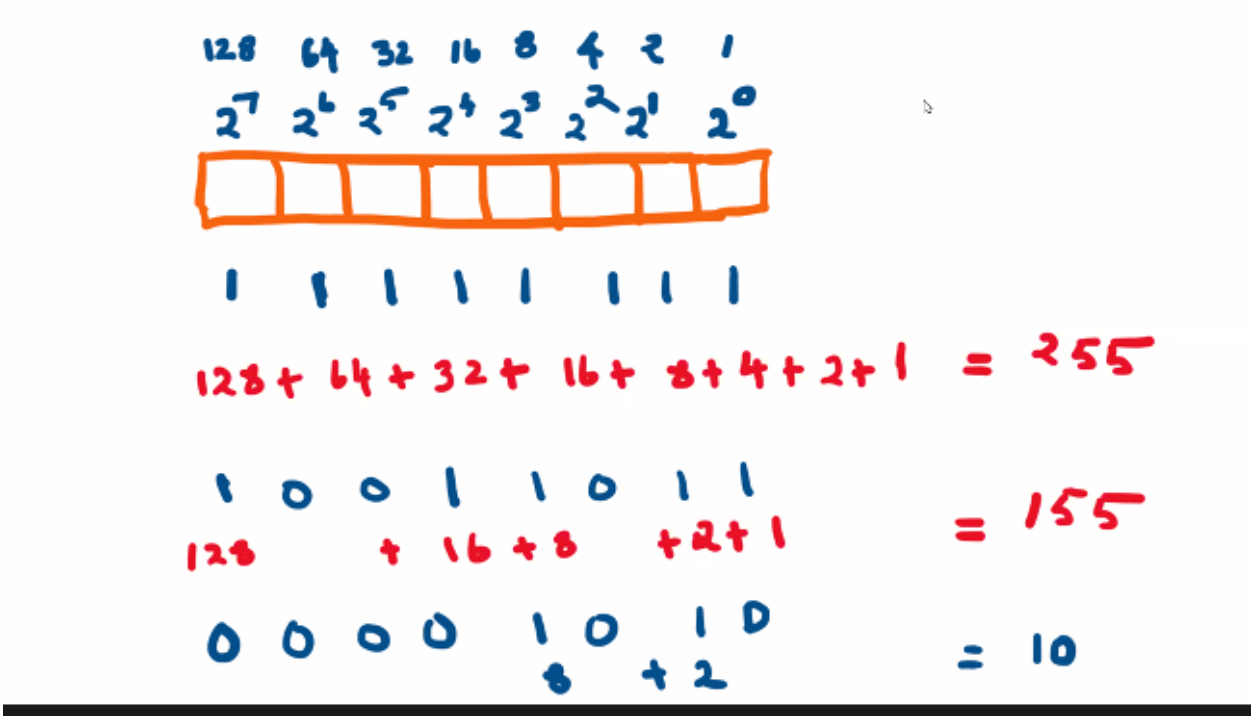
Session 9 - Microcontroller logic gates

Created	@February 22, 2022 2:14 PM
Class	Embeded Systems
Type	
Materials	
Reviewed	☐

Number System

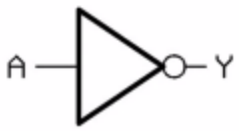
- Way of representing numbers
- Types:

	Base	Number Range
Decimal	10	0-9
Binary	2	0,1
Octal	8	0-7
Hexadecimal	16	0-9, A to F



NOT Gate (Inverter)

- Purpose: To perform negation on all bits
- Symbol: ~
- Logic Diagram:



- Truth Table:

Input	Output
0	1
1	0

AND Gate

- Purpose: To RESET particular bit/s
- Symbol: &
- Logic Diagram:

- Truth Table:

A	B	Y = A&B
0	0	0
0	1	0
1	0	0
1	1	1

OR Gate

- Purpose: To SET particular bit/s
- Symbol: |
- Logic Diagram:

- Truth Table:

A	B	Y= A | B
0	0	0
0	1	1
1	0	1
1	1	1

Masking:

What are Ports?

