CS 315-01 Lab   Bits

Project 03 Overview

bit manipulation
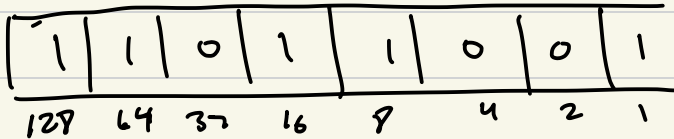
In C ⇒ bitwise operators
binary   bits

0	1
unset	set
low	high
off	on
false	true

byte 8 bits

Most significant bit (msb)   7

least significant bit (lsb)   0

1	1	0	1	1	0	0	1
128	64	32	16	8	4	2	1

$128 + 64 + 16 + 8 + 1 = 217$

32 bit value word

31	24 / 23	16 / 15	8 / 7	0

byte 3   byte 2   byte 1   byte 0
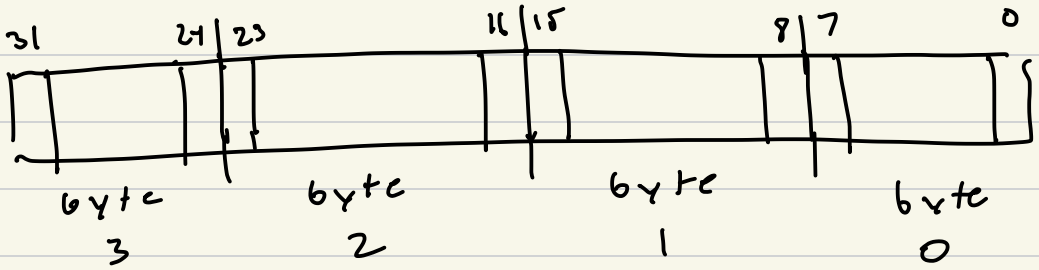
$$0x \; FFAA1122$$

Bitwise operators

AND &   OR | NOT ~   XOR ^

a	b	a&b
0	0	0
0	1	0
1	0	0
1	1	1

a	b	a|b
0	0	0
0	1	1
1	0	1
1	1	1

a	~a
0	1
1	0

a	b	a^b
0	0	0
0	1	1
1	0	1
1	1	0

uint8_t a, b;

$$a = 0b11001010$$
$$b = 0b10011001$$

Shifts

<<	>>
Left Shift	Right shift

$a >> \underline{n}$ ← nbits

$a << n$

$a >> 1;$

a

1	0	1	1	1	0	1	0

a>>1

0	1	0	1	1	1	0	1

→ X
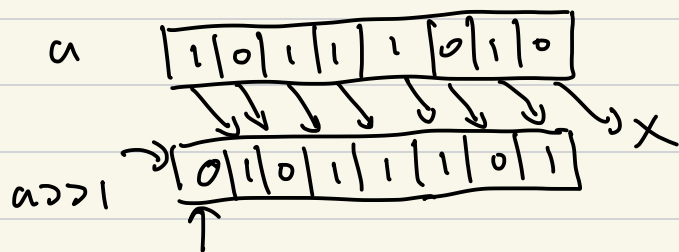
Assembly bitwise instructions

and | andi
or | ori
xor | xori ←
sll | slli
srl | srli

li t0, -1
xor a0, a0, t0

Project03

Calling   strlen   from assembly

. global   strlen

preserve

```
# a0 = str addr
call strlen
```

a0,a1,... t0,t1...

restore