

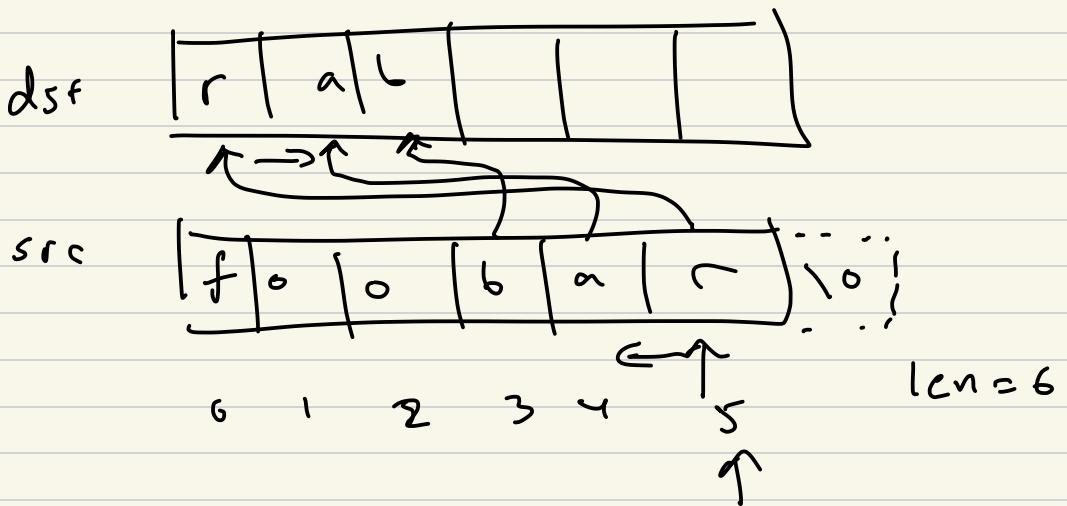
CS315-01 Lab Bits

Project03 IG

Project03 rstr bug

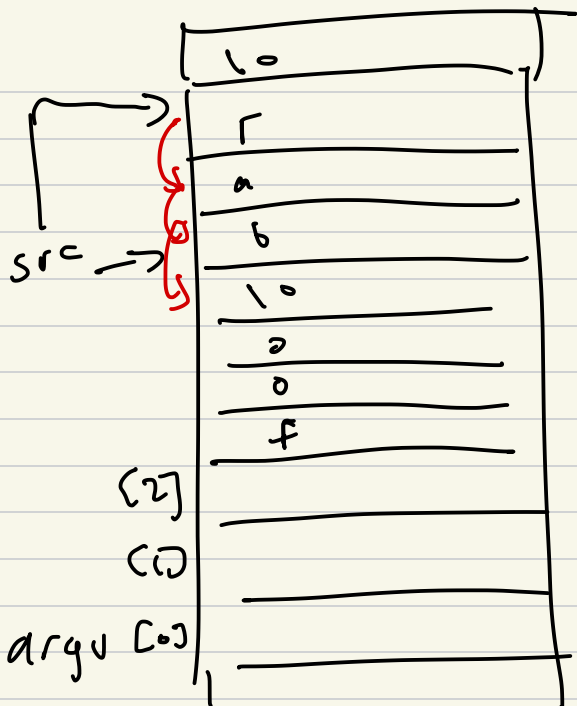
Big Picture

rstr_rec

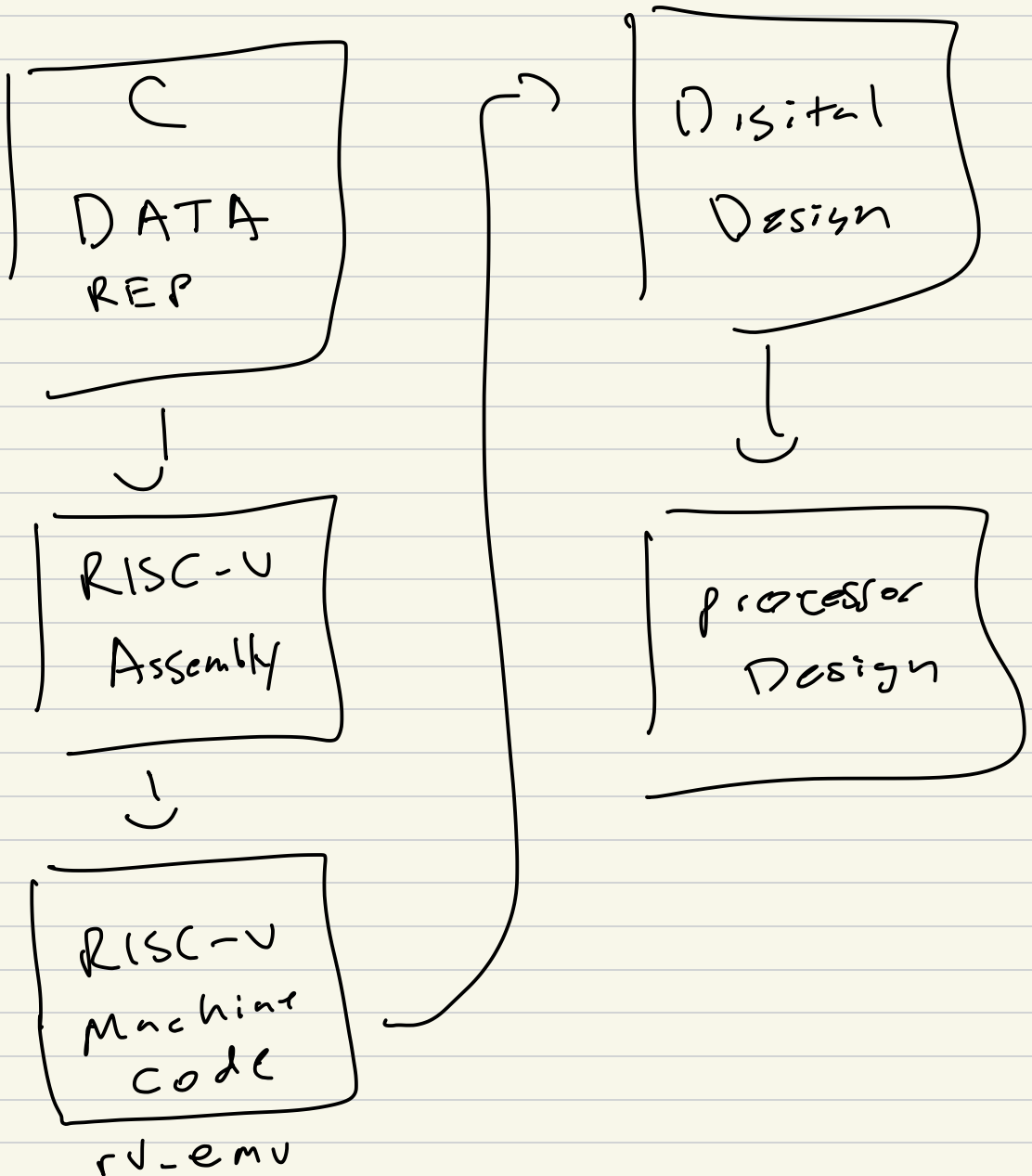


argv

./foo bar



Big Picture



Bit Manipulation

C bitwise operators
