

Very Busy Expression	
Domain	L'insieme delle espressioni
Direction	Backward $in[b] = f_b(out[b])$ $out[b] = \wedge in[succ(b)]$
Transfer function	$f_b(x) = Gen_b \cup (x - Kill_b)$
Meet operation	\cap
Boundary condition	$in[exit] = \emptyset$
Initial interior points	$in[b] = u$ (universal set)

	GEN[]	KILL[]
BB1	\emptyset	\emptyset
BB2	\emptyset	\emptyset
BB3	b-a	\emptyset
BB4	a-b	\emptyset
BB5	b-a	\emptyset
BB6	\emptyset	a-b
BB7	a-b	\emptyset
BB8	\emptyset	\emptyset

	IN	OUT
BB1	$\emptyset \cup (\{b-a\} - \emptyset) = \{b-a\}$	$\{b-a\}$
BB2	$\emptyset \cup (\{b-a\} - \emptyset) = \{b-a\}$	$\{b-a, a-b\} \cap \{b-a\} = \{b-a\}$
BB3	$\{b-a\} \cup (\{a-b\} - \emptyset) = \{b-a, a-b\}$	$\{a-b\}$
BB4	$\{a-b\} \cup (\emptyset - \emptyset) = \{a-b\}$	\emptyset
BB5	$\{b-a\} \cup (\emptyset - \emptyset) = \{b-a\}$	\emptyset
BB6	$\emptyset \cup (\{a-b\} - \{a-b\}) = \emptyset$	$\{a-b\}$
BB7	$\{a-b\} \cup (\emptyset - \emptyset) = \{a-b\}$	\emptyset
BB8	\emptyset	\emptyset

Dominator Analys	
Domain	L'insieme dei blocchi
Direction	Forward $out[b] = f_b(in[b])$ $in[b] = \wedge out[pred(b)]$
Transfer function	$f_b(x) = Gen_b \cup (x - Kill_b)$
Meet operation	\cap
Boundary condition	$out[entry] = \emptyset$
Initial interior points	$out[b] = u$ (universal set)

$GEN[b] = B$ (ogni blocco genera se stesso)

$KILL[b] = \emptyset$ (non sono presenti operazioni di kill)

	IN	OUT
A	\emptyset	$A \cup (\emptyset - \emptyset) = \{A\}$
B	A	$B \cup (A - \emptyset) = \{A, B\}$
C	A	$C \cup (A - \emptyset) = \{A, C\}$
D	$\{A, C\}$	$D \cup (\{A, C\} - \emptyset) = \{A, C, D\}$
E	$\{A, C\}$	$E \cup (\{A, C\} - \emptyset) = \{A, C, E\}$
F	$\{A, C, D\} \cap \{A, C, E\} = \{A, C\}$	$F \cup (\{A, C\} - \emptyset) = \{A, C, F\}$
G	$\{A, B\} \cap \{A, C, F\} = \{A\}$	$G \cup (A - \emptyset) = \{A, G\}$

Constant Propagation	
Domain	L'insieme delle coppie <variabile, valore costante>
Direction	Forward $out[b] = f_b(in[b])$ $in[b] = \wedge out[pred(b)]$
Transfer function	$f_b(x) = Gen_b \cup (x - Kill_b)$
Meet operation	\cap
Boundary condition	$out[entry] = \emptyset$
Initial interior points	$out[b] = u$ (universal set)

	GEN[]	KILL[]
BB1 (entry)	\emptyset	\emptyset
BB2	$\langle k, 2 \rangle$	\emptyset
BB3 (if)	\emptyset	\emptyset
BB4	$\langle a, 4 \rangle$	\emptyset
BB5	$\langle x, 5 \rangle$	\emptyset
BB6	$\langle a, 4 \rangle$	\emptyset
BB7	$\langle x, 8 \rangle$	\emptyset
BB8	$\langle k, 4 \rangle$	$\langle k, 2 \rangle$
BB9 (while)	\emptyset	\emptyset
BB10	$\langle b, 2 \rangle$	\emptyset
BB11	$\langle x, 8 \rangle$	\emptyset
BB12	$\langle y, 8 \rangle$	\emptyset
BB13	$\langle k, 5 \rangle$	$\langle k, 4 \rangle$
BB14	\emptyset	\emptyset
BB15	\emptyset	\emptyset

