Assignment 1

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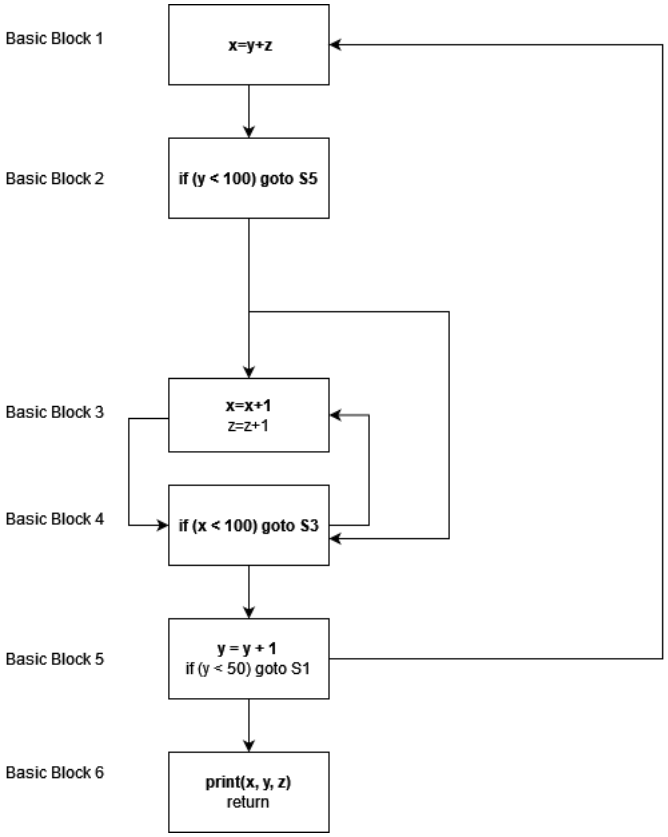
1 Control Flow Graph

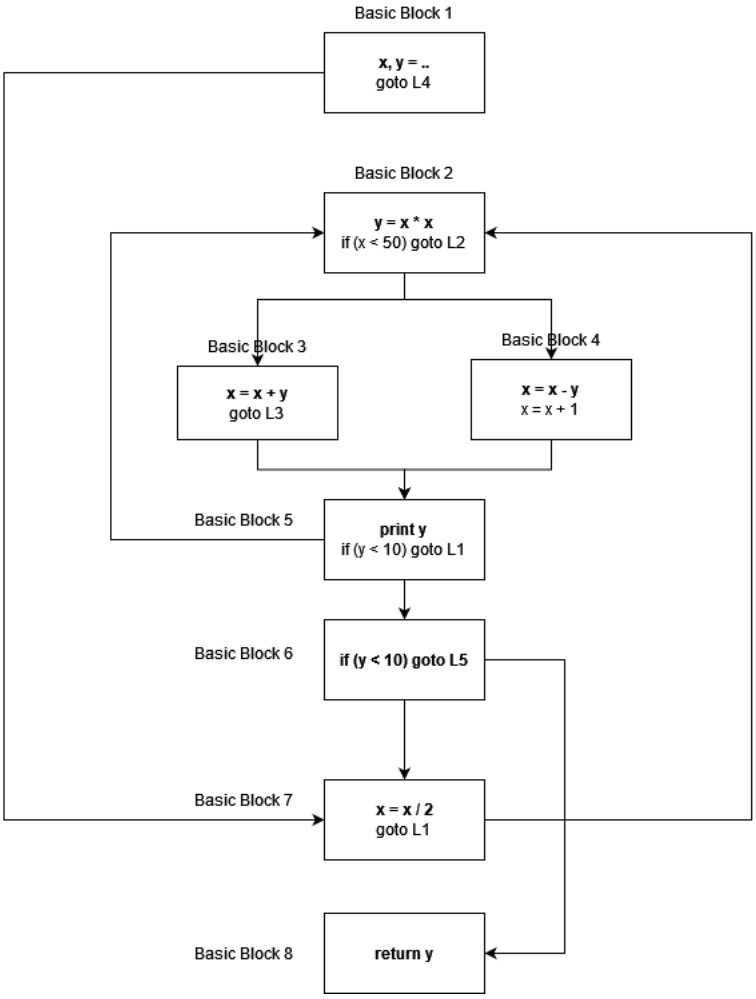
1. 

