Embedded Systems interfacing

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Data Direction Register → DDR

O/P

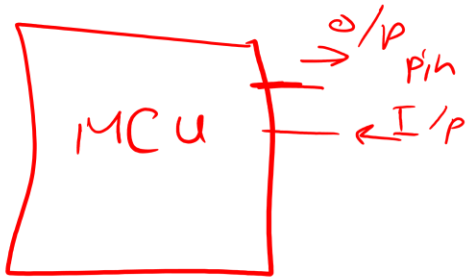
1

High
5V
logic(1)

Low
0V - GND
logic (0)

I/P

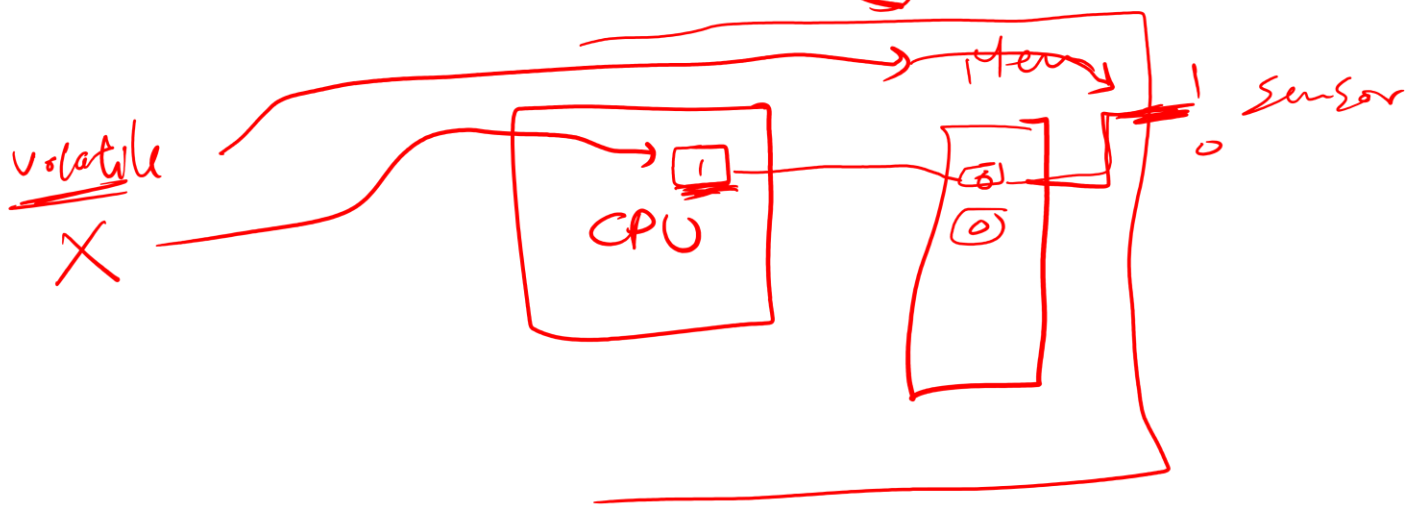
0



DDRA → (1) → output

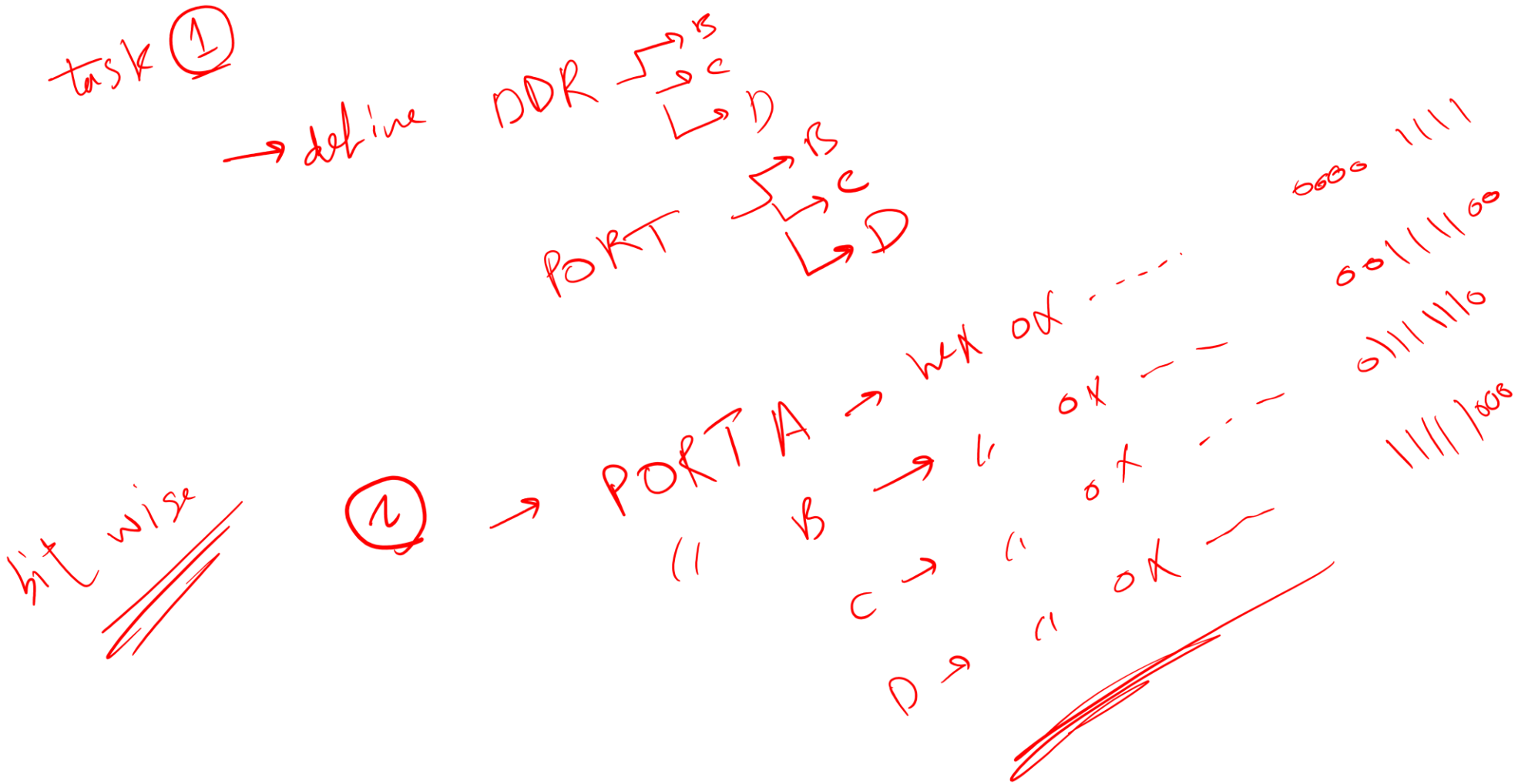
PORTA → (1) → High → (1) → 5V

PORTA → (0) → low → (0) → 0V - GND



0b 1111 1111 → 255 → 0xFF ← DDR

0b 0000 0011 → 3 → 0x03 ← Port


task 1
→ define DDR
B
C
D
PORT
B
C
D
bit wise
1
→ PORTA → 0x
B → 0x
C → 0x
D → 0x
0000 1111
00111100
01111110
11111008

clk = 8 MHz

$$T_{Ins.} = \frac{1}{8*10^6} = \frac{1}{8}\left(\frac{10^{-6}}{\mu.sec}\right) * (8*10^6) = 1\ sec$$

