

CS 631-01 Analysis and Cache Memory

Lab 05 Q: A

immediates

sign extension

jal

immediates

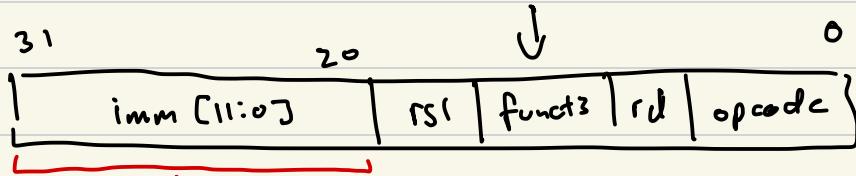
goal: create a signed 64 bit value
from immediat bits.

steps

- ① extract immediate sequences
- ② combine sequences into proper order
- ③ sign extend to 64 bits

i-type

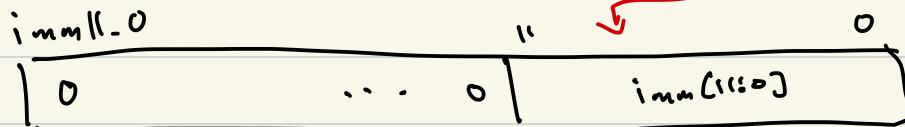
Vint32-f iw;



int64-t imm64;

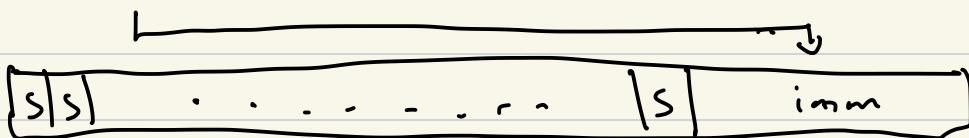
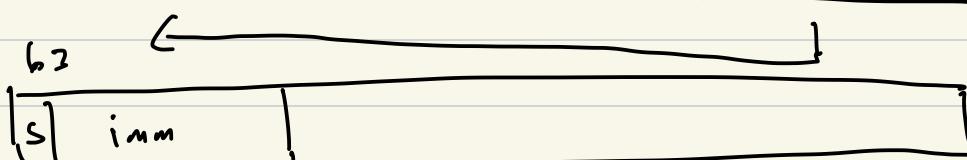
Vint64-t imm11-0;

imm11-0 = get_bits(iw, 20, 12);

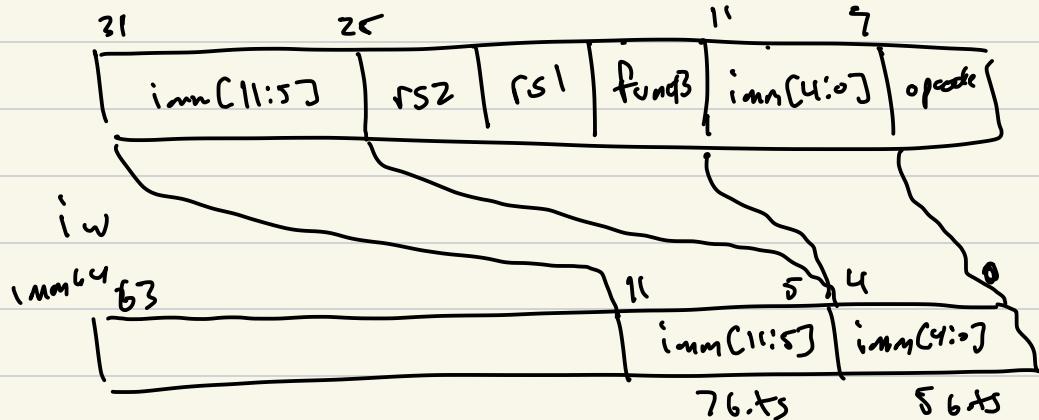


imm64 = sign-extend(imm11-0, 11);

imm11-0



S type



vint64_t imm11-5;

vint64_t imm4-0 ;

imm11-5 = get_bits(iw, 25, 7)

imm4-0 = get_bits(iw, 7, 5)

int64_t imm64

imm64 = (imm11-5 << 5) | imm4-0 ;

imm64 = sign-extend(imm64, 11)) ;

