CS738: Advanced Compiler Optimizations

SSA Continued

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Agenda

- Properties of SSA
- SSA to Executable
- SSA for Optimizations

Complexity of Construction

- $R = \max(N, E, A, M)$

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- Practical complexity: $O(R)$

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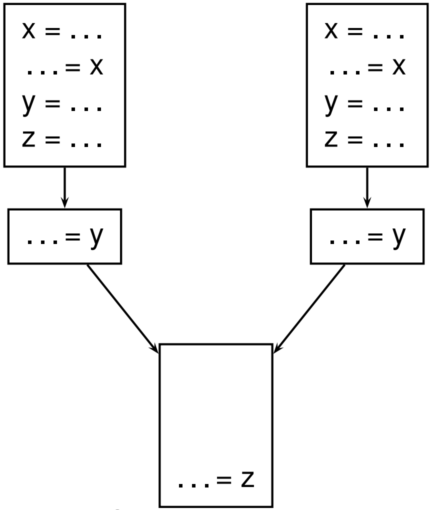
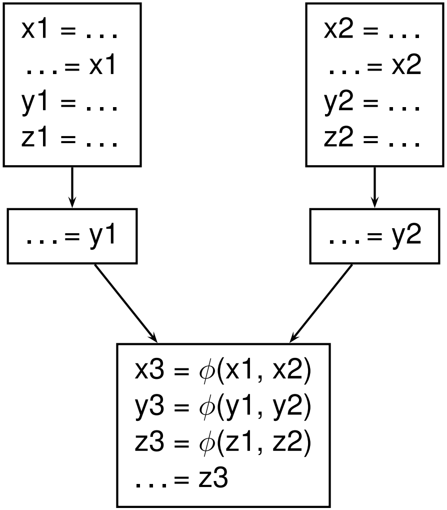
- Linear time is achieved by careful ordering of nodes in the DJ-graph
- DF for a node is computed only once an reused later if required.

Variants of SSA Form: Simple Example



Original Program

Variants of SSA Form: Simple Example



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- Semi-Pruned SSA

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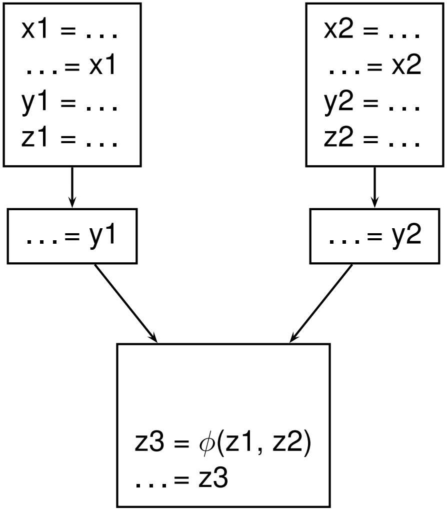
Variants of SSA Form: Pruned SSA Example



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- Non-locals can be computed without iteration or elimination

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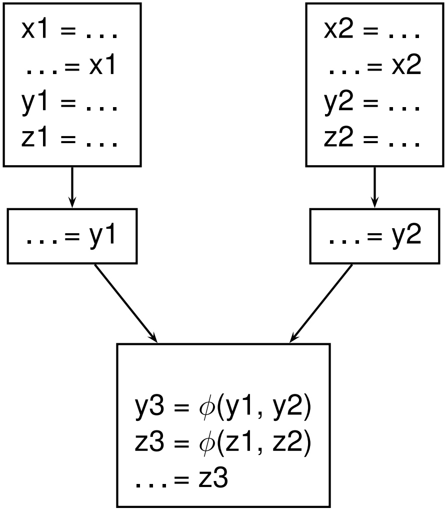

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        defined = defined $\cup$ $\{v\}$
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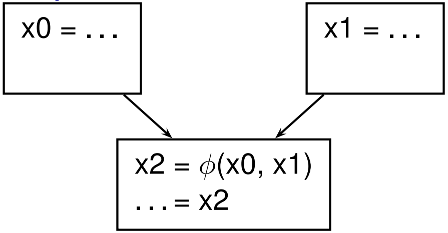
  - Adds lots of copies
    - Many of them will be optimized by later passes

ϕ-removal: Example



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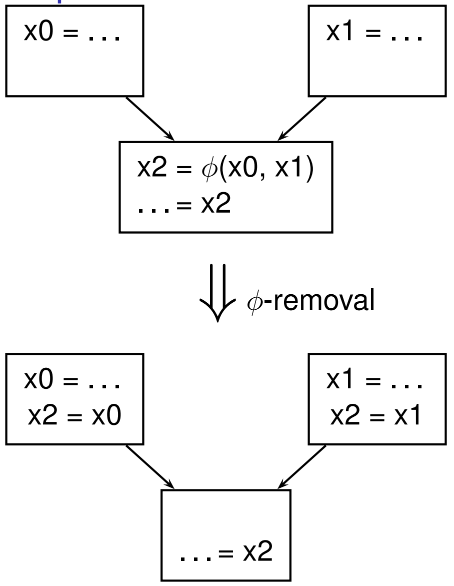
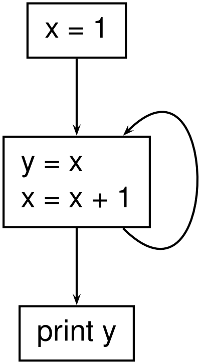


