**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 PORTB = PORTB ^ (1<<LED\_GREEN) this will store 00100000 in PORTB because 0^1 is 1

Now PORTB = 00100000, when we execute the same line of code (PORTB = PORTB ^ (1<<LED\_GREEN)) this time it will store 00000000 because 1^1 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

PORTB = PORTB & ~ (1<<LED\_GREEN)

We are doing AND operation of PORTB and 0 (because 1<<LED\_GREEN IS 1 and ~(1<<LED\_GREEN) will be zero)

DDRB = DDRB & ~ (1<<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

PORTB = PORTB|(1<<LED\_GREEN) it will move 1 to pin 5 of port B

DDRB = DDRB | (1<<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

DDRB = DDRB & ~(1<<LED\_GREEN) It means we are shifting 0 to pin 5 making it input pin