CMSC 430

Introduction to Compilers

Fall 2016

Static Single Assignment Form

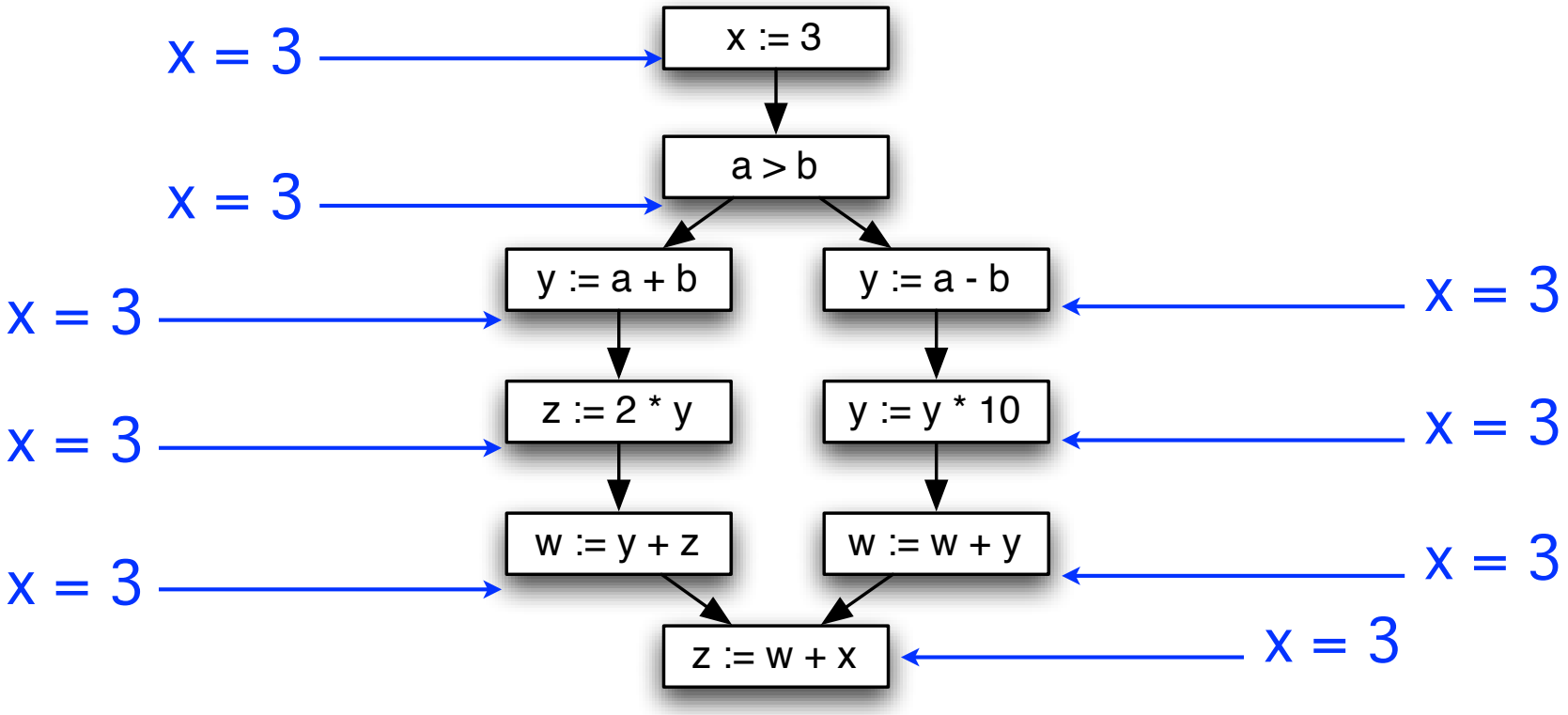
Motivation

- Data flow analysis needs to represent facts at every program point

- What if
  - There are a lot of facts and
  - There are a lot of program points?
  - ⇒ potentially takes a lot of space/time

