



CS 4120
Introduction to Compilers

Ross Tate
Cornell University

Lecture 28: Analysis Examples

Constant Propagation
for a given var x at node n in CFG:

Multi-valued

Constant 1 2 3 4 ...

no-valued

2

Flow Function

$i \mapsto c_1$
 $j \mapsto c_2$

$x := i + j$

$i \mapsto c_3$
 $j \mapsto c_4$

$c_1 + c_2 = c_3 + c_4$

$x \mapsto c_1 + c_2$

3

Live-Variable Analysis

$in[n] \subseteq (out[n] \setminus def[n]) \cup use[n]$

$in^1 = (out^1 \setminus def[n]) \cup use[n]$

$out[n] \subseteq \bigcup_{n' \text{ assoc } n} in[n']$

$F_n(\mathcal{V}) = (\bigcup (def[n]) \cup use[n])$

4

Live-Variable Correctness

$\pi_n(\sigma) \supseteq F_n(F_{n_1}(F_{n_2}(F_{n_3}(\dots(L))))))$

For any path
 $n \rightarrow n_1 \rightarrow n_2 \rightarrow n_3 \rightarrow \dots \rightarrow \text{ret}$

5

$F_n(\bigcup_i \mathcal{V}_i) = \bigcup_i F_n(\mathcal{V}_i)$

$\pi_n(F(\sigma)) = F_n(\bigcup_{n' \rightarrow n} \pi_{n'}(\sigma))$

$F_n(\bigcup_{n' \rightarrow n} F_{n'}(\bigcup_{n'' \rightarrow n'} F_{n''}(\dots))))$

$= \bigcup_{n' \rightarrow \dots \rightarrow \text{ret}} F_n(\dots(L))$

6

Copy Propagation

for each node n in the CFG

Equip Rel sorted by
anti-implication

7