ITER 1

	IN	OUT
BB1 (entry)	\emptyset	\emptyset
BB2	\emptyset	$\langle k, 2 \rangle \cup (\emptyset - \emptyset) = \langle k, 2 \rangle$
BB3 (if)	$\langle k, 2 \rangle$	$\emptyset \cup (\langle k, 2 \rangle - \emptyset) = \langle k, 2 \rangle$
BB4	$\langle k, 2 \rangle$	$\langle a, 4 \rangle \cup (\langle k, 2 \rangle - \emptyset) = \langle a, 4 \rangle, \langle k, 2 \rangle$
BB5	$\langle a, 4 \rangle, \langle k, 2 \rangle$	$\langle x, 5 \rangle \cup (\langle a, 4 \rangle, \langle k, 2 \rangle - \emptyset) = \langle x, 5 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle$
BB6	$\langle k, 2 \rangle$	$\langle a, 4 \rangle \cup (\langle k, 2 \rangle - \emptyset) = \langle a, 4 \rangle, \langle k, 2 \rangle$
BB7	$\langle a, 4 \rangle, \langle k, 2 \rangle$	$\langle x, 8 \rangle \cup (\langle a, 4 \rangle, \langle k, 2 \rangle - \emptyset) = \langle x, 8 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle$
BB8	$\langle x, 5 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle \cap \langle x, 8 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle = \langle a, 4 \rangle, \langle k, 2 \rangle$	$\langle k, 4 \rangle \cup (\langle a, 4 \rangle, \langle k, 2 \rangle - \langle k, 2 \rangle) = \langle k, 4 \rangle, \langle a, 4 \rangle$
BB9 (while)	$\langle k, 4 \rangle, \langle a, 4 \rangle$	$\emptyset \cup (\langle k, 4 \rangle, \langle a, 4 \rangle - \emptyset) = \langle k, 4 \rangle, \langle a, 4 \rangle$
BB10	$\langle k, 4 \rangle, \langle a, 4 \rangle$	$\langle b, 2 \rangle \cup (\langle k, 4 \rangle, \langle a, 4 \rangle - \emptyset) = \langle k, 4 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle$
BB11	$\langle k, 4 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle$	$\langle x, 8 \rangle \cup (\langle k, 4 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle - \emptyset) = \langle x, 8 \rangle, \langle k, 4 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle$
BB12	$\langle x, 8 \rangle, \langle k, 4 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle$	$\langle y, 8 \rangle \cup (\langle x, 8 \rangle, \langle k, 4 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle - \emptyset) = \langle x, 8 \rangle, \langle k, 4 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle$
BB13	$\langle x, 8 \rangle, \langle k, 4 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle$	$\langle k, 5 \rangle \cup (\langle x, 8 \rangle, \langle k, 4 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle - \langle k, 4 \rangle) = \langle x, 8 \rangle, \langle k, 5 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle$
BB14	$\langle k, 4 \rangle, \langle a, 4 \rangle$	$\emptyset \cup (\langle k, 4 \rangle, \langle a, 4 \rangle - \emptyset) = \langle k, 4 \rangle, \langle a, 4 \rangle$
BB15	$\langle k, 4 \rangle, \langle a, 4 \rangle$	$\langle k, 4 \rangle, \langle a, 4 \rangle$

ITER 2

	IN	OUT
BB1 (entry)	\emptyset	\emptyset
BB2	\emptyset	$\langle k, 2 \rangle \cup (\emptyset - \emptyset) = \langle k, 2 \rangle$
BB3 (if)	$\langle k, 2 \rangle$	$\emptyset \cup (\langle k, 2 \rangle - \emptyset) = \langle k, 2 \rangle$
BB4	$\langle k, 2 \rangle$	$\langle a, 4 \rangle \cup (\langle k, 2 \rangle - \emptyset) = \langle a, 4 \rangle, \langle k, 2 \rangle$
BB5	$\langle a, 4 \rangle, \langle k, 2 \rangle$	$\langle x, 5 \rangle \cup (\langle a, 4 \rangle, \langle k, 2 \rangle - \emptyset) = \langle x, 5 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle$
BB6	$\langle k, 2 \rangle$	$\langle a, 4 \rangle \cup (\langle k, 2 \rangle - \emptyset) = \langle a, 4 \rangle, \langle k, 2 \rangle$
BB7	$\langle a, 4 \rangle, \langle k, 2 \rangle$	$\langle x, 8 \rangle \cup (\langle a, 4 \rangle, \langle k, 2 \rangle - \emptyset) = \langle x, 8 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle$
BB8	$\langle x, 5 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle \cap \langle x, 8 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle = \langle a, 4 \rangle, \langle k, 2 \rangle$	$\langle k, 4 \rangle \cup (\langle a, 4 \rangle, \langle k, 2 \rangle - \langle k, 2 \rangle) = \langle k, 4 \rangle, \langle a, 4 \rangle$
BB9 (while)	$\langle k, 4 \rangle, \langle a, 4 \rangle \cap \langle x, 8 \rangle, \langle k, 5 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle = \langle a, 4 \rangle$	$\emptyset \cup (\langle a, 4 \rangle - \emptyset) = \langle a, 4 \rangle$
BB10	$\langle a, 4 \rangle$	$\langle b, 2 \rangle \cup (\langle a, 4 \rangle - \emptyset) = \langle a, 4 \rangle, \langle b, 2 \rangle$
BB11	$\langle a, 4 \rangle, \langle b, 2 \rangle$	$\langle x, 9 \rangle \cup (\langle a, 4 \rangle, \langle b, 2 \rangle - \emptyset) = \langle x, 9 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle$
BB12	$\langle x, 9 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle$	$\langle y, 8 \rangle \cup (\langle x, 9 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle - \emptyset) = \langle x, 9 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle$
BB13	$\langle x, 9 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle$	$\langle k, 6 \rangle \cup (\langle x, 9 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle - \langle k, 5 \rangle) = \langle x, 9 \rangle, \langle k, 6 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle$
BB14	$\langle a, 4 \rangle$	$\emptyset \cup (\langle a, 4 \rangle - \emptyset) = \langle a, 4 \rangle$
BB15	$\langle a, 4 \rangle$	$\langle a, 4 \rangle$

