Assignment 2
(Due: Jan 25 23:59)

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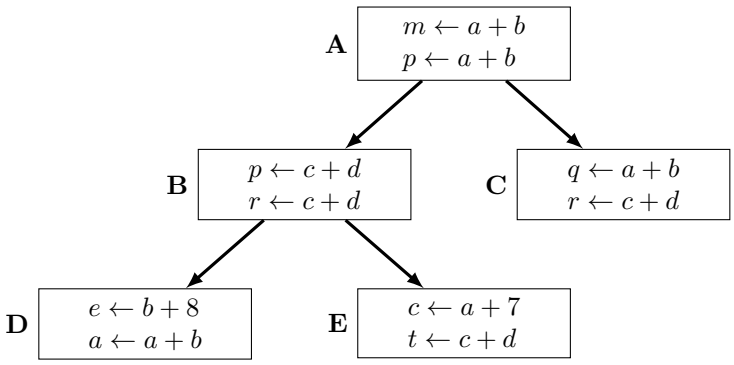
Problem 1: Apply super-local value numbering (SVN) to the following EBB:

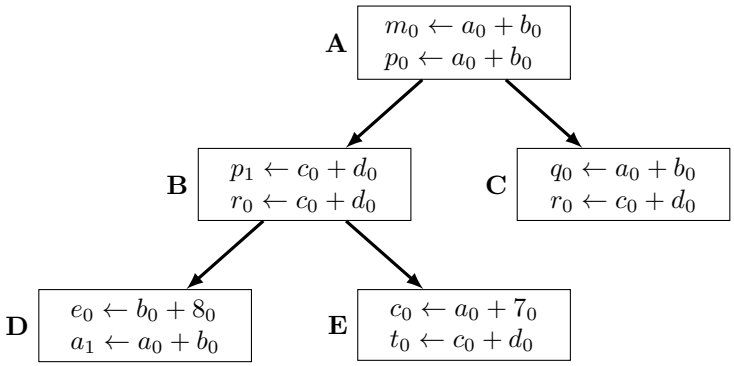


Requirements:

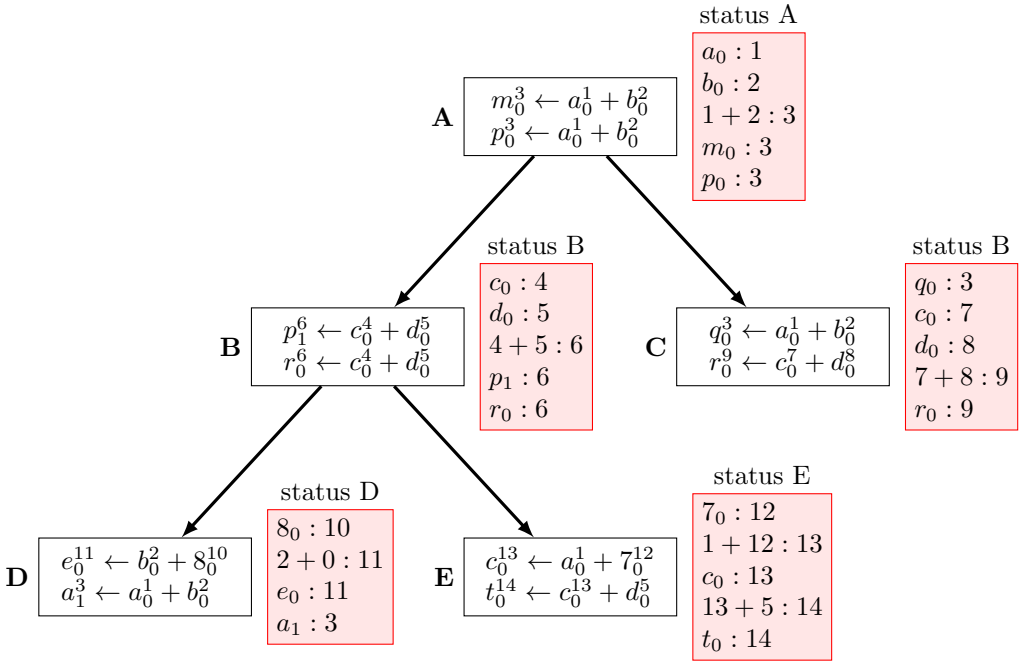
1) Before applying SVN, first rename all variables with version numbers (subscripts starting from 0). This will address the overwritten issues that may occur during the later transformation;
2) Write down hash table status next to each basic block (assume a scoped hash table is used);
3) Write down the transformed EBB after removing the redundancies.

