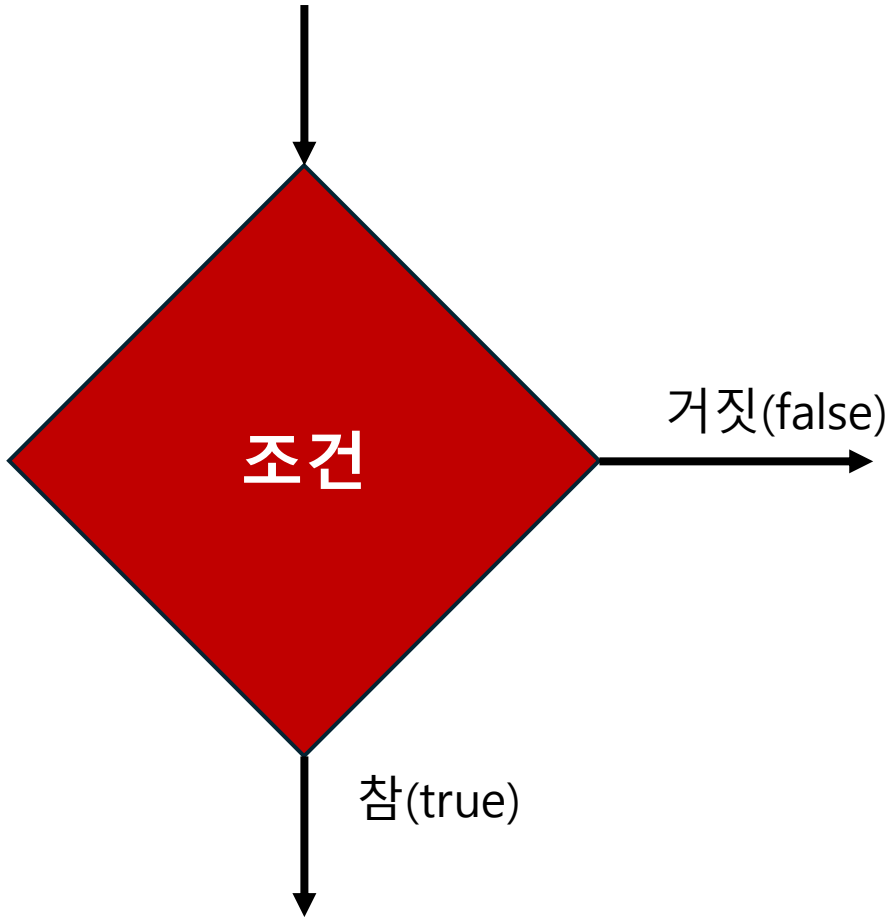
마이크로프로세서와 C언어 – 조건문 if



- 조건의 (변수)값이 0이 아닌가?
- 조건의 식이 참인가?

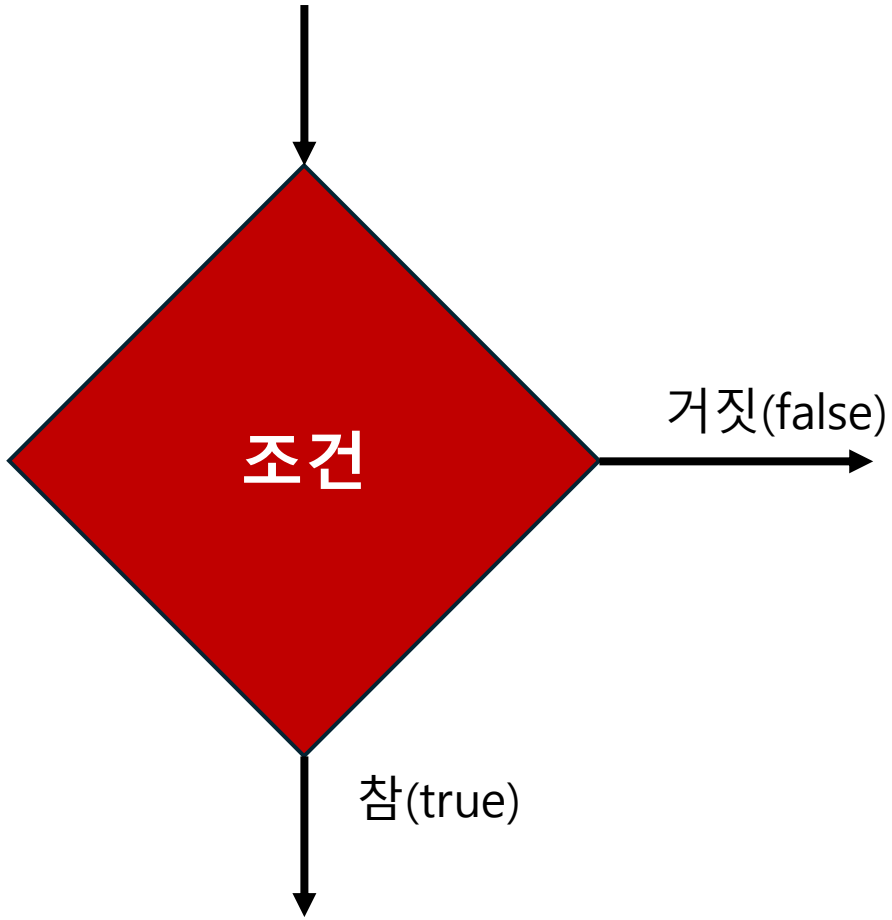
```
if( 조건 )
{
    //조건이 참(true)인 경우 실행 문
}
else
{
    //조건이 거짓(flase)인 경우 실행 문
}
```