Code

1 MHz → $\frac{1}{10^6}$ = 1 μsec

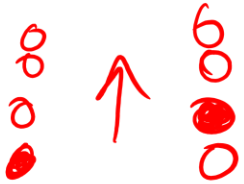
MCU
8 MHz

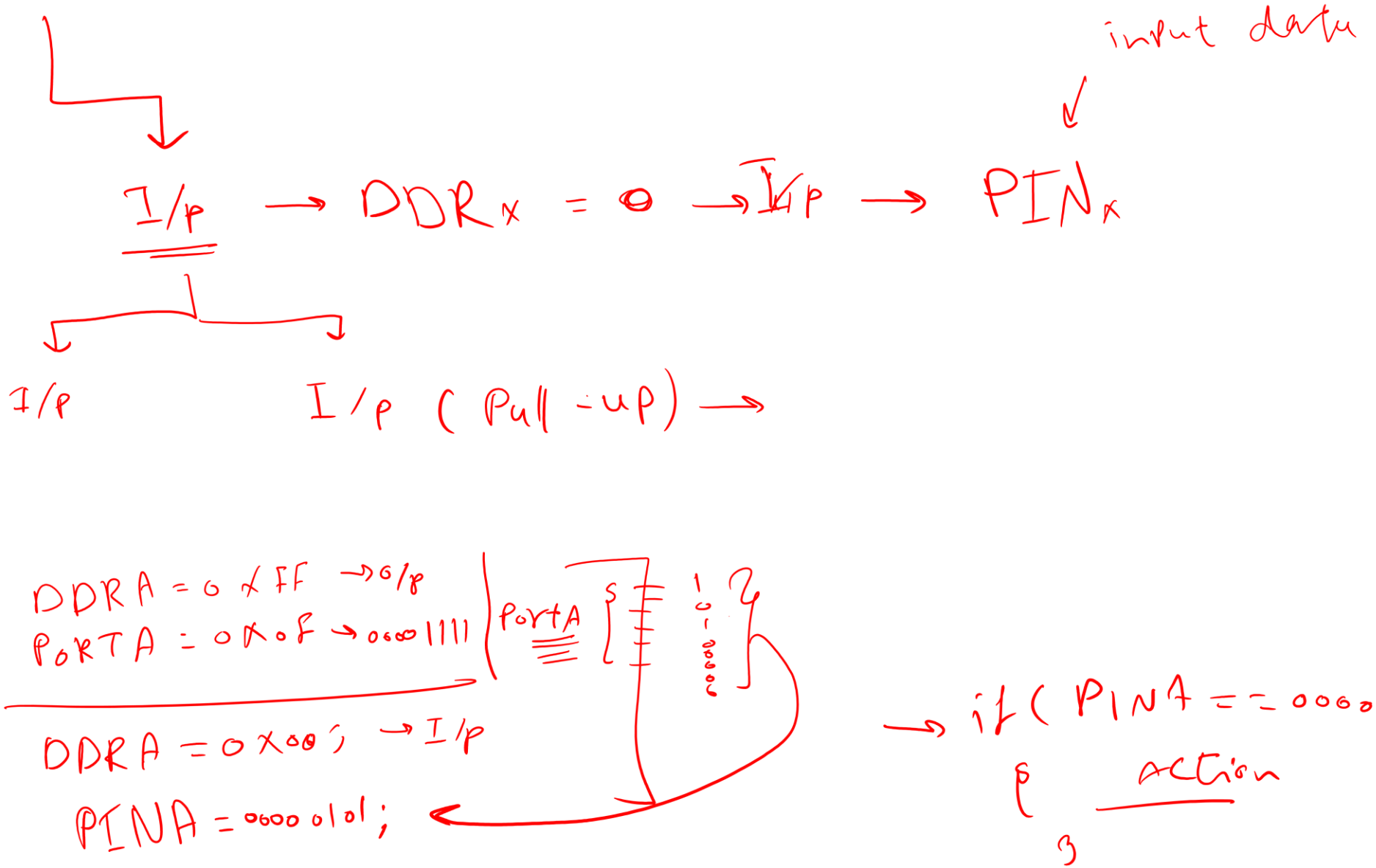
$\frac{1}{8*10^6} = \frac{1}{8} * 10^{-6}$

0.125 μsec

delay_ms(1000);

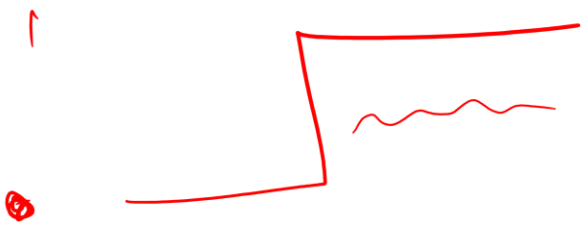
Task

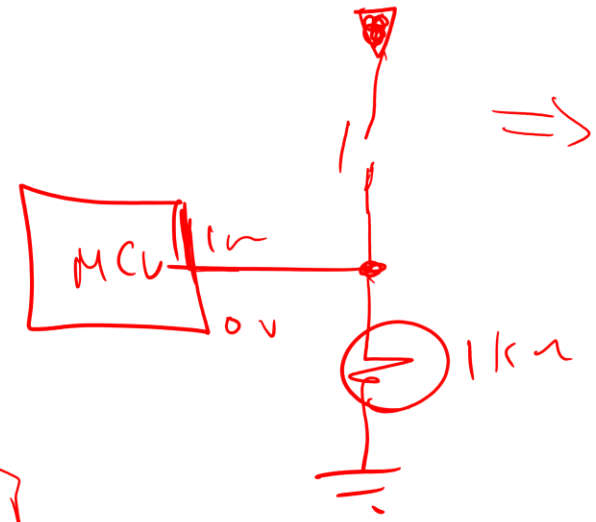



input data
I/p → DDRx = 0 → I/p → PINx
I/p
I/p (Pull-up) →
DDRA = 0xFF → o/p
PORTA = 0x0F → 0000 1111
DDRA = 0x00; → I/p
PINA = 0000 0101;
PortA
5
1
0
1
0
1
→ if (PINA == 0000 0101)
{ action
}

