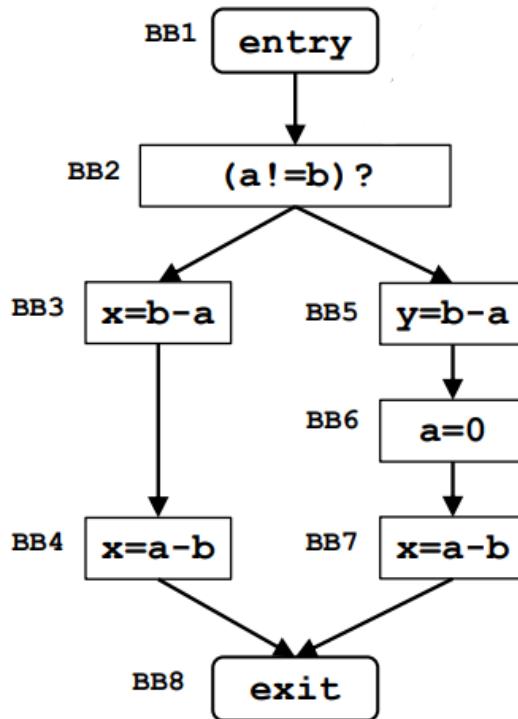


# Very Busy Expression



	Framework VBE
Domain	$D = \{b - a, a - b, a \neq b\}$
Direction	Backward: $\text{IN}_B = f_b(\text{OUT}_B)$ $\text{OUT}_B = \wedge \text{IN}(\text{succ}_B)$
Transfer Function	$f_b(x) = \text{Gen}_B \cup (x - \text{Kill}_B)$
Meet Operator	Intersezione $\cap$
Boundary Condition	$\text{OUT}[Exit] = \emptyset$
Initial Interior Points	$\text{IN}_B = \mathcal{U}$

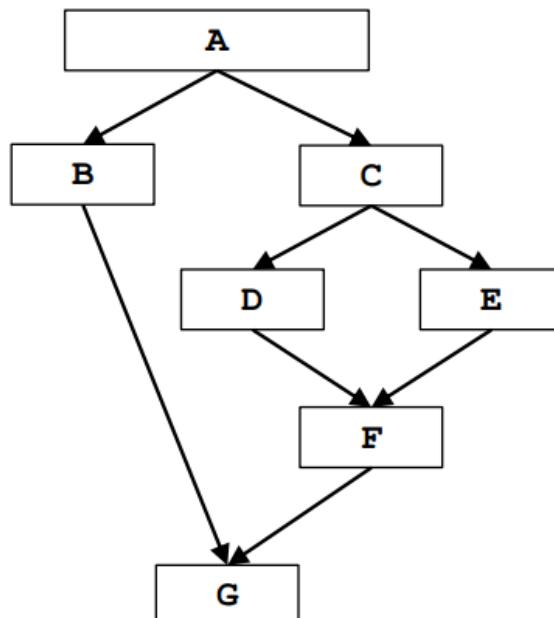
	$\text{IN}_B$	$\text{OUT}_B$
BB1	$a \neq b, b - a$	$a \neq b, b - a$
BB2	$a \neq b, b - a$	$b - a$
BB3	$b - a, a - b$	$a - b$
BB4	$a - b$	$\emptyset$
BB5	$b - a$	$\emptyset$

	$\text{IN}_B$	$\text{OUT}_B$
BB6	$\emptyset$	$a - b$
BB7	$a - b$	$\emptyset$
BB8	$\emptyset$	$\emptyset$

Perciò possiamo dire che le VBE di questo pezzo di codice sono  $a \neq b$  e  $b - a$ , poiché vengono valutate almeno una volta prima di essere ridefinite.

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## Dominator Analysis



$$\text{DOM}[F] = \{A, C, F\}$$

	Framework Dominators
Domain	$D = \{A, B, C, D, E, F, G\}$
Direction	Forward: $\text{OUT}_B = f_b(\text{IN}_B)$ $\text{IN}_B = \wedge \text{OUT}(\text{pred}_B)$
Transfer Function	$f_b(x) = B \cup x$
Meet Operator	Intersezione $\cap$
Boundary Condition	$\text{OUT}_A = A$