Lost Copy Problem



Program

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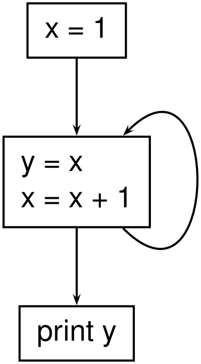

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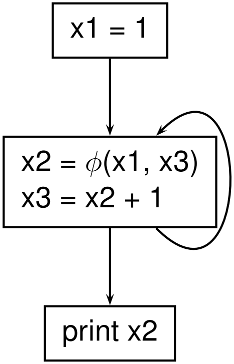

SSA from with
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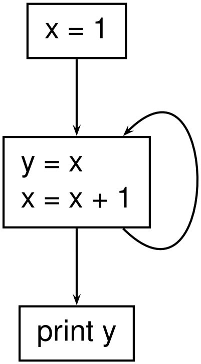

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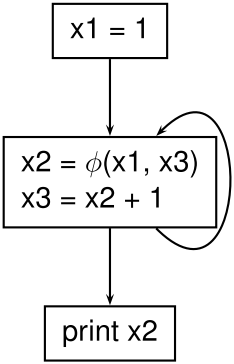

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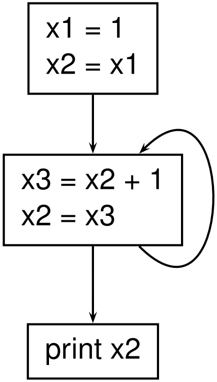
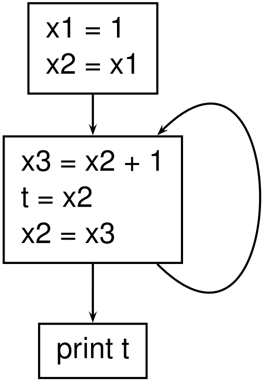


After ϕ-removel

Lost Copy Problem: Solutions



1. Use of Temporary

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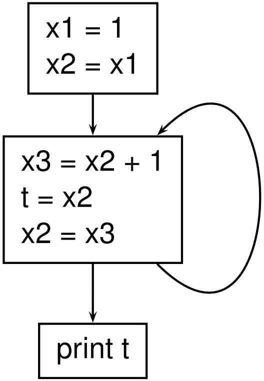

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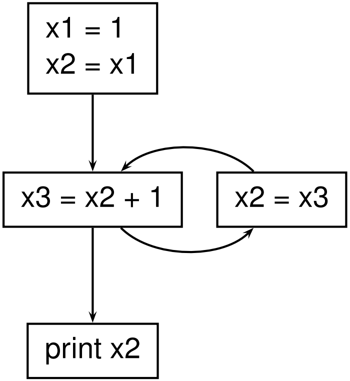
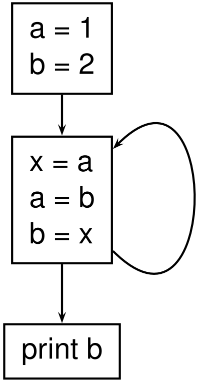


2. Critical Edge Split

Swap Problem



Program

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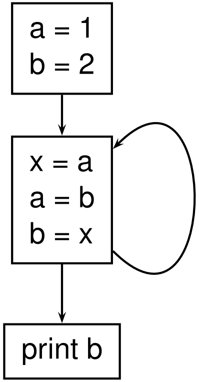

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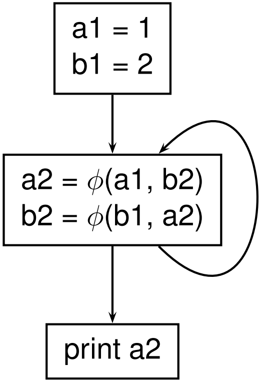

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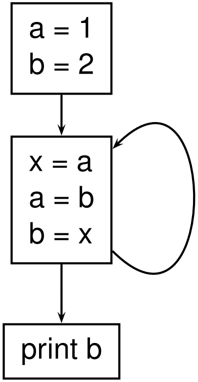

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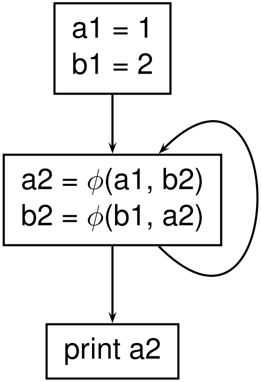

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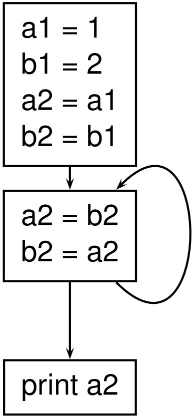

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