3b) Big-step Semantics

- small-step semantics: transition relation
  = individual steps of computation
- now: transition relation
  = full evaluation
- configuration remains the same
- evaluation relation:

$$\langle P, s \rangle \Downarrow \langle P', s' \rangle$$

"evaluates to"

last configuration of $\langle P, s \rangle$'s evaluation seq. (if P terminates)

(Some) axioms & rules

$$\frac{}{\langle !\ell, s\rangle \Downarrow \langle n, s\rangle} \quad \text{if } s(\ell) = n \qquad \text{(var)}$$

almost as before

$$\frac{\langle E, s\rangle \Downarrow \langle n, s'\rangle}{\langle \ell := E, s\rangle \Downarrow \langle \text{skip}, s'[\ell \mapsto n]\rangle} \qquad (:=)$$

much simpler: ↑ rule instead of 2

$$\frac{\langle C_1, s\rangle \Downarrow \langle \text{skip}, s'\rangle \quad \langle C_2, s'\rangle \Downarrow \langle \text{skip}, s''\rangle}{\langle C_1; C_2, s\rangle \Downarrow \langle \text{skip}, s''\rangle} \qquad \text{(seq)}$$

Example

$P = (z := !x ; x := !y) ; y := !z$

$s = \{z \mapsto 0,\ x \mapsto 1,\ y \mapsto 2\}$

$\langle P, s \rangle \Downarrow \langle skip, s' \rangle$

where $s' = \{z \mapsto 1,\ x \mapsto 2,\ y \mapsto 1\}$

Homework: Show using rules from previous slide