

Advanced: Relative Induction

- Break circularity with induction
 - Guess $a \geq 0$
 - $Init \models a \geq 0 \wedge c \geq 0$,
 - Relative Induction: $a \geq 0 \wedge c \geq 0 \models c' \geq 0$
 - $Init \models a \geq 0 \wedge c \geq 0 \wedge b \geq 0$
 - Induction: $a \geq 0 \wedge c \geq 0 \wedge b \geq 0 \models a' \geq 0 \wedge c' \geq 0 \wedge b' \geq 0$
- The last inductive proof is a complete proof
 - But obtaining the inductive invariant by first guessing $a \geq 0$, then finding $c \geq 0$ could be easier

```
a = 0 ; b = 0 ; c = 0
while * do:
  assert a ≥ 0
  a' = a + b
  b' = b + c
  c' = c + 1 + a
```