ATmega 2560 is a 100 pin micro-controller

- 86 pins can be used as Input/Output pins
- Pins are grouped together and are called as **Ports**

ATmega 2560 has ten 8-bit Ports

- Port x; x = A to F and H, J, K, L

ATmega 2560 has one 6-bit Port

- Port G

Each Port has three associated registers with it:

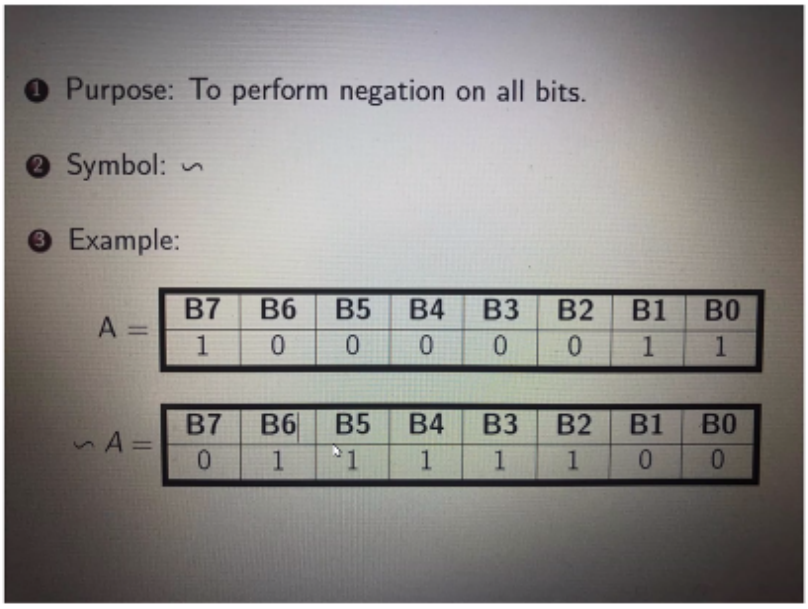
- **DDRx x = A to H and J, K, L**
- **PORTx x = A to H and J, K, L**
- **PINx x = A to H and J, K, L**

these are used for accessing the port pin

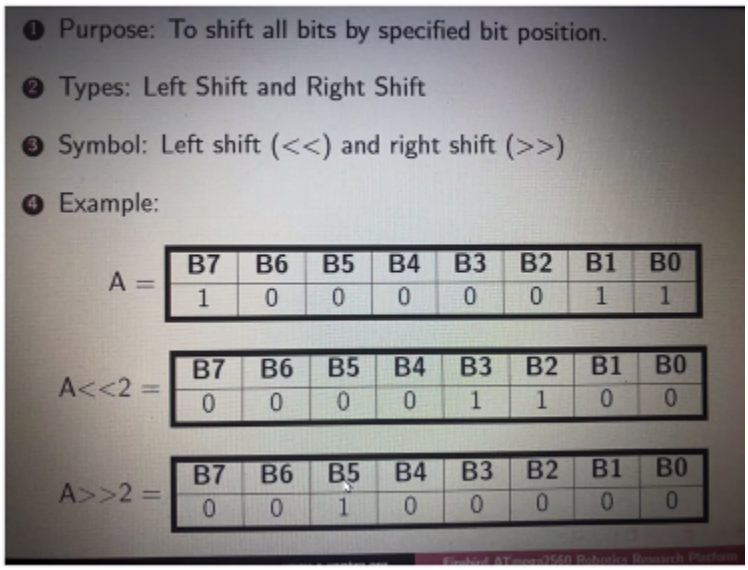
Need for masking

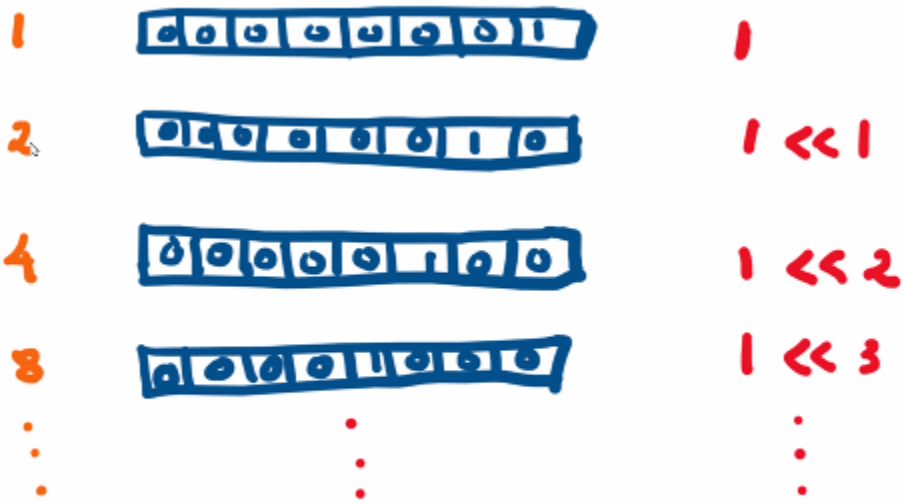
- AVR is not bit addressable. It is only bit accessible.
- No 'address' to a specific bit.
- Sometimes we need to change the state of one or more pins of the port keeping the rest of the pins unchanged.

