

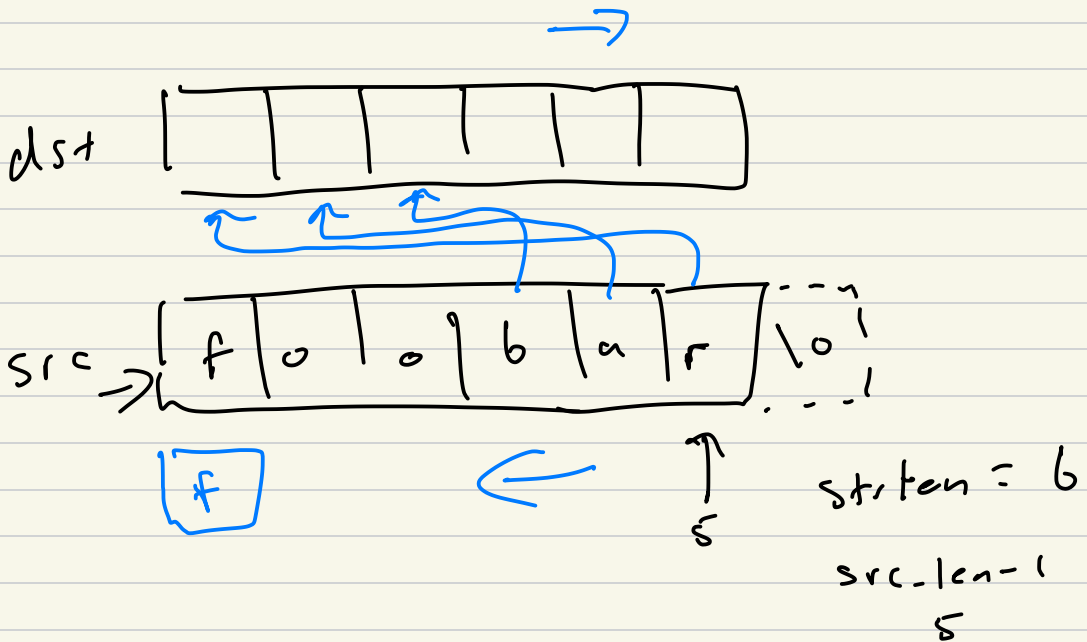
CS318-02 Lab Bits

Project03 IG

Project03 rstr-rec-5 bug

