

3-4

assign-homes: $X^* \rightarrow X^0$

```
(program (vs ...) (x86-inst ...))
  let k = (vs ...)
```

 $vs = (x \ y \ z)$ $k = 3$

count = k if even and k+1 if odd

count = 4

```
[ pushq %rbp    movq rsi,rbp
  subq count,rsi ] setup
```

 $\sigma_{rbp} = [x \mapsto 0$ $\sigma' \dots = \text{map } \text{rename}(\sigma) \text{ is}$ $\sigma \quad y \mapsto 1$ $z \mapsto z]$

```
[ addq count,rsi
  popq rbp ] restore
```

ret

rename (σ , addq x, y) $= \text{addq } -\bar{x} * 8 (\%rbp)$ $\sigma(x) = \bar{x}$ $- \bar{y} * 8 (\%rbp)$ $\sigma(y) = \bar{y}$ patch: $X^0 \rightarrow X$ movq x, y
 \Rightarrow

movq -8(%rbp), -16(%rbp)

 \Rightarrow

movq -8(%rbp), %rax

movq %rax, -16(%rbp)

man: inst $\rightarrow \text{list}(\text{inst})$ mut: inst (inst $\rightarrow \text{void}$) $\rightarrow \text{void}$

4-1

(program

(program (v w x y z t,1 t,2) | L_{after}

(let ([v 1])	→	(movq (int 1) (var v))	v
(let ([w 46])	→	(movq (int 46) (var w))	v, w
(let ([x (+ v 7)])	→	(movq (var v) (var x))	w, x
(let ([y (+ 4 x)])	→	(addq (int 4) (var x))	w, x
(let ([z (+ x w)])	→	(movq (var x) (var y))	w, x, y
(+ z (- y))))))	→	(addq (int 4) (var y))	w, x, y
	→	(movq (var x) (var z))	w, y, z
	→	(addq (var w) (var z))	y, z
	→	(movq (var y) (var t,1))	t,1, z
	→	(negq (var t,1))	t,1, z
	→	(movq (var z) (var t,2))	t,1, t,2
	→	(addq (var t,1) (var t,2))	t,2
	→	(movq (var t,2) (reg rax)))	{}

liveness → when a variable is needed

interference → rel between var $\hat{=}$ the two vars are live at same time

spillage → when a var lives on the stack

2 3

mov 5, a = I₁ Are a and b live at once?

mov 30, b
2

asm = I₁ ... I_n

mov a, c
3

L_{after}(k) = live after I_k

L_{before}(k) = live before I_k

mov 10, b
4

L_{after}(k) = L_{before}(k+1)

add b, c = I₅

L_{after}(n) = \emptyset = L_{before}(1)

L_{before}(k) = (L_{after}(k) - W(k)) \cup R(k)

W = things written

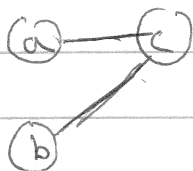
R = things read

4-2

u interferes with v = "live a tonce"

$$(\forall u, v, \exists k, \{u, v\} \in \text{Euler}(k)) = \text{X wrong}$$

Graph $\mathcal{I} = (V, E)$ $V = \text{variables}$

$$(u, v) \in E \quad ; \text{ff } u \text{ inter. } v$$


1. a goes in max

S. a go m r b x

for (a, b, c) \rightarrow put c on stack

for (a, b, e) → get c from stack

read c

For I_k in I_1 to I_n ...

If I_k is (movg $\leq d$), then for $v \in L_{\text{after}}(k)$

add (d, v) to E unless $v = d$ or $v = s$

If I_k is like $(addg \ s \ d)$, then for $v \in \text{Latter}(k)$

add (d, v) to E unless $v = d$

$$\begin{aligned} \{z\} & \\ \{(w, v)\} & \\ (x, w) & \\ (x, w) & \\ (y, w) & \\ (y, w), (y, x) & \\ (z, y), (z, w) & \\ (z, y) & \\ (t, z) & \\ (t, z) & \\ (t, z, t) & \\ \{z\} & \\ \{z\} & \end{aligned}$$

A close-up photograph of a person's hand writing the letter 'C' on a piece of lined paper. The letter is formed with a single, continuous, dark stroke. The paper has horizontal blue lines, and the letter 'C' is positioned between two of these lines. The background is slightly blurred, showing more of the paper and the hand.

You must rotate

