Static Single Assignment

Bojian Zheng

CSCD70 Spring 2018

bojian@cs.toronto.edu

Recap: What is SSA

- What is **SSA**?
  - SSA is a rule which states that **each variable cannot be assigned more than once in the program text**.
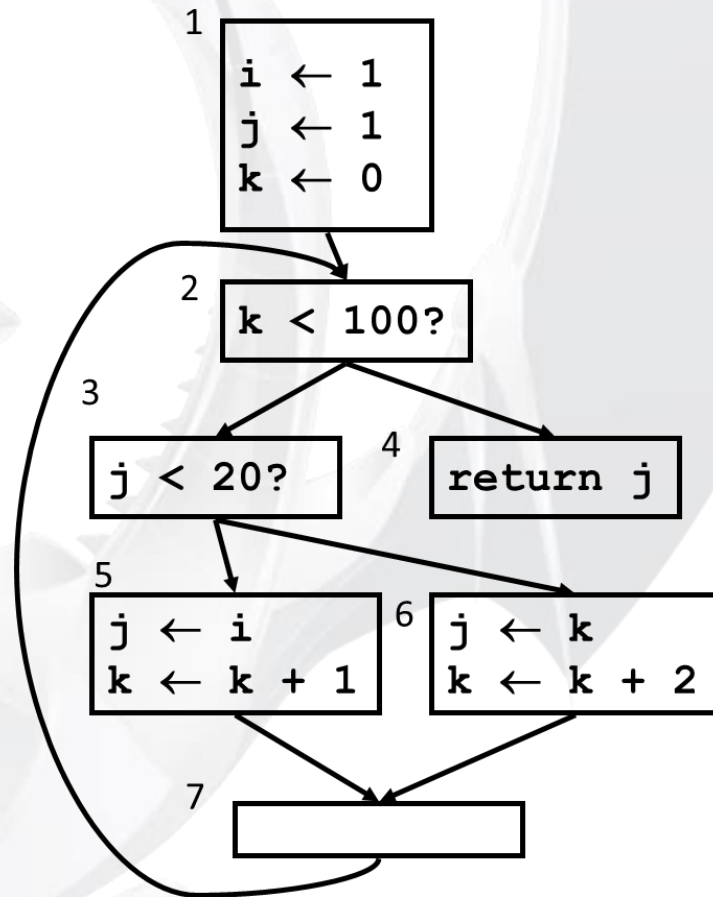
Recap: Three Algorithms

- Dominance Frontier
- φ Placement
- Variable Renaming

Dominance Frontier

Dominance Frontier

- What are the definitions of **Dominance Frontier**?
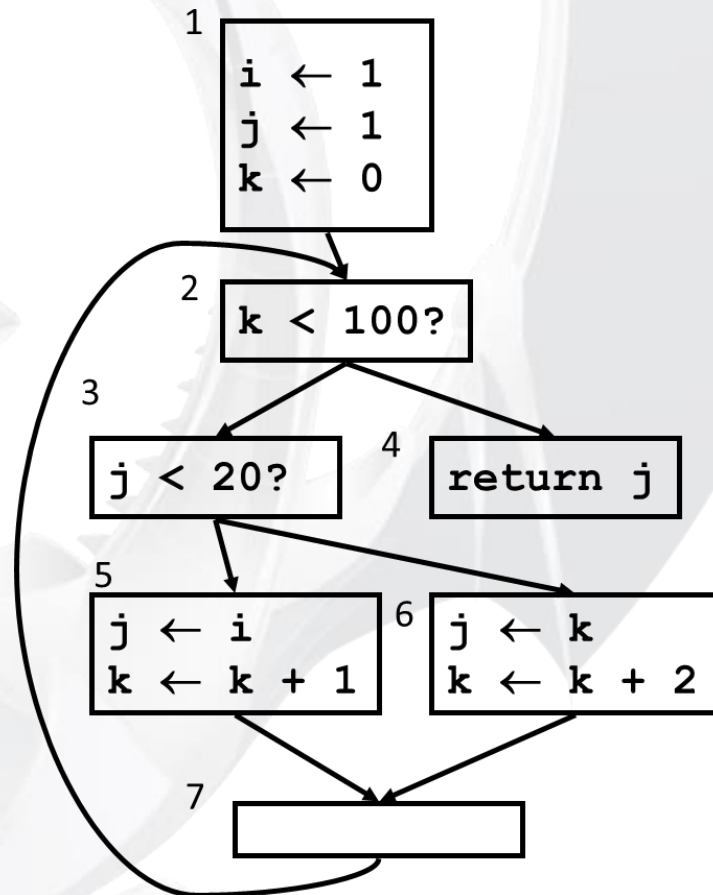
Dominance Frontier in LLVM

- Implemented in `llvm/Analysis/DominanceFrontierImpl.h` (line 160) using worklist algorithm.

- Has a **<u>wrapper pass</u>** that can be used as a prerequisite for other passes (needs to be specified inside `AnalysisUsage`).
  - There is also similar wrapper pass for Dominator Tree: `DominatorTreeWrapperPass`

φ Placement

φ Placement

- Where should we place φ?
  - i?
  - j?
  - k?

1
```
i ← 1
j ← 1
k ← 0
```

2
```
k < 100?
```

3
```
j < 20?
```

4
```
return j
```

5
```
j ← i
k ← k + 1
```

6
```
j ← k
k ← k + 2
```

7

Rename Variables

Rename Variables

- Traverse through the CFG, and rename variables as we go.