

Logical Operations & Bit Manipulation

AND

a	b	a AND b
0	0	0
0	1	0
1	0	0
1	1	1

$$0 \text{ AND } x = 0$$

$$1 \text{ AND } x = x$$

To **CLEAR** bits

Data	x	x	x	x	x	x	x	x
Mask	1	1	1	1	0	0	0	0
AND	x	x	x	x	0	0	0	0

OR

a	b	a OR b
0	0	0
0	1	1
1	0	1
1	1	1

$$0 \text{ OR } x = x$$

$$1 \text{ OR } x = 1$$

To **SET** bits

Data	x	x	x	x	x	x	x	x
Mask	1	1	1	1	0	0	0	0
OR	1	1	1	1	x	x	x	x

XOR

a	b	a XOR b
0	0	0
0	1	1
1	0	1
1	1	0

$$0 \text{ XOR } x = x$$

$$1 \text{ XOR } x = \sim x$$

To **COMPLEMENT** bits

Data	x	x	x	x	x	x	x	x
Mask	1	1	1	1	0	0	0	0
XOR	~	~	~	~	x	x	x	x

7-bit ASCII Letters

Lowercase
x61 ... x7A

7	6	5	4	3	2	1	0
0	1	1	0	x	x	x	x

 ...

7	6	5	4	3	2	1	0
0	1	1	1	x	x	x	x

Uppercase
x41 ... x5A

7	6	5	4	3	2	1	0
0	1	0	0	x	x	x	x

 ...

7	6	5	4	3	2	1	0
0	1	0	1	x	x	x	x

Converting to Lowercase

Letter **OR** x20

7	6	5	4	3	2	1	0
Letter	0	1	x	x	x	x	x
Mask	0	0	1	0	0	0	0
OR	0	1	1	x	x	x	x

Converting to Uppercase

Letter **AND** xDF

7	6	5	4	3	2	1	0
Letter	0	1	x	x	x	x	x
Mask	1	1	0	1	1	1	1
AND	0	1	0	x	x	x	x

Reversing Case

Letter **XOR** x20

7	6	5	4	3	2	1	0
Letter	0	1	x	x	x	x	x
Mask	0	0	1	0	0	0	0
XOR	0	1	~	x	x	x	x