   Leader Instruction are in **bold**

2. There are two back edge in the above CFG the edge from:
   Basic Block 4 → Basic Block 3
   Basic Block 5 → Basic Block 1

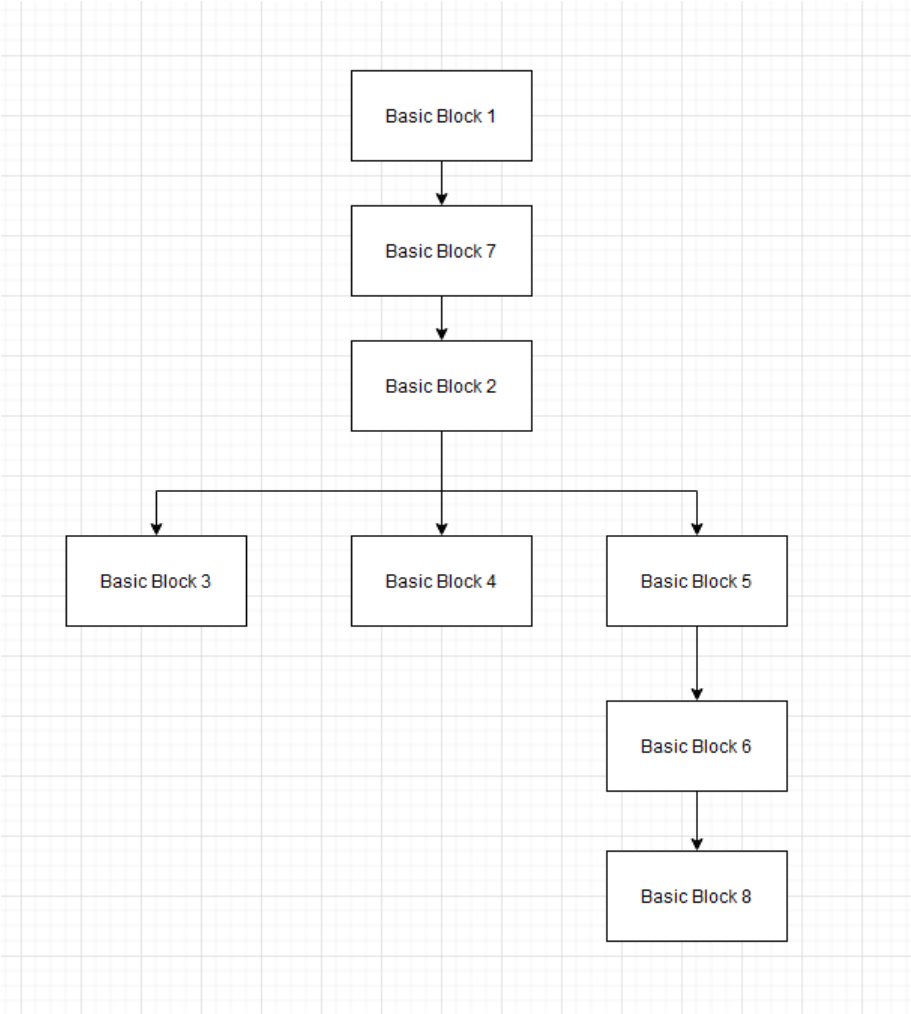
2 Natural Loops

2.1 Basic Blocks/CFG



Leader Instruction are in **bold**

2.2 Dominator Tree



2.3 Back Edges

There are two back edge in the above CFG the edge from:
Basic Block 7 → Basic Block 2
Basic Block 5 → Basic Block 2

3 Available Expression

The meet operator is the set intersection operator or ∩. The reason is that available expression is defined if **every** path from entry to p evaluates $x \bigoplus y$. The

intersection operator ensures every predecessor to the current node evaluates $x \bigoplus y$.

Table 1: Avaliable expression

BB	**GEN**	**KILL**	**IN**	**OUT**
1	$\{\}$	$\{a+b, c-a, b+d, b*d, a-d\}$	$\{\}$	$\{\}$
2	$\{a+b, c-a\}$	$\{b+d, a-d\}$	$\{\}$	$\{a+b, c-a\}$
3	$\{b+d\}$	$\{a-d, b*d\}$	$\{a+b\}$	$\{b+d, a+b\}$
4	$\{a+b\}$	$\{a-d, b*d, b+d\}$	$\{b+d, a+b\}$	$\{\ a+b\ \}$
5	$\{c-a\}$	$\{a+b, b+d, b*d\}$	$\{a+b, c-a\}$	$\{\ c-a\ \}$
6	$\{a-d\}$	$\{a+b, c-a, b+d, b*d\}$	$\{\ c-a\ \}$	$\{a-d\}$