Constant Propagation

Domain: $V \times D$ where V = "set of all variables" and D = "set of all possible values" (e.g. $\mathbb{Z}$ if variables are all of integer type)

Direction: Forward

Meet Operator: $\wedge$

$$\begin{cases} out[b] = f_b(in[b]) \\ in[b] = \bigwedge_{p \in pred(b)} out[p] \end{cases}$$

Transfer Function: $f_b(x) = Gen[b] \cup (X \setminus Kill[b])$

Boundary Condition: $out[entry] = \varnothing$

Initial interior points: $out[b] = U$

For each instruction i of the form

$$lhs \leftarrow g(op_1, op_2, \ldots, op_n) \text{ where } g : (V \cup D)^n \to D,\ n \in \mathbb{N}$$

we have

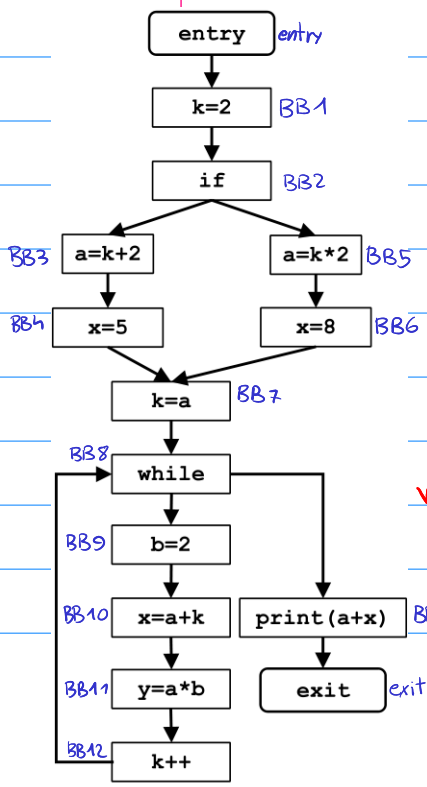
$$Kill[i] = \{(var, val) \in in[i] \mid var = lhs\}$$

"any known value for variable lhs"

and

$$Gen[i] = \begin{cases} \{(lhs, f(op_1, op_2, \ldots, op_n))\} & \text{if } \forall j=1..n, \text{ either } op_j \in D \\ & \text{or } \exists (var, val) \in in[i] \mid op_j = var \\ \varnothing & \text{otherwise} \end{cases}$$

"every operand is either a literal or a variable with known constant value"



	Iteration 1		Iteration 2		Iteration 3
b	IN[b]	OUT[b]	IN[b]	OUT[b]	
entry		∅		∅	
1	∅	k=2	∅	k=2	
2	k=2	k=2	k=2	k=2	
3	k=2	a=4,k=2	k=2	a=4,k=2	
4	a=4,k=2	a=4,k=2,x=5	a=4,k=2	a=4,k=2,x=5	
5	k=2	a=4,k=2	k=2	a=4,k=2	
6	a=4,k=2	a=4,k=2,x=8	a=4,k=2	a=4,k=2,x=8	
7	a=4,k=2	a=4,k=4	a=4,k=4	a=4,k=4	Unchanged
while 8	a=4,k=4	a=4,k=4	a=4	a=4	
9	a=4,k=4	a=4,k=4,b=2	a=4	a=4,b=2	
10	a=4,k=4,b=2	a=4,k=4,b=2,x=8	a=4,b=2	a=4,b=2	
11	a=4,k=4,b=2,x=8	a=4,k=4,b=2,x=8,y=8	a=4,b=2	a=4,b=2,y=8	
12	a=4,k=4,b=2,x=8,y=8	a=4,k=5,b=2,x=8,y=8	a=4,b=2,y=8	a=4,b=2,y=8	
13	a=4,k=4	a=4,k=4	a=4	a=4	
exit	a=4,k=4		a=4		