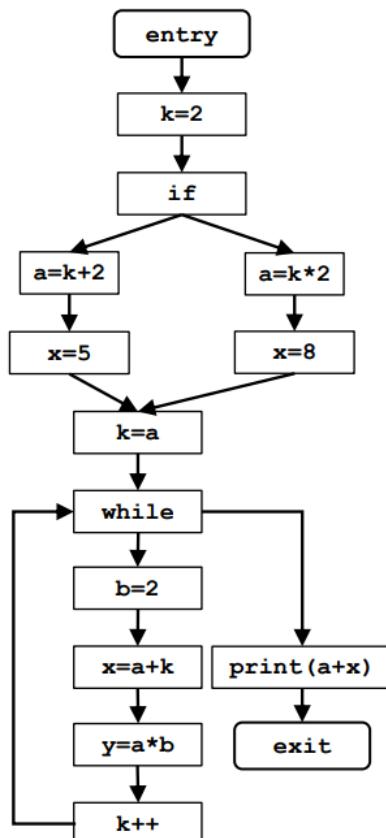
	Framework Dominators
Initial Interior Points	$\text{OUT}_B = U$

	$\text{IN}_B$	$\text{OUT}_B$
A	$\emptyset$	$A$
B	$A$	$B, A$
C	$A$	$C, A$
D	$C, A$	$D, C, A$
E	$C, A$	$E, C, A$
F	$C, A$	$F, C, A$
G	$A$	$G, A$

NOTA: la boundary condition serve posta così poiché l'intersezione di un insieme vuoto NON è un insieme vuoto.

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## Constant Propagation



	<b>Framework CP</b>
Domain	$D = \{[x, c]\}$ dove $[x, c]$ sono le coppie
Direction	Forward: $\text{OUT}_B = f_b(\text{IN}_B)$ $\text{IN}_B = \wedge \text{OUT}(\text{pred}_B)$
Transfer Function	$f_b(x) = \text{Gen}_B \cup (x - \text{Kill}_B)$
Meet Operator	Intersezione $\cap$
Boundary Condition	$\text{OUT}[Entry] = \emptyset$
Initial Interior Points	$\text{OUT}_B = \mathcal{U}$

<b>BB</b>	<b>I1</b>	<b>I2</b>
	$\text{IN}_B$	$\text{OUT}_B$
Entry	$\emptyset$	$\emptyset$
$k=2$	$\emptyset$	$[k, 2]$
if	$[k, 2]$	$[k, 2]$
$a=k+2$	$[k, 2]$	$[k, 2][a, 4]$
$x=5$	$[k, 2][a, 4]$	$[k, 2][a, 4][x, 5]$
$a=k^2$	$[k, 2]$	$[k, 2][a, 4]$
$x=8$	$[k, 2][a, 4]$	$[k, 2][a, 4][x, 8]$
$k=a$	$[k, 2][a, 4]$	$[a, 4][k, 4]$
while	$[a, 4][k, 4]$	$[a, 4][k, 4]$
$b=2$	$[a, 4][k, 4]$	$[a, 4][k, 4][b, 2]$
$x=a+k$	$[a, 4][k, 4][b, 2]$	$[a, 4][k, 4][b, 2][x, 8]$
$y=a*b$	$[a, 4][k, 4][b, 2][x, 8]$	$[a, 4][k, 4][b, 2][x, 8][y, 8]$
$k++$	$[a, 4][k, 4][b, 2][x, 8][y, 8]$	$[a, 4][b, 2][x, 8][y, 8][k, 5]$
print( $a+x$ )	$[a, 4][k, 4]$	$[a, 4][k, 4]$
Exit	$[a, 4][k, 4]$	$[a, 4][k, 4]$

<b>BB</b>	<b>I2</b>	<b>I2</b>
	$\text{In}_B$	$\text{Out}_B$

<b>BB</b>	<b>I2</b>	<b>I2</b>
Entry	$\emptyset$	$\emptyset$
k=2	$\emptyset$	$[k, 2]$
if	$[k, 2]$	$[k, 2]$
a=k+2	$[k, 2]$	$[k, 2][a, 4]$
x=5	$[k, 2][a, 4]$	$[k, 2][a, 4][x, 5]$
a=k*2	$[k, 2]$	$[k, 2][a, 4]$
x=8	$[k, 2][a, 4]$	$[k, 2][a, 4][x, 8]$
k=a	$[k, 2][a, 4]$	$[a, 4][k, 4]$
while	$[a, 4]$	$[a, 4]$
b=2	$[a, 4]$	$[a, 4][b, 2]$
x=a+k	$[a, 4][b, 2]$	$[a, 4][b, 2]$
y=a*b	$[a, 4][b, 2]$	$[a, 4][b, 2][y, 8]$
k++	$[a, 4][b, 2][y, 8]$	$[a, 4][b, 2][y, 8]$
print(a+x)	$[a, 4]$	$[a, 4]$
Exit	$[a, 4]$	$[a, 4]$

Dalla terza in poi le iterazioni convergono.