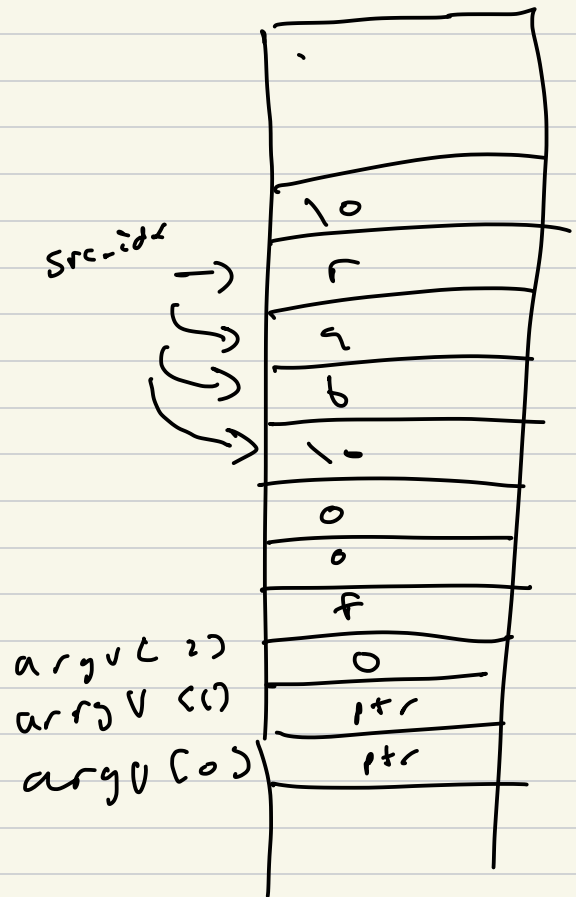
Big Picture

rstr-rec-5

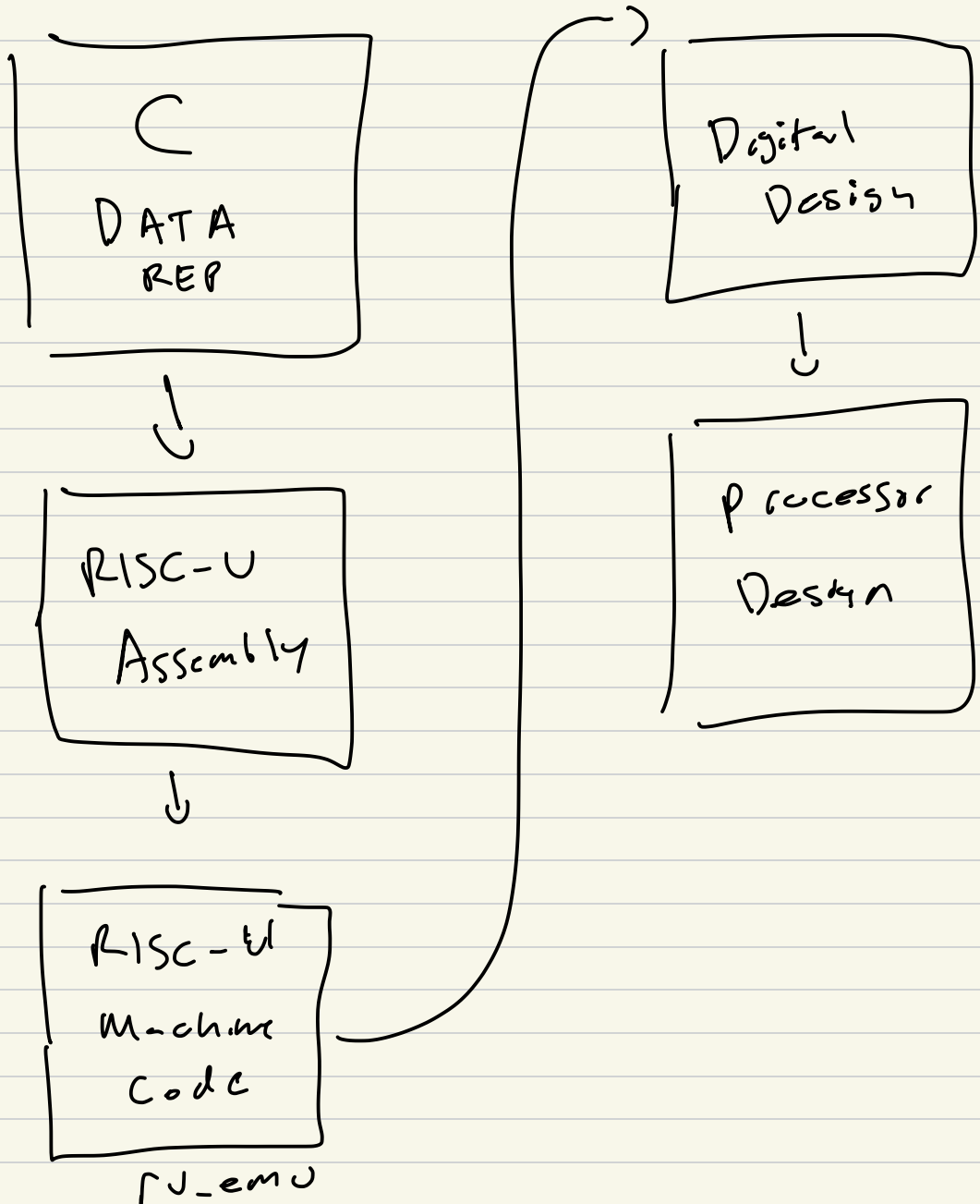


argv[0]