RISC-v bitwise instruction

bitwise ops

~	(not)
>>	right shift
<<	left shift
&	and
	or
^	xor

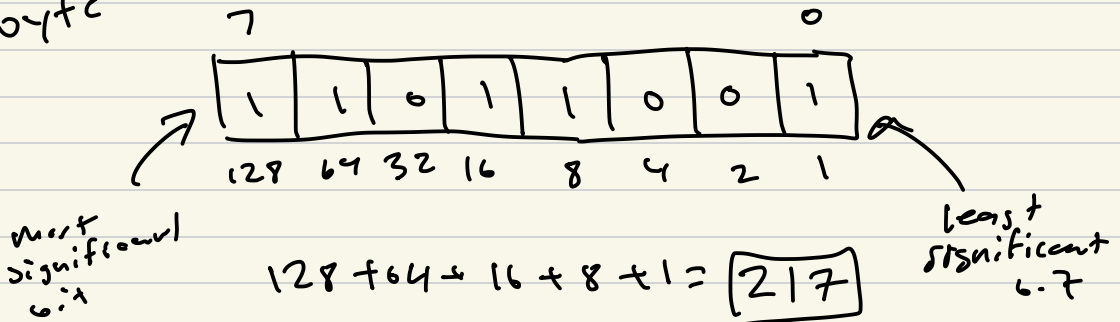
relational

&&	and
	or
!	not

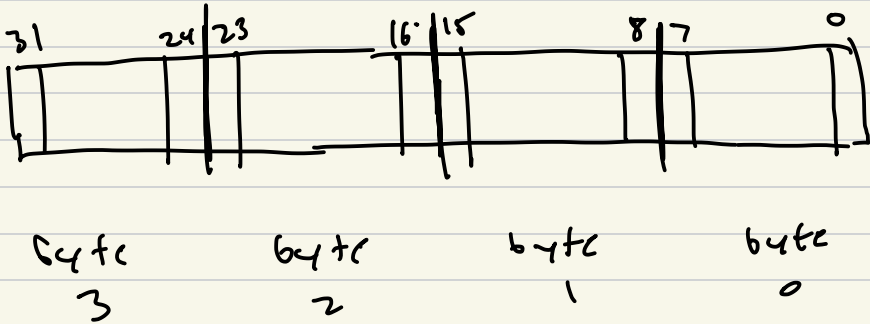
Binary

0	1
false	true
unset	set
low	high

byte



32 bit value (word)



