Control Flow Graphs
what’s a control flow graph?

• A directed graph $G = (V, E)$ where:
  • $V$ (vertices) are the basic blocks in the program
  • $E$ (edges) are control flow edges between basic blocks

• A control flow edge shows that execution may proceed along that edge
  • It is possible (though not always guaranteed) that a program’s execution can go from the source of the edge directly to the target of the edge

```
ADD t7, t1, t2
Lab1:
  ADD t9, t1, t3
  SUB t2, t7, t9
  BNE t2, t1 Lab1
  ADD t2, t4, t7
```
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adding control flow edges

- There is a directed edge from $B_1$ to $B_2$ if
  - There is a branch from the last statement of $B_1$ to the first statement (leader) of $B_2$
  - $B_2$ immediately follows $B_1$ in program order and $B_1$ does not end with an unconditional branch
- Input: block, a sequence of basic blocks
- Output: The CFG

```plaintext
for i = 1 to |block|
  x = last statement of block(i)
  if stat(x) is a branch, then
    for each explicit target $y$ of stat(x)
      create edge from block $i$ to block $y$
    end for
  end if
  if stat(x) is not unconditional branch, then
    create edge from block $i$ to block $i+1$
  end if
end for
```
A = 4

t1 = A * B

L1: t2 = t1 / C

if t2 < W goto L2

M = t1 * k

t3 = M + I

L2: H = I

M = t3 - H

if t3 ≥ 0 goto L3

goto L1

L3: halt
A = 4

\[ t_1 = A \times B \]

\[ t_2 = t_1 / C \]

\[ \text{if } t_2 < W \text{ goto L2} \]

\[ M = t_1 \times k \]

\[ t_3 = M + I \]

\[ H = I \]

\[ M = t_3 - H \]

\[ \text{if } t_3 \geq 0 \text{ goto L3} \]

\[ \text{goto L1} \]

\[ \text{L3: halt} \]