./foo bar



Big Picture



Bit Manipulation

C bitwise operators
RISC-u bitwise instructions

bitwise ops

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

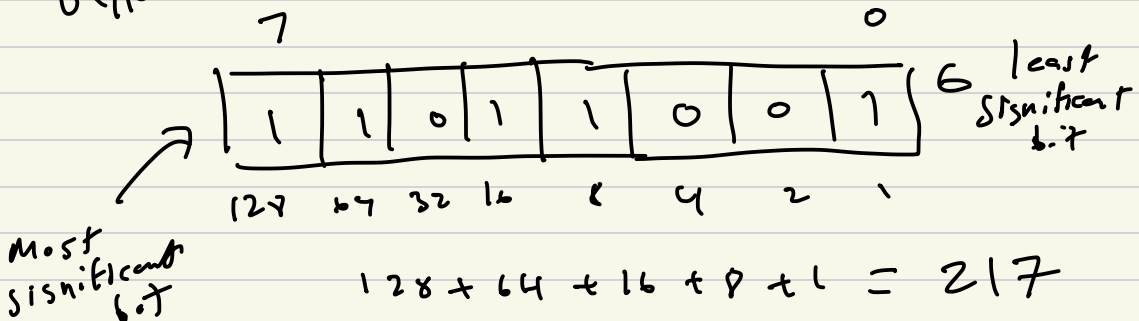
relational

&&	and
	or
!	not

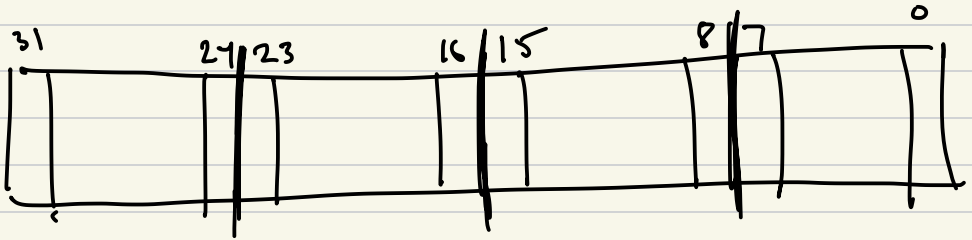
Binary

0	1
false	true
unset	set
low	high

byte



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

XOR $\oplus$

a	b	a $\oplus$ b
0	0	0
0	1	1
1	0	1
1	1	0

NOT $\sim$

a	$\sim a$
0	1
1	0

uint8_t a, b;

a = 0b 1100 1010

b = 0b 1001 1001

a & b = 0b 1000 1000

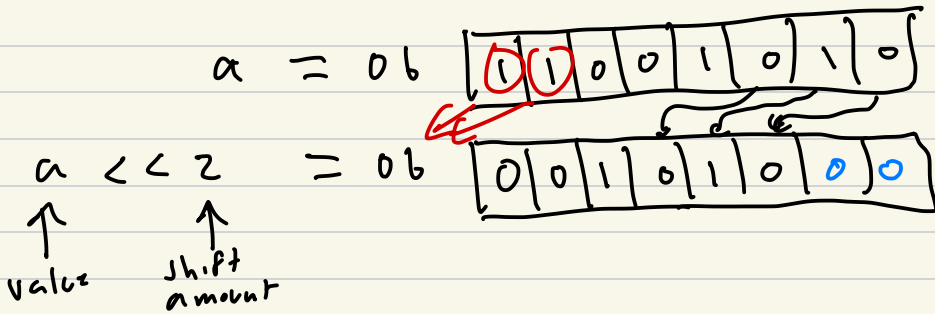
$$\sim a = 0b\ 0011\ 0101$$

$$a \mid b = 0b\ 1101\ 1011$$

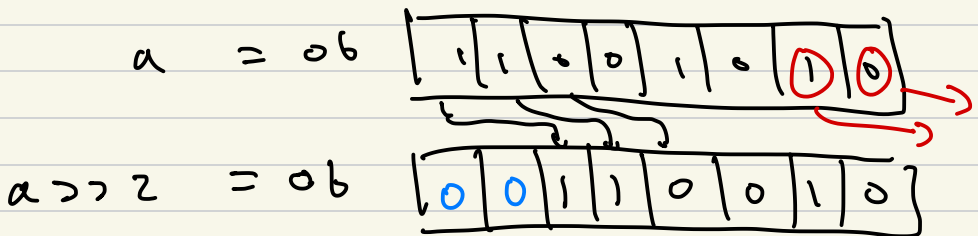
$$a \wedge b = 0b\ 0101\ 0011$$

Shifts

SLL Shift Left Logical



SRL Shift Right Logical



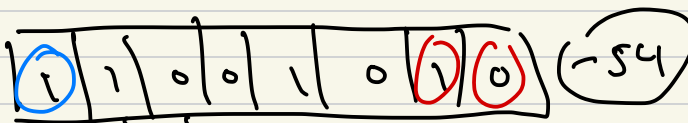
$$8 = 00001000$$

$$8 < 1 \quad 00010000 = 16$$

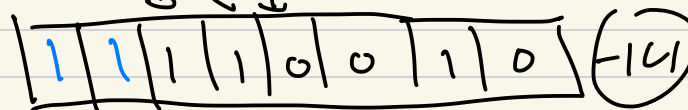
SRA Shift Right Arithmetic

int8_t a

$$a = 0b$$



$$a \gg 2 = 0b$$



$$\begin{array}{r}
 \text{in} \quad 00110101 \\
 + \quad \quad \quad 1 \\
 \hline
 00110110 \\
 \text{32 16 4 2 54}
 \end{array}$$

$$\begin{array}{r}
 \text{in} \quad 00001101 \\
 + \quad \quad \quad 1 \\
 \hline
 00001110 \\
 \text{8 4 2 14}
 \end{array}$$