Solution:

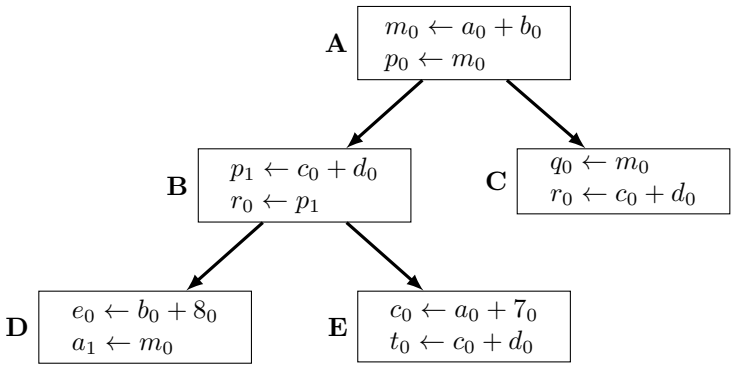
Solution 1.1) Adding version numbers



Solution 1.2) Adding a hash table status next to each basic block. Also applying Value Numbering.

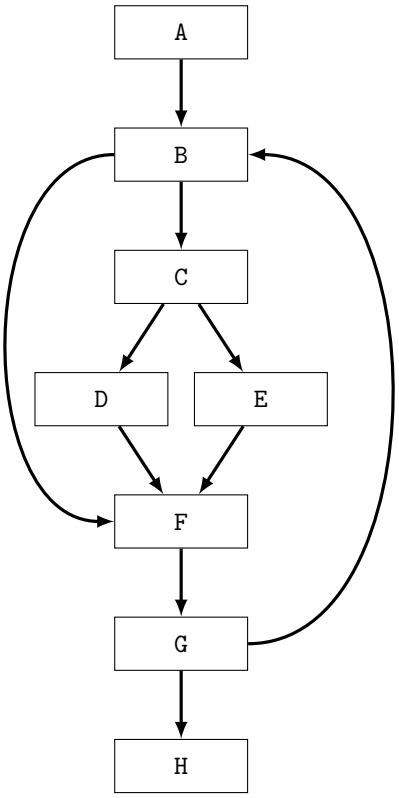


Solution 1.3) Writing down transformed EBB after removing redundancies



Problem 2: Consider the following control flow graph (CFG) and answer the following questions.

1. Find all the EBBs in the CFG;
2. Check if any of the following block sets (and their associated edges) may form a region:
   a) $\{B, C, D\}$
   b) $\{B, C, D, E\}$
   c) $\{C, D, E, F\}$
   d) $\{B, C, D, E, F, G\}$
3. Find the dominator set for each basic block;
4. Build the dominance tree for the CFG;



Solution:

Solution 1.1) Finding all the EBBs in the CFG

$EBB_1 = \{A\}$

$EBB_2 = \{B, C, D, E\}$

$EBB_3 = \{F, G, H\}$

Solution 1.2) Check if block sets form a region

a) $\{B, C, D\}$ - Yes

b) $\{B, C, D, E\}$ - Yes

c) $\{C, D, E, F\}$ - No, because C does not dominate F. F also cannot reach any nodes C, D, E without going through C.

d) $\{B, C, D, E, F, G\}$ - Yes

Solution 1.3) Find the dominator set for each basic block

Block	Dominator Set	Immediate Dominator
A	$\{A\}$	$-$
B	$\{A, B\}$	A
C	$\{A, B, C\}$	B
D	$\{A, B, C, D\}$	C
E	$\{A, B, C, E\}$	C
F	$\{A, B, F\}$	B
G	$\{A, B, F, G\}$	F
H	$\{A, B, F, G, H\}$	G

Solution 1.4) Build the dominance tree for the CFG