

S-11

assign-locals =  $X$  (vars)  $\rightarrow X$  (no vars)

- the stack is vast, but it is slow

- registers are few and fast

$\rightarrow (< 16)$

(let v := 1 in

(let w := 46 in

(let x := v + 7 in

(let y := 4 + x in

(let z := x + w in

(+ z (-y))))))

7-2]

assignments to  
regs as we  
see them

movq	\$1, %v	// let v := 1	{v}	
movq	\$46, %w	// let w := 46	{v, w}	live set =
movq	%v, %x		{x, w}	active vars
addq	\$7, %x	// let x = v + 7	{x, w}	
movq	%x, %y		{x, w, y}	
addq	\$4, %y	// let y = 4 + x	{x, w, y}	}
movq	%x, %z		{w, y, z}	
addq	%w, %z	// let z = x + w	{y, z}	
movq	%y, %t		{t, z}	
negq	%t	// (- y)	{t, z}	
movq	%z, %rax		{t, %rax}	
addq	%t, %rax	// (+ z +)	{%rax}	live-after

S-31

instrs  $i_0 \dots i_n$  or  $\{0 \dots n\}$

LiveAfter  $(k) = \emptyset$  if  $k = n$

LiveBefore  $(k+1)$  o.v.

LiveBefore  $(k) = (\text{LiveAfter}(k) \setminus W(k)) \cup R(k)$

$W = \text{inst} \rightarrow \text{set}(\text{vars and reg})$  we write

$R = \text{inst} \rightarrow \text{set}(\text{vars and reg})$  we read

$m: \text{arg} \rightarrow \text{set}(\text{vars and reg})$

$W(\text{pop}, a) = M(a)$

$m \circ r = \{r\}$

$R(\text{pop}, a) = \emptyset$

$m \vee = \{v\}$

$W(\text{push}, a) = \emptyset$

$m \cap = \emptyset$

$R(\text{push}, a) = M(a)$

5-4/

$$w(\text{negg } a) = M(a)$$

$$R(\text{negg } a) = M(a)$$

$$w(\text{addg } \text{src}, \text{dst}) = M(\text{dst})$$

$$R(\text{addg } \text{src}, \text{dst}) = M(\text{src}) \cup M(\text{dst})$$

$$w(\text{movg } \text{src}, \text{dst}) = M(\text{dst})$$

$$R(\text{movg } \text{src}, \text{dst}) = M(\text{src})$$

movg !x, !z     ~~!x, !y, !z~~ = {w, y, z}

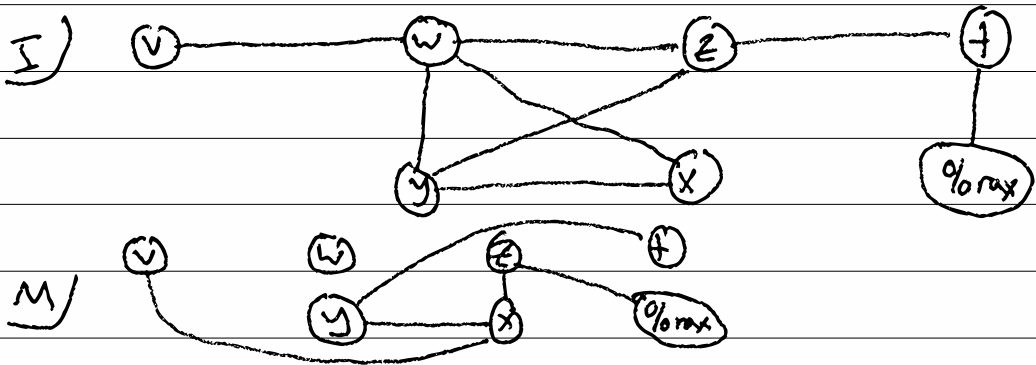
$$w = \{z\} \quad R = \{x\}$$

$$\begin{aligned} & (\{w, y, z\} \setminus \{z\}) \cup \{x\} \\ & = \{x, y, w\} \end{aligned}$$

5-5 interference: When we need two vars at the same time

$V = \{\text{vars and regs}\}$  edges = I

$x \text{ I } y$  iff  $\exists k. \text{LiveAfter}(k) \ni \{x, y\}$   
move-binding = M



5-6)

Suppose inst<sub>k</sub> is ...

(add s d)

$\forall v \in \text{LiveAfter}(k)$ , we'll add  $(d, v)$  to  $I$   
except for  $v = d$

(mov s d)

add  $(s, d)$  to  $M$

$\forall v \in \text{LiveAfter}(k)$ , we'll add  $(d, v)$  to  $I$   
except for  $v = d$  or  $v = s$

If inst<sub>k</sub> treats a ~~register~~ <sup>register  $r$</sup>  "special" then add

$(r, r)$  to  $I$  for all  $v \in \text{LiveAfter}(k)$

callg it treats caller-saved regs special and %rax

$\hookrightarrow$  rax, rdx, rcx, rsi, rdi, r8-r11