ITER 3

	IN	OUT
BB1 (entry)	\emptyset	\emptyset
BB2	\emptyset	$\langle k, 2 \rangle \cup (\emptyset - \emptyset) = \langle k, 2 \rangle$
BB3 (if)	$\langle k, 2 \rangle$	$\emptyset \cup (\langle k, 2 \rangle - \emptyset) = \langle k, 2 \rangle$
BB4	$\langle k, 2 \rangle$	$\langle a, 4 \rangle \cup (\langle k, 2 \rangle - \emptyset) = \langle a, 4 \rangle, \langle k, 2 \rangle$
BB5	$\langle a, 4 \rangle, \langle k, 2 \rangle$	$\langle x, 5 \rangle \cup (\langle a, 4 \rangle, \langle k, 2 \rangle - \emptyset) = \langle x, 5 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle$
BB6	$\langle k, 2 \rangle$	$\langle a, 4 \rangle \cup (\langle k, 2 \rangle - \emptyset) = \langle a, 4 \rangle, \langle k, 2 \rangle$
BB7	$\langle a, 4 \rangle, \langle k, 2 \rangle$	$\langle x, 8 \rangle \cup (\langle a, 4 \rangle, \langle k, 2 \rangle - \emptyset) = \langle x, 8 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle$
BB8	$\langle x, 5 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle \cap \langle x, 8 \rangle, \langle a, 4 \rangle, \langle k, 2 \rangle = \langle a, 4 \rangle, \langle k, 2 \rangle$	$\langle k, 4 \rangle \cup (\langle a, 4 \rangle, \langle k, 2 \rangle - \langle k, 2 \rangle) = \langle k, 4 \rangle, \langle a, 4 \rangle$
BB9 (while)	$\langle k, 4 \rangle, \langle a, 4 \rangle \cap \langle x, 9 \rangle, \langle k, 6 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle = \langle a, 4 \rangle$	$\emptyset \cup (\langle a, 4 \rangle - \emptyset) = \langle a, 4 \rangle$
BB10	$\langle a, 4 \rangle$	$\langle b, 2 \rangle \cup (\langle a, 4 \rangle - \emptyset) = \langle a, 4 \rangle, \langle b, 2 \rangle$
BB11	$\langle a, 4 \rangle, \langle b, 2 \rangle$	$\langle x, 10 \rangle \cup (\langle a, 4 \rangle, \langle b, 2 \rangle - \emptyset) = \langle x, 10 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle$
BB12	$\langle x, 10 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle$	$\langle y, 8 \rangle \cup (\langle x, 10 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle - \emptyset) = \langle x, 10 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle$
BB13	$\langle x, 10 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle$	$\langle k, 7 \rangle \cup (\langle x, 10 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle - \langle k, 6 \rangle) = \langle x, 10 \rangle, \langle k, 7 \rangle, \langle a, 4 \rangle, \langle b, 2 \rangle, \langle y, 8 \rangle$
BB14	$\langle a, 4 \rangle$	$\emptyset \cup (\langle a, 4 \rangle - \emptyset) = \langle a, 4 \rangle$
BB15	$\langle a, 4 \rangle$	$\langle a, 4 \rangle$