- Most likely, we're keeping track of irrelevant facts

Example

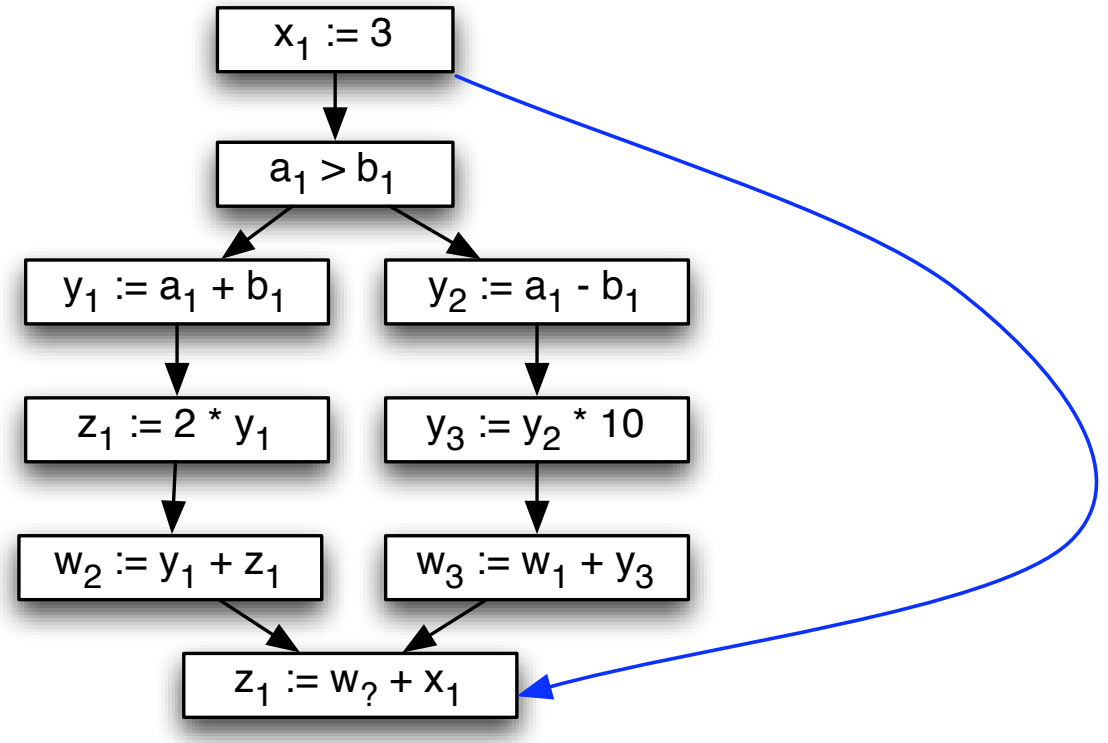


Sparse Representation

- Instead, we'd like to use a sparse representation
  - Only propagate facts about x where they're needed

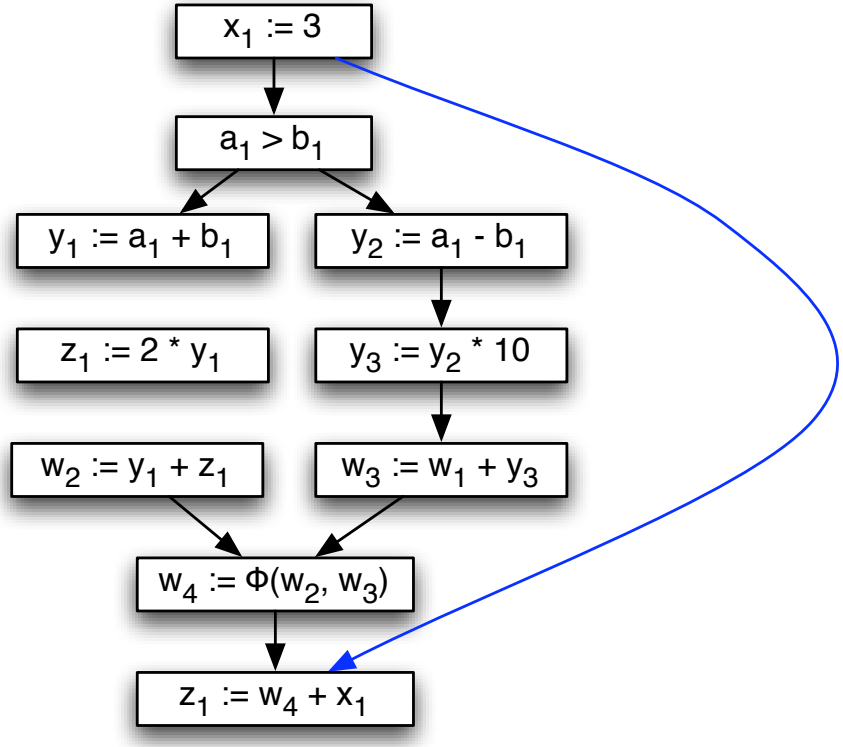
- Enter *static single assignment* form
  - Each variable is defined (assigned to) exactly once
  - But may be used multiple times

Example: SSA



- Add *SSA edges* from definitions to uses
  - No intervening statements use/define variable
  - Safe to propagate only along SSA edges

What About Joins?



- Add Φ functions/nodes to model joins
  - Intuitively, takes meet of arguments
  - At code generation time, need to eliminate Φ nodes