마이크로프로세서와 C언어 – 조건문 if



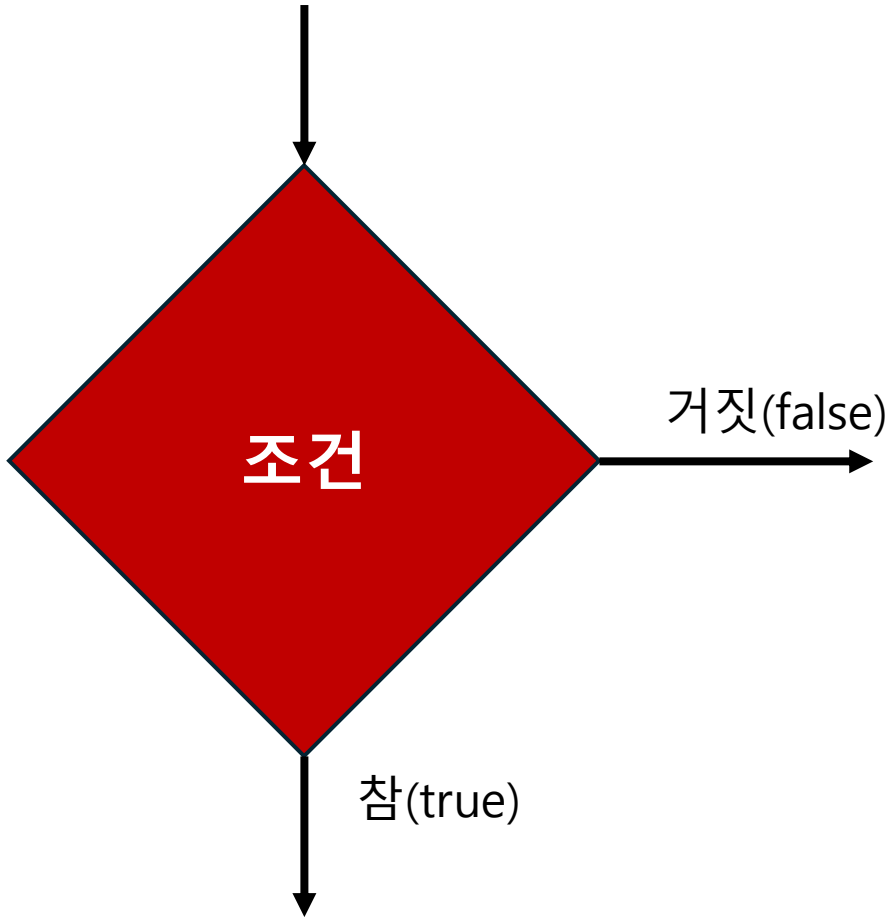

```
void setup()
{
  DDRD = B01111111 ;
}

void loop()
{
   if( 0 )
   {
      PORTD = B11000000 ;  //0
   }
   else
   {
      PORTD = B10011001 ;  //4
   }
}
```

마이크로프로세서와 C언어 – 조건문 if




```
void setup()
{
  DDRD = B01111111 ;
}

void loop()
{
    int a = 1 ;
    if( a == 0 )
    {
        PORTD = B11000000 ;  //0
    }
    else
    {
        PORTD = B10011001 ;  //4
    }
}
```