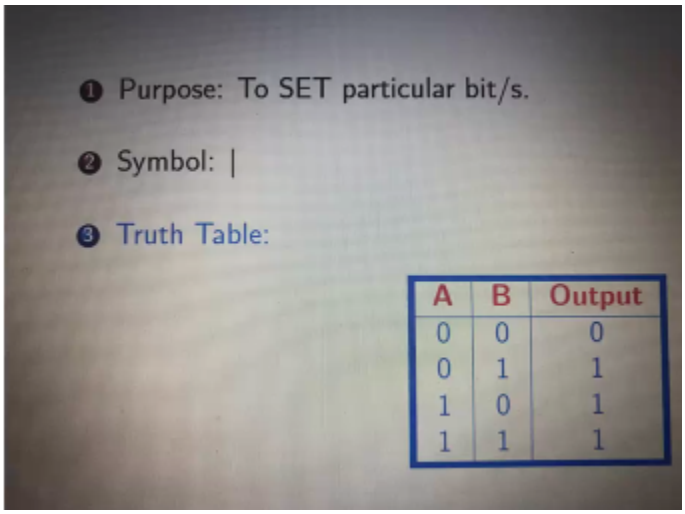
NOT operator

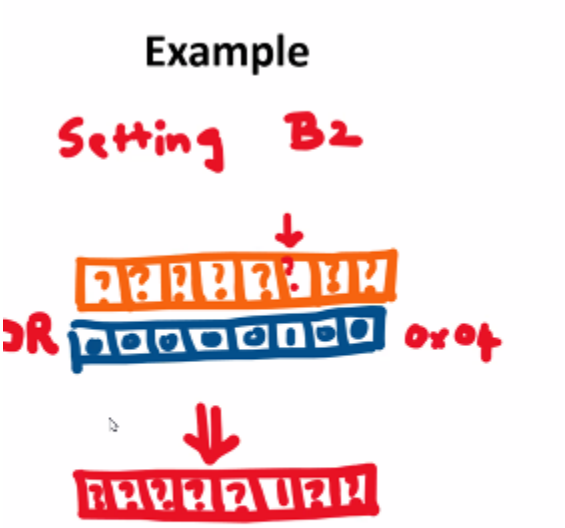


Shift Operators

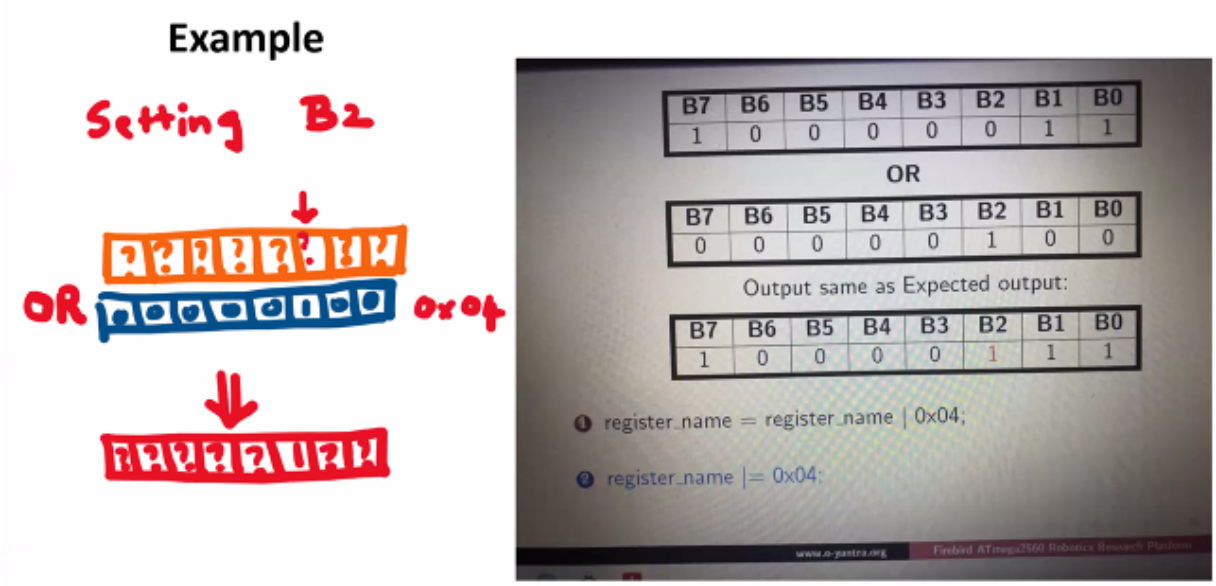








- Whichever bit you want to set only there you are putting a 1, other than that the others are zero, as the value will remain the same



B7	B6	B5	B4	B3	B2	B1	B0
1	0	0	0	0	0	1	1

OR

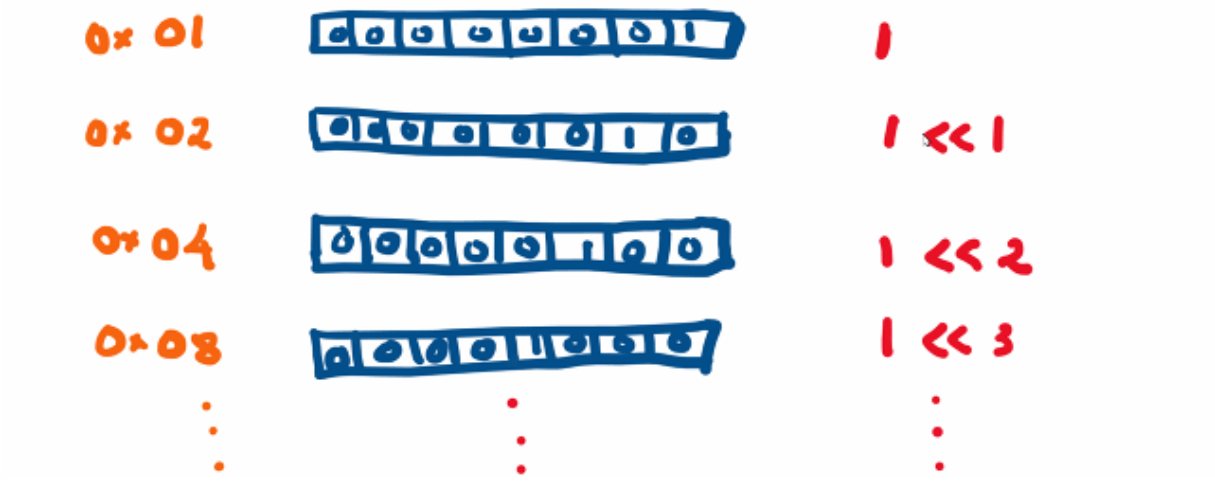
