

## Binary operators &, |, ^, ~ and <<

### & (AND Operator)

Truth Table

X	Y	Output
0	0	0
0	1	0
1	0	0
1	1	1

### Example in C code

If PORTB initially is 00000000 (PIN0 TO PIN7 are low)

Then `PORTB = PORTB & (00000001)` this will store 00000000 in PORTB because `0&1` is 0

If PORTB initially is 00000100 (PIN0 TO PIN7 are low except PIN2 (which is high))

Then `PORTB = PORTB & (00000101)` this will store 00000100 in PORTB because `0&1` is 0 and `1&1` is 1

### | (OR Operator)

Truth Table

X	Y	Output
0	0	0
0	1	1
1	0	1
1	1	1

### Example in C code

`DDRB or "0010 0000"`

```
DDRB = DDRB | (1<<LED_GREEN);
```

```
DDRB ="0010 0000";
```

**^ (XOR Operator)** Output is 1 when the Inputs are different values and is 0 when both are same.

**Truth Table**

X	Y	Output
0	0	0
0	1	1
1	0	1
1	1	0

**Example in C code (ACCORDING TO OUR TASK)**

LED\_GREEN means Pin 5 of PORT B (PB5)

If PORTB initially is 00000000 (PIN0 TO PIN7 are low)

Then  $\text{PORTB} = \text{PORTB} \wedge (1 \ll \text{LED\_GREEN})$  this will store 00100000 in PORTB because  $0 \wedge 1$  is 1

Now  $\text{PORTB} = 00100000$ , when we execute the same line of code ( $\text{PORTB} = \text{PORTB} \wedge (1 \ll \text{LED\_GREEN})$ )

this time it will store 00000000 because  $1 \wedge 1$  is 0

**~ (Tilde)** We mostly use this to make pin as input pin OR to turn off the led

Used to reverse the bit

**For example**

$\text{PORTB} = \text{PORTB} \& \sim (1 \ll \text{LED\_GREEN})$

We are doing AND operation of PORTB and 0 (because  $1 \ll \text{LED\_GREEN}$  IS 1 and  $\sim(1 \ll \text{LED\_GREEN})$  will be zero)

$\text{DDRB} = \text{DDRB} \& \sim (1 \ll \text{LED\_GREEN})$

This line will make pin 5 of PORTB as input

**<< (Shift Operator)**

This operator is used to shift the value either it is 1 or 0

**For example**

$\text{PORTB} = \text{PORTB} | (1 \ll \text{LED\_GREEN})$  it will move 1 to pin 5 of port B

$\text{DDRB} = \text{DDRB} | (1 \ll \text{LED\_GREEN})$  As we are using DDRB here then it will make the pin 5 of PORTB as output pin because we have moved or shifted 1 to pin 5

If we write

$\text{DDRB} = \text{DDRB} \& \sim(1 \ll \text{LED\_GREEN})$  It means we are shifting 0 to pin 5 making it input pin