B - type no zero b=t

imm4-1

imm64 =  | (imm4-1 << 1)
 ↑

JAL jump and link

call foo < $\frac{RA}{PC} = PC + 4$
 $\frac{PC}{PC} = PC + \underline{\text{offset}}$

jal r_a > offset

cmu-jal
get offset
get rd

$rsp \rightarrow \text{regs}[rd] = rsp \rightarrow PC + 4;$

$rsp \rightarrow PC = rsp \rightarrow PC + \text{offset};$

for ^

j rd == 0

if (rd != 0) ε

$rsp \rightarrow \text{regs}[rd] = rsp \rightarrow PC + 4;$

$rsp \rightarrow PC = rsp \rightarrow PC + \text{offset};$

Project 03 - Full RISC-V Emulator

① Additional Instructions (jal, jalr, auipc)

② Dynamic Analysis

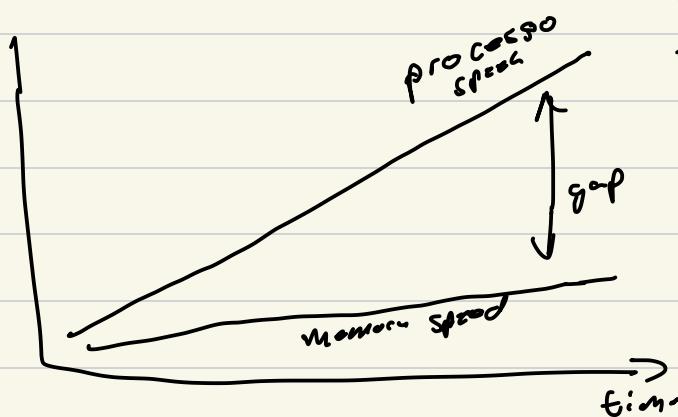
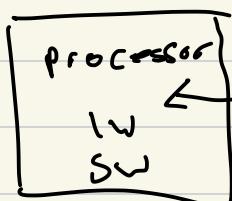
instruction count

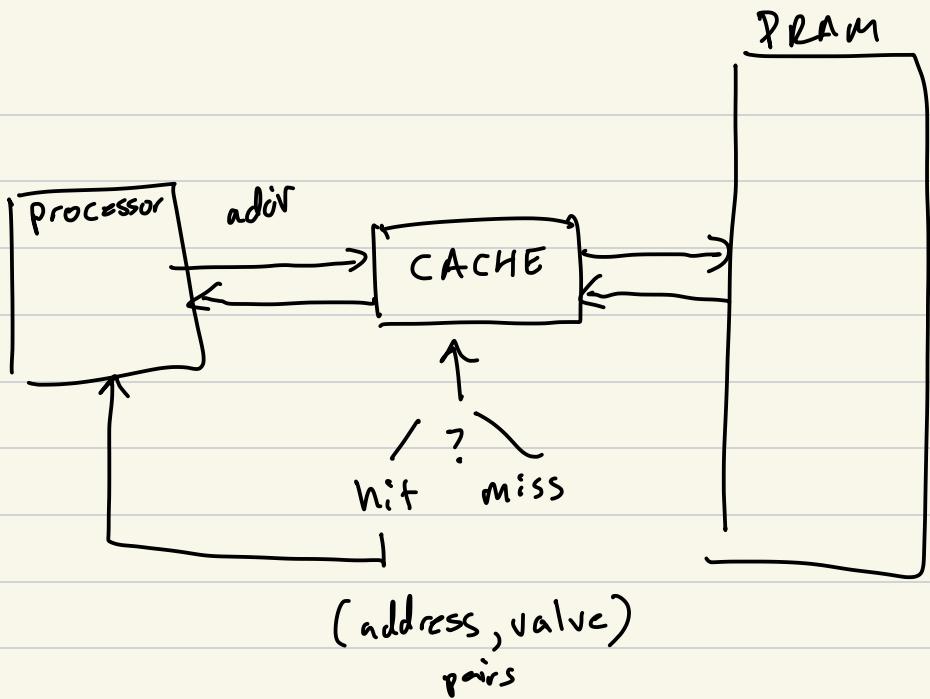
branch count

branch not taken

③ Cache Simulation

Memory (DRAM)





Questions

- 1) Where to look for a given addr?
- 2) How to know if addr is in cache?
- 3) How to resolve a conflict?