B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	0	0	1	0	0

Output same as Expected output:

B7	B6	B5	B4	B3	B2	B1	B0
1	0	0	0	0	1	1	1

1. register_name = register_name | 0x04;
2. register_name |= 0x04;

the simple name to check the above equation

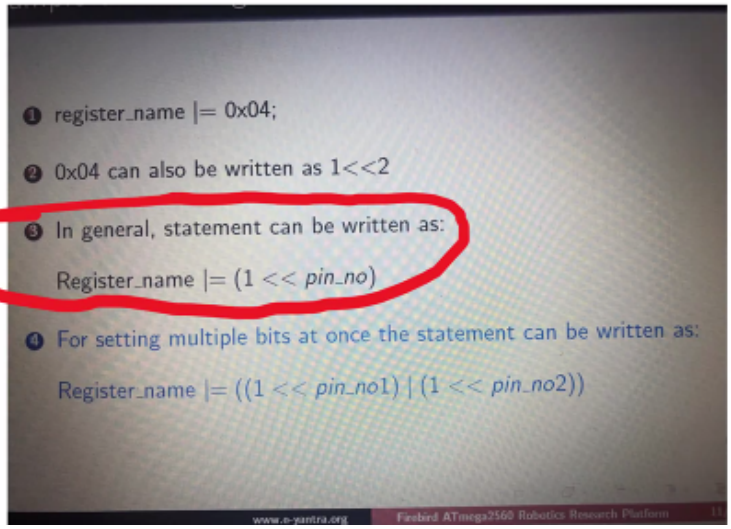


Example of Masking with Shift Operator

Sets B2 →

Using shift operator

For setting multiple bits →



To set pin/s:

