CS 315-02 Lab Bits Machine Code

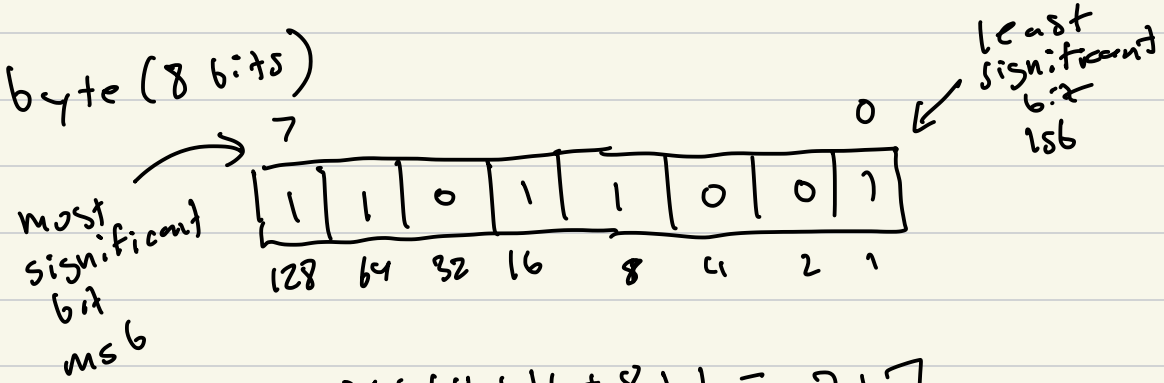
Bit Manipulation

bitwise operator	relational opers
>>	
<<	
&	&&
~	!
|	||

C bitwise operators

RISC-V bitwise instructions

0	1
false	true
off	on
unset	set
low	high



128 + 64 + 16 + 8 + 1 = 217

32 bit value (word)

byte 3 | byte 2 | byte 1 | byte 0

Bitwise Operators

AND &

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

OR |

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

NOT ~

a	~a
0	1
1	0

XOR ^

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

uint8_t a, b;

a = 0b 11 01 11 00

b = 0b 10 01 10 01

a & b = 0b 10 01 10 00

~a = 0b 00 10 00 11

a | b = 0b 11 01 11 01

a ^ b = 0b 01 00 01 01

Shifts <<

left shift

a << n

bits

>>

right shift

a >> n

a << 2 = 0b 01 11 00 00

LSL

Logical a >> 2 = 0b 00 11 01 11

LSR

int8_t c; c = 0b 11 01 11 00 −36

00 10 00 11

+ 1

00 10 01 00 36

32 4

c >>> 2 = 0b 1111 0111 -9

ASR
↑
arithmetic

0000 1000
+ 1
0000 1001 9

Assembly language

and / andi
or / ori
xor / xori
sll / slli
srl / srli
sra / srai

9

uint8_t a = 0b 11100101

a >>> 2 = 0b 00111001

uint8_t a4 = 0b 00000111 mask

0b 00001001 9

Vant
a4 = 9