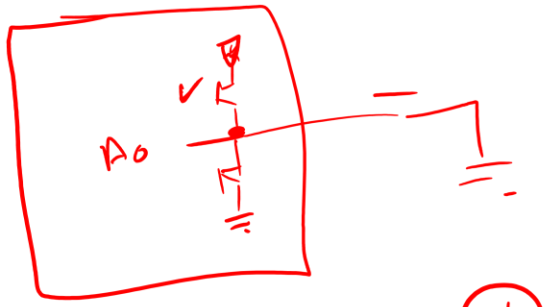
High → 5 v → 1 (logic)

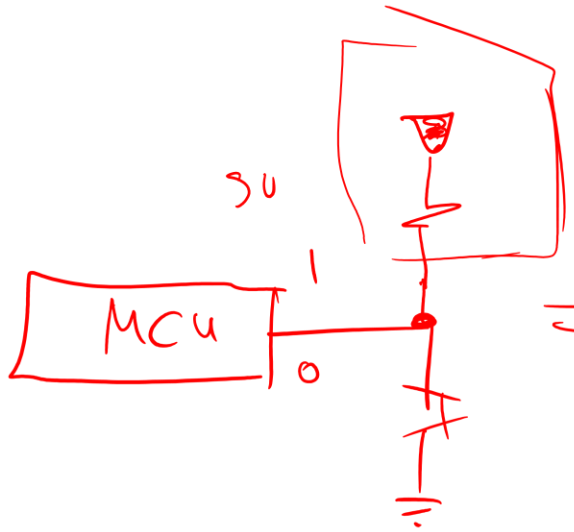
Low → 0 V / GND → 0 (logic)





⇒ Pull down Resistor





⇒ Pull up resistor

④ = 0000 0100

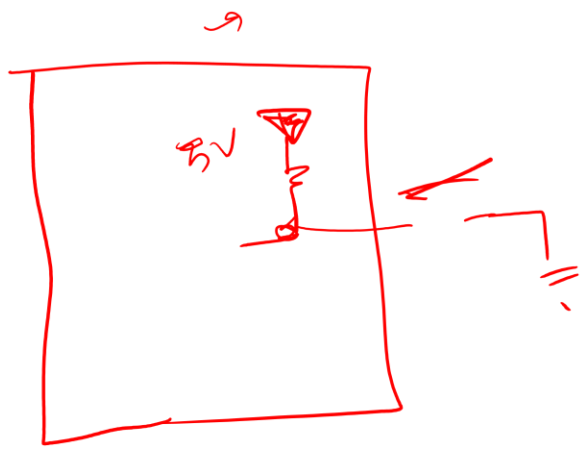
5 = 0000 0101

PortA = 0b 0000 0001

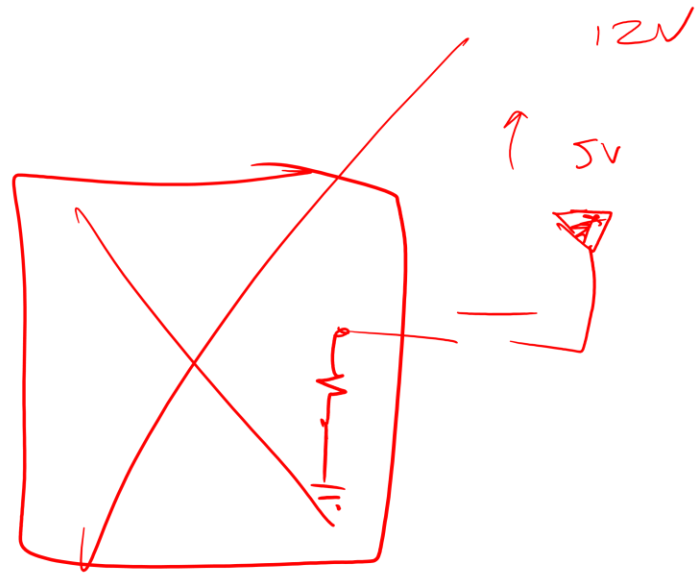
0000 1111

0000 1111

Common



internal Pull-UP Res.



internal Pull-Down Res.

