

CSCD70 Compiler Optimization

Tutorial #4 Dataflow Analysis (ii)

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Abstract

In this tutorial, we will be discussing the following topics:

- ▶ Dataflow Analysis Case Study:

- ① Dominator
- ② Constant Propagation

- ▶ Assignment 1 Q & A

Dominator

Problem Statement

Given a basic block A , determine all the basic blocks B s.t. $B \text{ dom } A$.

- ▶ **Domain:** Basic Blocks
- ▶ **Transfer Function:** $f_B = B \cup x$
- ▶ **Direction:** Forward
- ▶ **Meet Operator:** \cap

Constant Propagation

Problem Statement

Given a variable, determine whether it is constant or not.

- ▶ **Domain:** Variables
- ▶ **Transfer Function:**

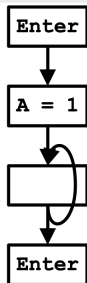
$$f_A(x) = \begin{cases} A \cup x & \text{if } \forall d \in \text{Def}(A), d = c_0 \in \mathbb{C} \\ x \setminus A & \text{otherwise} \end{cases}$$

- ▶ **Direction:** Forward
- ▶ **Meet Operator:** $\cap \Rightarrow$ **Initial Conditions:** Assumes ALL variables are constant (unless proven otherwise).

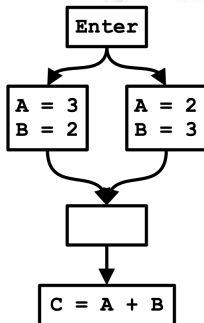
Constant Propagation

Q: Why $FP \leq MFP \leq MOP \leq \text{Perfect}$?

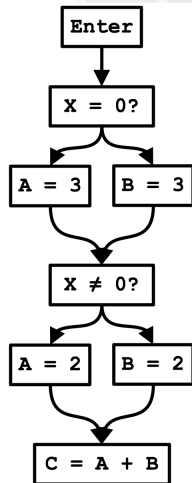
$FP \leq MFP$



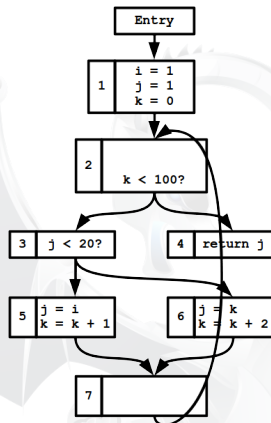
$MFP \leq MOP$



$MOP \leq \text{Perfect}$



Constant Propagation



- ▶ Our current implementation might not yield the most satisfactory result ...

👉 **Conditional** Constant Propagation (later in lecture)

Review

In this tutorial, we have discussed about the followings:

▶ **Dataflow Analysis Case Study:**

- 1 Dominator
- 2 Constant Propagation