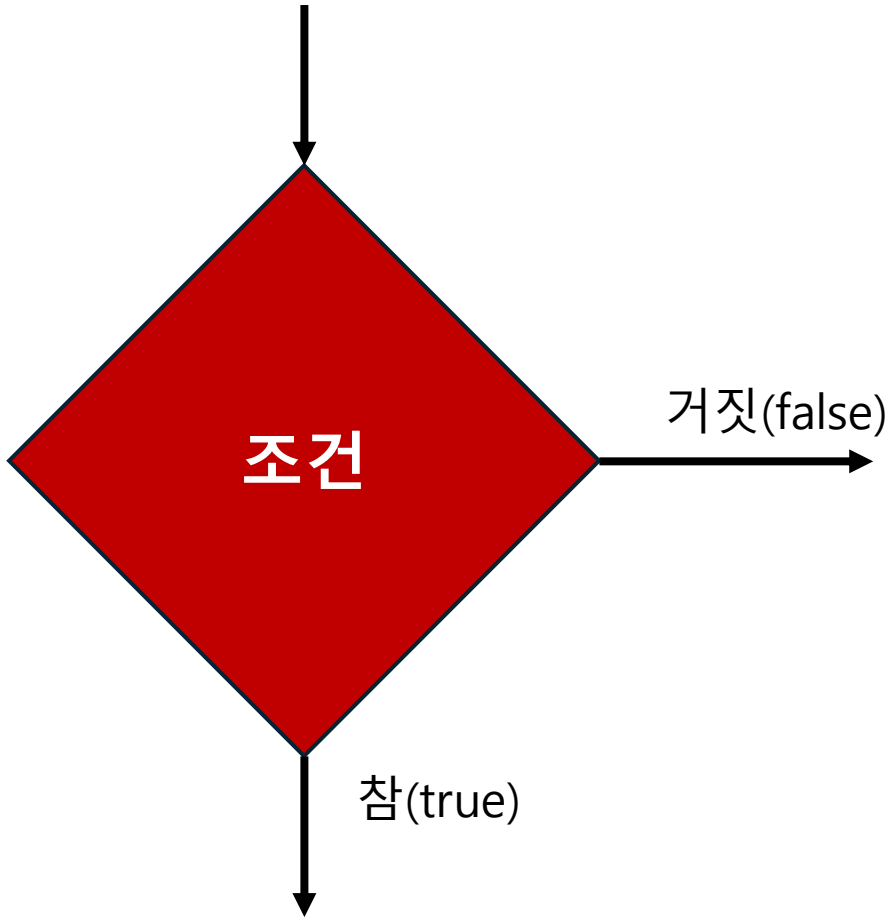
마이크로프로세서와 C언어 – 조건문 if




```
void setup()
{
  DDRD = B01111111 ;
}

void loop()
{
    int a = 1
    if( a == 0 )
    {
        PORTD = B11000000 ;  //0
    }
    else
    {
        PORTD = B10011001 ;  //4
    }
}
```

- A > B
- A < B
- A >= B
- A <= B
- A == B
- A != B

마이크로프로세서와 C언어 – 조건문 if




```
void setup()
{
  DDRD = B01111111 ;
}

void loop()
{
    int a = 0
    if( a == 0 )
    {
        PORTD = B11000000 ;  //0
    }
    else if( a == 1)
    {
        PORTD = B11111001 ;  //1
    }
    else
    {
        PORTD = B10011001 ;  //4
    }
}
```

LED를 이용한 포트 제어 실험

```
void segment(int number)
{
    if( number == 1 )
    {
        PORTD = B11111001 ;
    }
    else if( number == 2 )
    {
        PORTD = B[_________] ;
    }
}

void setup()
{
    DDRD = B01111111 ;
}

void loop()
{
    segment(1) ;
    delay(1000) ;
    segment(2) ;
    delay(1000) ;
}
```

		a	b	c	d	e	f	g	DP
		PD0	PD1	PD2	PD3	PD4	PD5	PD6	PD7
0	→	0	0	0	0	0	0	1	1
1	→	1	0	0	1	1	1	1	1
2	→	0	0	1	0	0	1	0	1
3	→	0	0	0	0	1	1	0	1
4	→	1	0	0	1	1	0	0	1
5	→	0	1	0	0	1	0	0	1
6	→	0	1	0	0	0	0	0	1
7	→	0	0	0	1	1	0	1	1
0	→	0	0	0	0	0	0	0	1
9	→	0	0	0	0	1	0	0	1