- DDR
- PORT
- PIN

DDR = 1 → o/p

PORT = 0
Low
0
0V
GND

PORT = 1
High
1
5V
5V

PIN ✗

I/p ← DDR = 0 ✓

PIN ✓
→ Internal pull up (off)

PIN
→ Internal Pull up (on)

✓ Port = 1
Internal pull up on

✓ Port = 0
internal Pull up off

if (x == 0b 1111 1101)

0 ✓

x ✓

&

1110 1100

0

1100 1100

0 <<

port >> 5 ✓

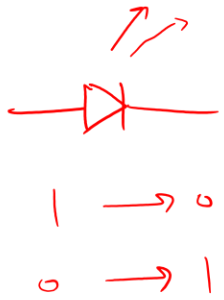
1011 0000

1

Task

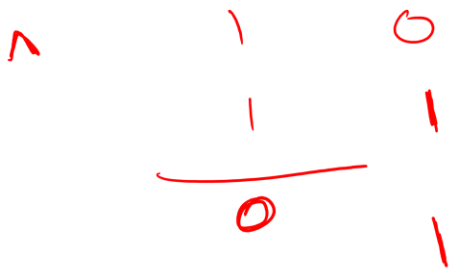
Toggle_bit ← macro like function

Take input C5 ← ↓ — press to button → Toggle A7



1 → 0

0 → 1



Set →

0 1 0 1 0 0 0 1

0 0 0 0 1 0 0 0

=> Port = Port | (1 << bit)

0 1 0 1 1 0 0 1

store

clk →

0 1 0 1 0 1 0 1 & Port = Port & ~(1 << bit)

0 1 0 0 0 0 0 0

0 1 0 0 0 1 0 1

Get →

0 0 0 1 0 1 0 0

0 0 0 0 0 0 0 1

& (Port >> bit) & 1

0

toggle bit → ToG →

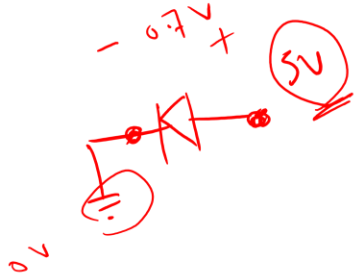
```
  1 0 1 0 1 0 1 0
  0 0 1 0 0 0 0 0   ^
-----------------
  1 0 0 0 1 0 1 0
```

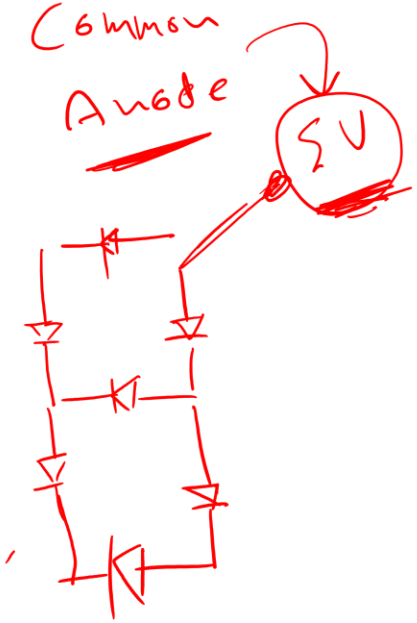
Port = Port ^ (1 << bit)

7-Seg

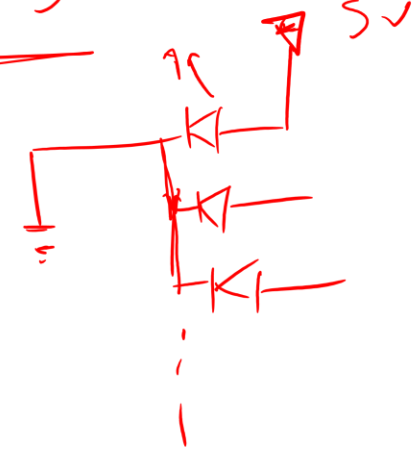
Common Anode

Common cathode





GND



the same

using VT switch

Task → Make 2 7-Seg using * Function to display From 0 to 99 → (count up 0, 1, 2 ... 99)