In general, statement can be written as:

Register name j= (1 << pin no)

For setting multiple bits at once the statement can be written as:

Register name j= ((1 << pin no1) j (1 << pin no2))

Example

Example

B7	B6	B5	B4	B3	B2	B1	B0
1	0	0	0	0	1	1	1

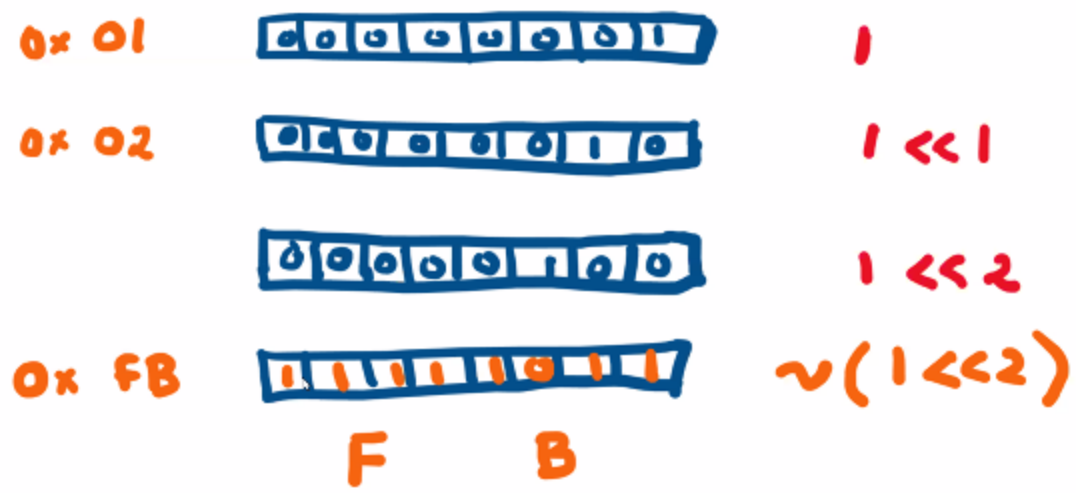
AND

B7	B6	B5	B4	B3	B2	B1	B0
1	1	1	1	1	0	1	1

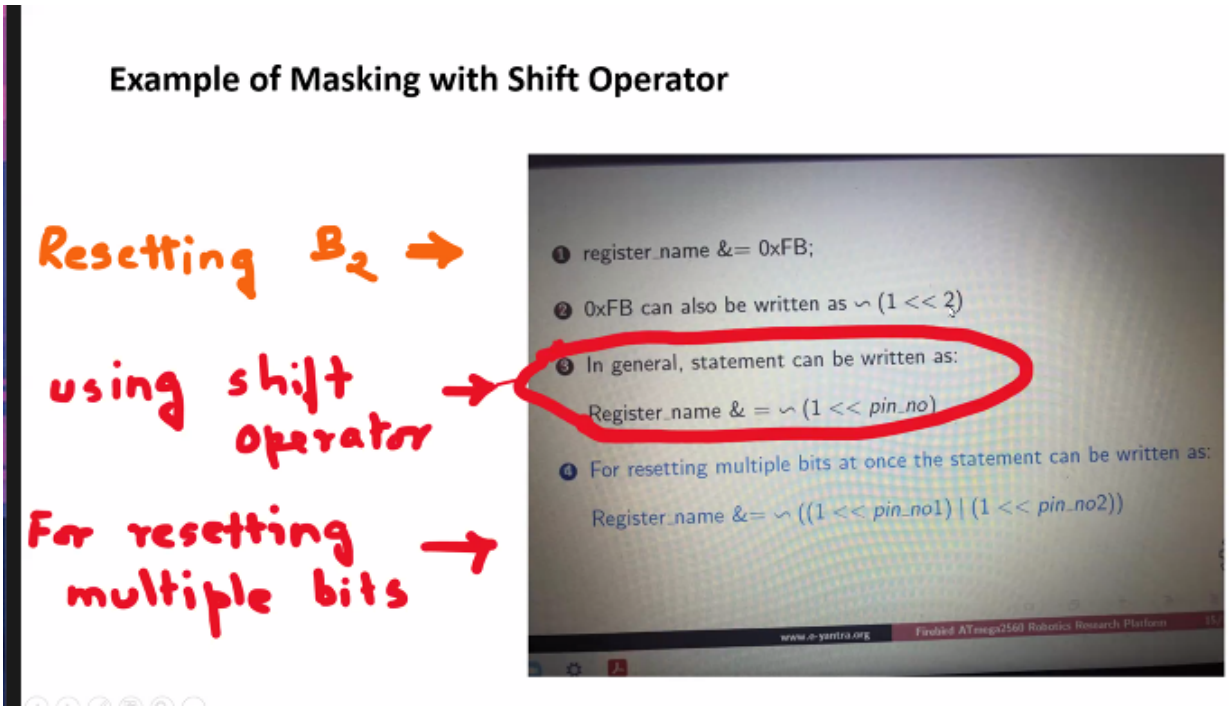
Output same as Expected output:

