

CS2308
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RISC - MIPS

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Need to support C compiler

with minimum "cost" \downarrow instruction

C compiler (static)

$a = b + c - d \times e;$

Arithmetic expression ① Evaluate

$a = c[i] + b[j]$

Logical Expression ②

if $((A == B) \vee (C \& D))$

$\langle \text{exp} \rangle$

2

Condition exp

conditional
Logic

if (Logical Exp)

{ Exp }

while (L Exp)

{ Exp }

Arithmetic expression are

3 operand expressions the operate

only on Registers

add a b c Syntax

$a \leftarrow b + c$ Semantics

Register Transfer Language

a, b, c are variables
stored in registers

3

Arithmetical / Logical set of instructions

Op dst SRC1 SRC2

add
sub

OR source 1
XOR |

add a b c

destination |
 source 2

32 GPR 32 bits

Referred to by number name

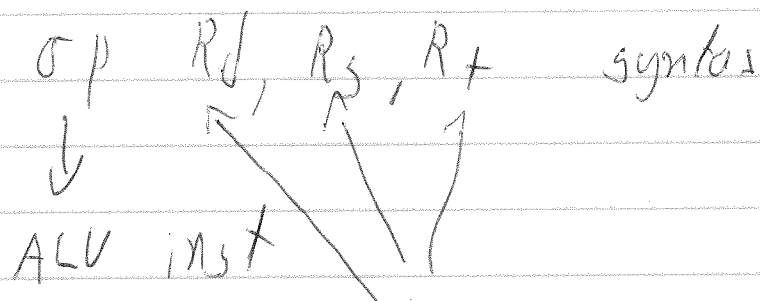
add \$5, \$6, \$7

Register allocation

\$5 ← \$6 + \$7

↑ ↑ ↑
A B C

4



$\$n \quad n = 0, \dots, 31$

sub \$5, \$11, \$0

$\$5 \leftarrow \$11 - \$0$

op Rd, Rs, Rt

$Rd \leftarrow Rs \text{ op } Rt$

$a = (b + c) - (e + d);$

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
 0 1 2 3 4

Register Allocation

add \$1, \$1, \$2 not so good

$\$5 \leftrightarrow t1$

$\$6 \leftrightarrow t2$

5)

Reg \$0 \equiv 0

Hardwired to 0

add \$5, \$6, \$0

mov \$5, \$6

add \$5, \$1, \$2

add \$6, \$3, \$4

sub \$0, \$5, \$6

Register \$0 is Hardw

$\$5 \leftarrow \$6 + \$0$

add \$5, \$6, \$0 \equiv mov \$5, \$6

Real inst

$\$5 \leftarrow \6

↓
machine code

6 `mov $5, $6` pseudo instruction

no machine code

Converted into Real

`sub $5, $6, $0` (\$Zero)

or `$5, $6, $0` Preferred way

MIPS Logical operations are bit-wise

`a & b` `a && b`

~~`a & b`~~

`a, b` `a, i, b`

1	0	0	0	0	0	1	0
---	---	---	---	---	---	---	---

0	0	1	0	0	0	1	1
---	---	---	---	---	---	---	---

1						0	1
---	--	--	--	--	--	---	---

XOR ^

7

if $(A \& \& B)$ Logical AND

<u>A</u>	<u>B</u>	A 8 B	
F	F	F	
F	F	F	$F \equiv D$
T	F	F	$T \text{ o. w.}$
T	T	T	

F = 10

T.O.W.

AS3Me

$$A = F$$

00000000

$$B = T$$

000000/

Q MIPS AND

o o o o o o o

O O O O O O



or \$5, \$6, \$0

\$5 \leftarrow \\$6 \text{ OR } \\$0 \leftarrow

Negotiate

$$a = \sqrt{-a}$$

May \$0, ~~\$0~~ \$10, \$1,

6v6 \$+P, \$0, \$+1