

# bitwise ~~logical~~ operations

- AND &

- OR |

- exclusive or XOR ^

Compliment NOT

AND

A	B	A & B
0	0	0
0	1	0
1	0	0
1	1	1

$$\begin{array}{r} & 1100 \\ \& & 1010 \\ \hline & 1000 \end{array}$$

~ 1100 & 1010 = ? = 1000

hex hex  
↓ ↓  
6F & 55 = ?

$$\begin{array}{r} \& 01101111 \\ & 01010101 \\ \hline & 01000101 = 45 \end{array}$$

## OBSERVATIONS

anything & 0 = 0

anything & 1 = anything

OR |

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

$$\begin{array}{r} 1011 \\ 0001 \\ \hline 1011 \end{array}$$

$$6F | 55 = ?$$

$$\begin{array}{r} 0110 \ 1111 \\ 0101 \ 0101 \\ \hline 0111 \ 1111 = 7F \end{array}$$

OBSERVATIONS

- Let A be anything

$$A | 0 = A$$

$$A | 1 = 1$$

XOR  
(exclusive or)

A	B	$A \wedge B$
0	0	0
0	1	1
1	0	1
1	1	0

$$\begin{array}{r} 1100 \\ 0101 \\ \hline 1001 \end{array}$$

$$6F \wedge 55 =$$

$$\begin{array}{r} 0110 \ 1111 \\ 0101 \ 0101 \\ \hline 0011 \ 1010 = 3A \end{array}$$

OBSERVATIONS

Let  $A = \text{anything}$

$$A \wedge 0 = A$$

$$A \wedge 1 = \text{not } A \\ = \sim A$$

NUT

Compliment

A	$\sim A$
0	1
1	0

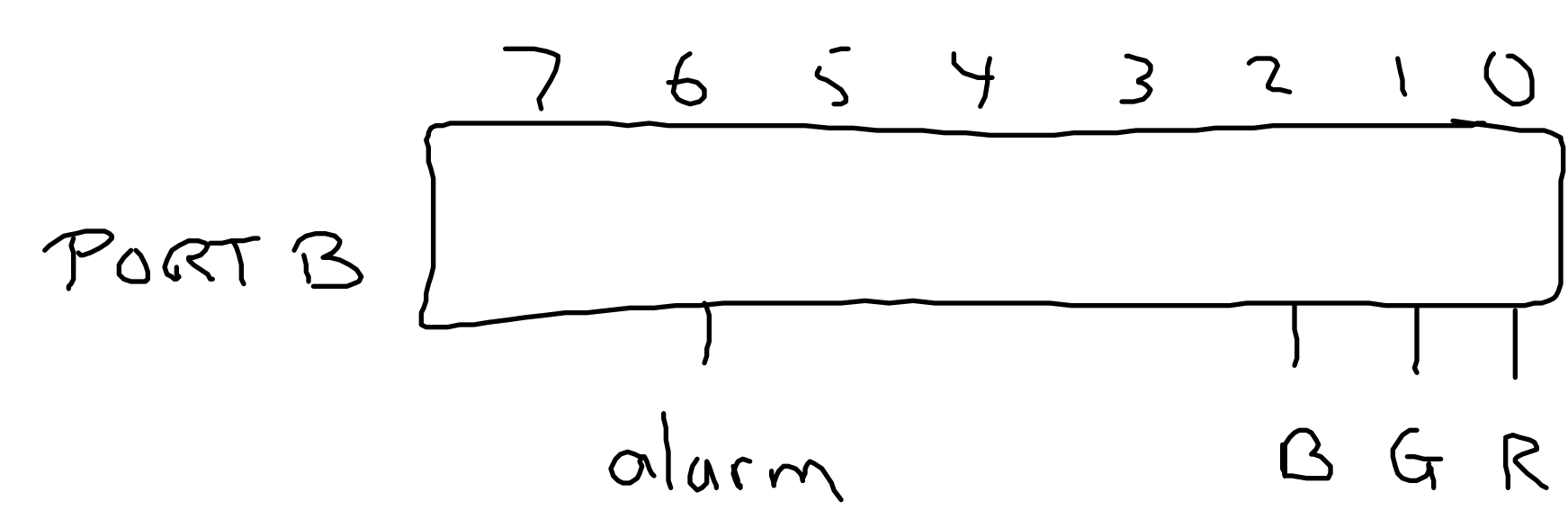
$$\begin{aligned}\sim 6F &= \sim 01101111 \\ &= 10010000\end{aligned}$$

Second      First  
   ↓            ↓  
 55 | 66 & 77

$$5 + 6 \times 7$$

$$\begin{array}{r}
 \& \quad 0110 \quad 0110 \\
 \quad 0111 \quad 0111 \\
 \hline
 | \quad 0110 \quad 0110 \\
 \quad 0101 \quad 0101 \\
 \hline
 \quad 0111 \quad 0111 = 77
 \end{array}$$

I/O, generally writing a 0 turns on an LED  
1 turns off an LED



Turn on Green led  
(don't affect any other bits)

set PORTB to  $PORTB | 00000010$

Turn off Blue Led  
(don't change other bits)

set PORTB to  $PORTB \& 11111011$