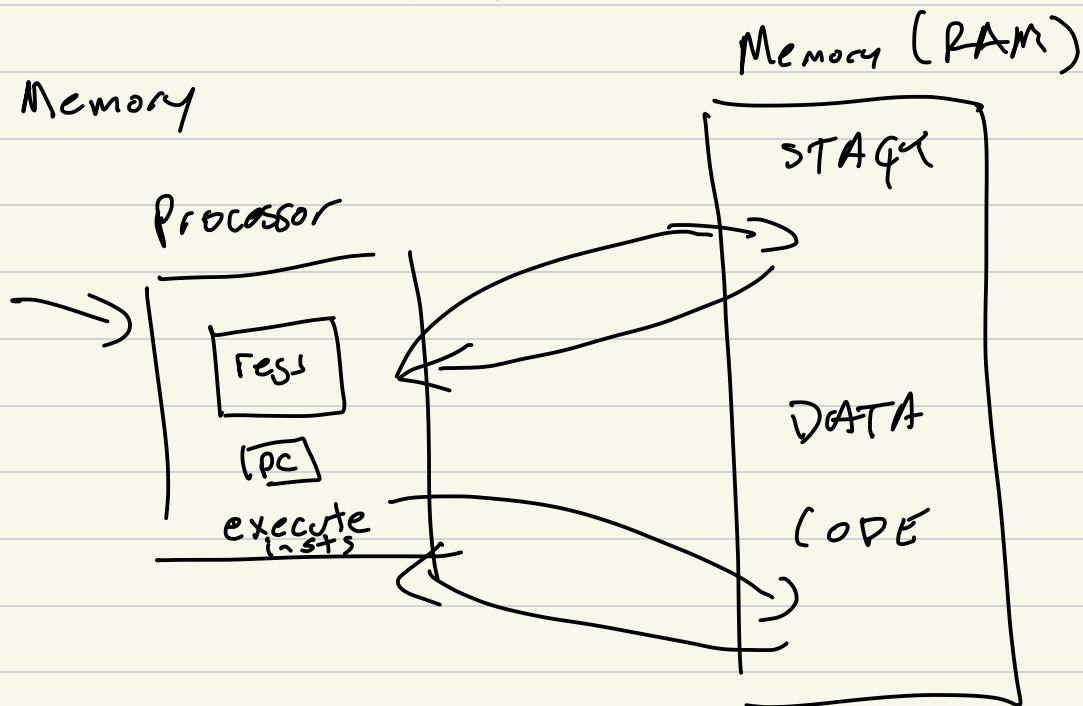


CS 315-01 RISC-V Strings Two's Complement

Project 02 - make up to 50% back
code quality - calling conventions

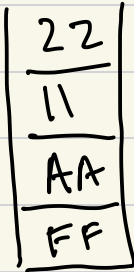
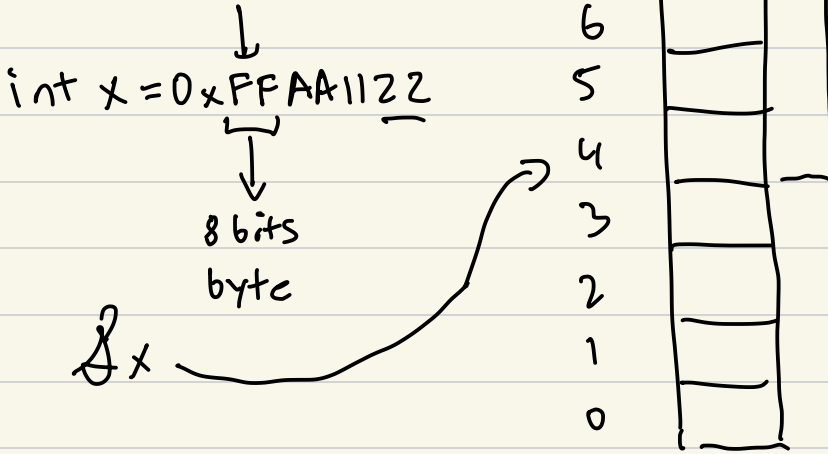
Project 02 Exam Questions due Wed Sep 18 11:59,

Project 03 due Mon Sep 23 11:59m
IG Tue Sep 24

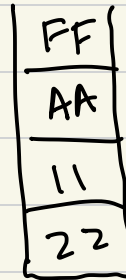


Memory → array of bytes

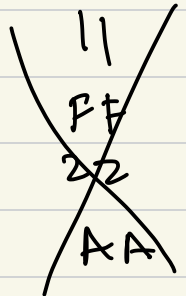
byte addressable



big
endian



byte ordering
endianess

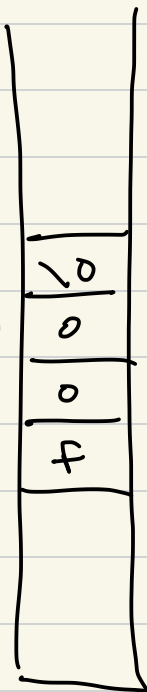


little
endian

Strings
arrays of
bytes

char *s = "foo"
 ↑
 s[0]

s[3]
s[2]
s[1]
s[0]



byte value zero

- ld load double
- lw load word
- lb load byte

Binary representation of integers

How to represent signed values

↳ Two's Complement

4 bit numbers

unsigned

Decimal Binary signed magnitude Two's complement

0	0000	0	0
1	0001	1	1
2	0010	2	2
3	0011	3	3
4	0100	4	4
5	0101	5	5
6	0110	6	6
7	0111	7	7
8	1000	-0	-8
9	1001	-1	-7
10	1010	-2	-6
11	1011	-3	-5
12	1100	-4	-4
13	1101	-5	-3
14	1110	-6	-2
15	1111	-7	-1

signed
mag

$$\begin{array}{r} 1111 \quad (5) \\ + 1011 \quad (-3) \\ \hline \boxed{0000} \quad 0 \end{array}$$

$$\begin{array}{r} 0101 \quad (5) \\ + 1101 \quad (-3) \\ \hline 0010 \quad (2) \end{array}$$

How to get two's complement negative representation from positive value?

$$\begin{array}{l} 3 \rightarrow -3 \\ 0011 \rightarrow 1100 + 1 = \underline{1101} \quad (-3) \end{array}$$

$$\text{invert}(x) + 1$$

$r=3$

$$1101 \rightarrow 0010 + 1 = 0011 \quad (3)$$

Other interesting facts about
Two's complement numbers

say you have a 4 bit 2's comp #

What an 8 bit 2's comp

$$4\text{bit} \quad \underline{1101} \quad (-3)$$

$$8\text{bit} \quad \underline{1111} \quad 1101$$

sign
extend

$$\begin{aligned} & \overset{i}{100} \\ 0000\ 0011 & \rightarrow 1111\ 1100 + 1 \\ & = 1111\ \underline{1101} \quad (-3) \end{aligned}$$