B7	B6	B5	B4	B3	B2	B1	B0
1	0	0	0	0	0	1	1

1. register_name = register_name & 0xFB;
2. register_name &= 0xFB;



Example of Masking with Shift Operator



To Reset pin/s:

In general, statement can be written as:

Register name & = ~ (1 << pin no)

For resetting multiple bits at once the statement can be written as:

Register name &= ~ ((1 << pin no1) | (1 << pin no2))

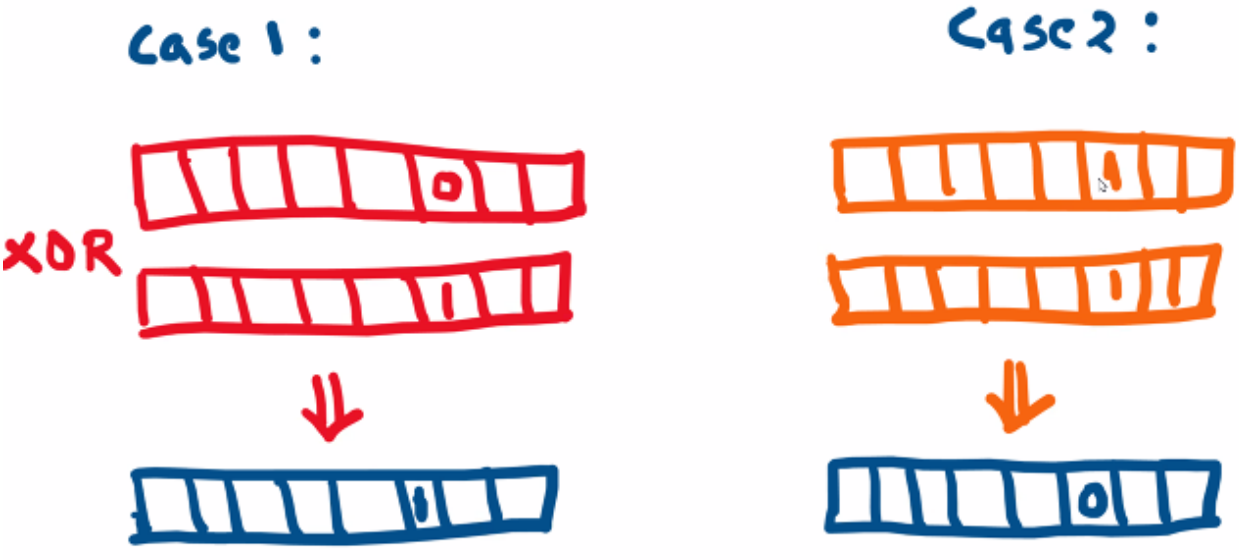
EOR Operator

Purpose: To TOGGLE particular bit

Symbol: ^

Truth Table:

A	B	Output
0	0	0
0	1	1
1	0	1
1	1	0



- For one bit : Register name ^= (1<<pin no)
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