



Intermediate Code Generation

Basic Blocks

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Basic Blocks

- How to Split Code into Basic Blocks?
 - Identify "head" instructions, or *leaders* of the basic blocks
 - Jumps (the instruction after) and Targets of jump are possible points of control-flow divergence
 - "Move forward" to next "header" instruction
 - Repeat until all headers and subsequent sequential instructions are identified





Basic Blocks

• Maximal sequence of instructions with the property:

If first instruction is executed, then all subsequent instructions are also executed

- Why is this Important?
 - Basis of Program Reasoning a single control-flow thread.
 - Locus of Opportunity for Analysis and Transformations.
- How to Identify the Basic Blocks?





Algorithm for Identifying Basic Blocks

- Idea: Identify Leader or Header of Basic Blocks
 - The instruction that initiates the execution of a basic block
 - Where control-flow may diverge or converge define end of a basic block
 - Block: all instructions between leader and the next leader (excluding it)

- The first instruction in the code is a leader;
- Any instruction target of a jump (conditional or unconditional) is a leader;
- Any instruction that immediately follows a jump is a leader;
- Repeatedly scans instructions until no additional leaders can be identified;
- Scan instructions from each leader to the next to identify basic blocks;





```
01: i = 1
02: j = 1
03: t1 = 10 * i
04: t2 = t1 + j
05: t3 = 8 * 12
06: t4 = t3 - 8
07: M[t4] = 0
08: j = j + 1
09: if j \le 10 goto 03
10: i = i + 1
11: if j \le 10 goto 02
12: i = 1
13: t5 = i - 1
14: t6 = 8 * t5
15: M[t6] = 1
16: i = i + 1
17: if i <= 10 goto 13
18: j = 1
19:
    i = j + 2
20:
     return i
```





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BB4

<u>if j <= 10 goto 02</u>

BB5

BB6

t6 = 8 * t5

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if i <= 10 goto 13

BB7

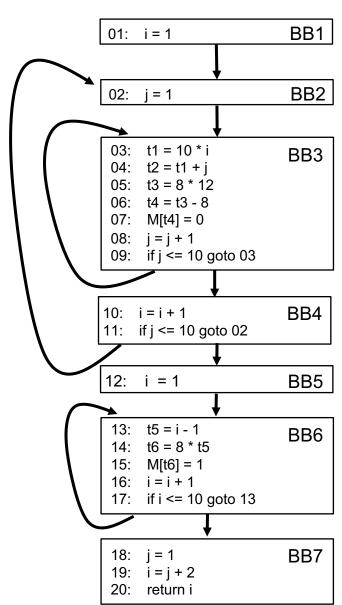
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Understanding which BBs reach which other BBs

Locus of Opportunity for Analysis and Transformations.

Data-Flow is "easy" to understand. Why?

Control-Flow and data-Flow Analysis Later