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 $\sim$

a	$\sim b$
0	1
1	0

XOR $\wedge$

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

uint8_t a, b;

a = 0b 1100 1010

b = 0b 1001 1001

a & b =

1000 1000

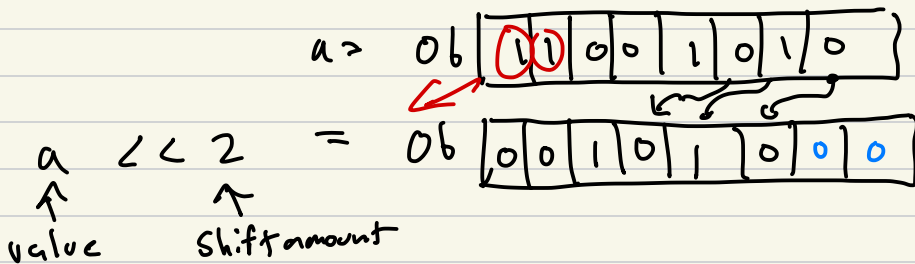
$$\sim a = 06 \ 00 \ 11 \ 01 \ 01$$

$$a \mid b = 06 \ 11 \ 01 \ 10 \ 11$$

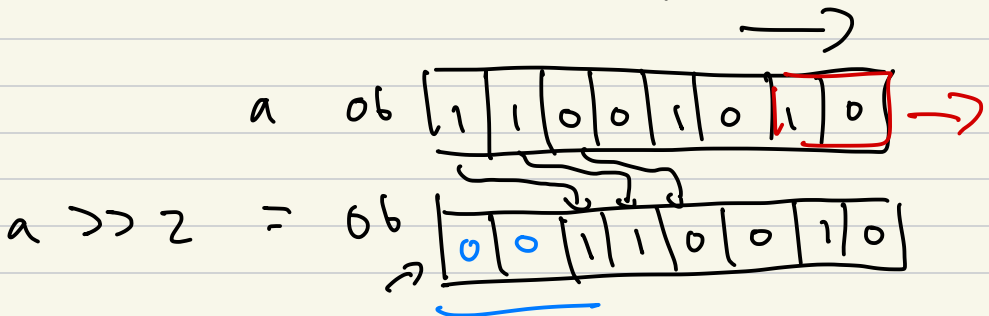
$$a \wedge b = 06 \ 01 \ 01 \ 00 \ 11$$

Shifts

SLL Shift Left Logical



SRL Shift Right Logical

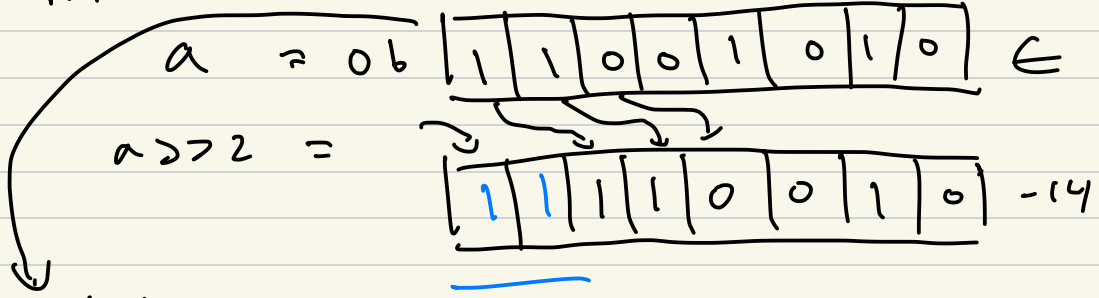


$$-54/4 = 27$$

SRA Shift Right Arithmetic

int-t a

-54



inv

$$\begin{array}{r} 00110101 \\ + \\ \hline 00110110 \end{array}$$

32 16 4 2 = 54

inv

$$\begin{array}{r} 00001101 \\ + \\ \hline 00001110 \end{array}$$

8 4 2 = 14