Compilatori, Gruppo 10 – Assignment 2
Manuele Baracchi, Francesca Neri, Emanuele Ugolotti
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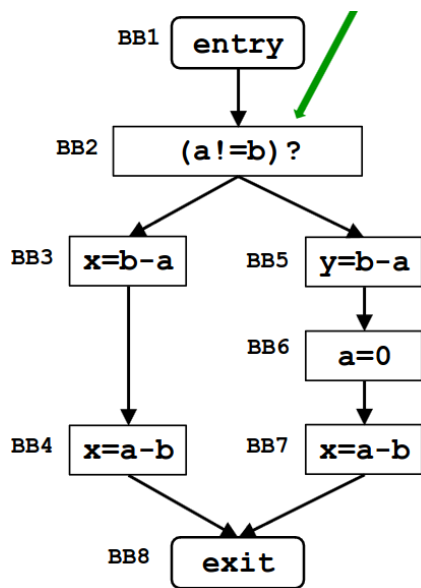
Contents

Problem 1: Very Busy Expressions

	Dataflow problem 1
Domain	Espressioni
Direction	Backward IN[b] = f_b(OUT[b]) OUT[b] = ^IN[succ(b)]
Transfer function	$\text{Gen}(b) \cup (\text{OUT}[b] - \text{Kill}[b])$
Meet operator	∩, Intersezione
Boundary condition	IN[Exit] = $\emptyset$
Initial Interior points	IN[b] = U

	GEN	KILL
BB1	/	/
BB2	/	/
BB3	x	BB4, BB7
BB4	x	BB3, BB7
BB5	y	/
BB6	a	/
BB7	x	BB3, BB4
BB8	/	/

Table 1: Tabella GEN/KILL

|	Prima iterazione		Seconda iterazione	
	IN[BB]	**OUT[BB]**	**IN[BB]**	**OUT[BB]**
BB8	$\emptyset$	$\emptyset$	$\emptyset \cup ((a-b) - \emptyset) =$ $(a-b)$	$\emptyset$
BB7	$\emptyset$	$(a-b)$	$(a-b) \cup (\emptyset - x) * (a-b)$ NC	$(a-b)$
BB6	$\emptyset$	$(a-b)$	$\emptyset \cup ((a-b) - (a-b)(b-a)) =$ $\emptyset$ NC	$(a-b)$
BB5	$\emptyset$	$(b-a)$	$(b-a) \cup (\emptyset - y) =$ $(b-a)$	$\emptyset$
BB4	$\emptyset$	$(a-b)$	$(b-a) \cup (\emptyset - (b-a)(a-b))$ $= (a)(b-a)$	
BB3	$\emptyset$	$(b-a)$	$b-a \cup (b-a-x) =$ $(b-a)$	$(b-a)$
BB2	$\emptyset$	$(a \neq b)$	$a \neq b \cup (a \neq b - \emptyset) =$ $a \neq b$	$(a \neq b)$
BB1	$\emptyset$	$\emptyset$		

Figure 3: Tabella Iterazioni

Problem 2: Dominator Analysis
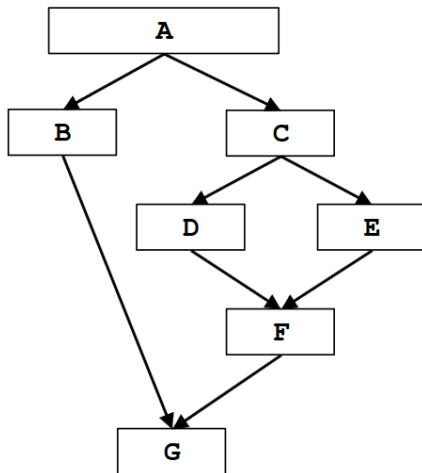
	Dataflow problem 2
Domain	Blocchi
Direction	Forward OUT[b]= $f_b(\text{IN}[b])$ IN[b] = $\wedge$ OUT[pred(b)]
Transfer function	$f_b(x) = \{b\} \cup x$
Meet operator	$\cap$
Boundary condition	OUT[Entry] = Entry
Initial Interior points	OUT[b]= U

	IN[B]	**OUT[B]**
A	/	{A}
B	OUT[A]={A}	$\{B\} \cup \text{IN}[B] =$ $\{B\} \cup \{A\} = \{A,B\}$
C	OUT[A]={A}	$\{C\} \cup \text{IN}[C] =$ $\{C\} \cup \{A\} = \{A,C\}$
D	OUT[C]={A,C}	$\{D\} \cup \text{IN}[D] =$ $\{D\} \cup \{A, C\} = \{A,C,D\}$
E	OUT[C]={A,C}	$\{E\} \cup \text{IN}[E] =$ $\{E\} \cup \{A, C\} = \{A,C,E\}$
F	OUT[D] $\cap$ OUT[E] = {A,C,D} $\cap$ {A,C,E} = {A,C}	$\{F\} \cup \text{IN}[F] =$ $\{F\} \cup \{A, C\} = \{A,C,F\}$
G	OUT[B] $\cap$ OUT[F] = {A,B} $\cap$ {A,C,F} = {A}	$\{G\} \cup \text{IN}[G] =$ $\{G\} \cup \{A\} = \{A,G\}$

Table 2: Tabella Iterazioni

Problem 3: Constant Propagation
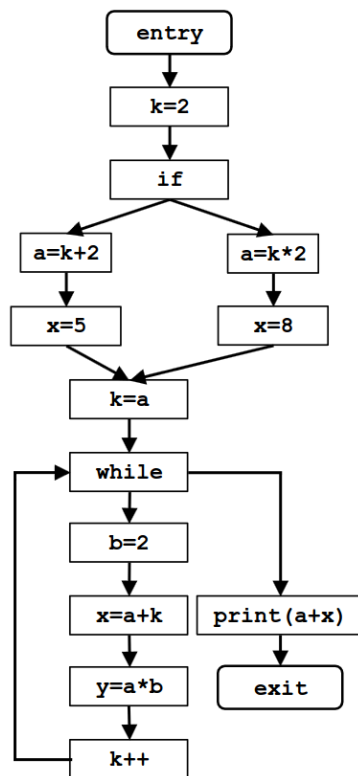
	Dataflow problem 3
Domain	Insieme di coppie <Variabile, Valore>
Direction	Forward OUT[b] = f_b(IN[b]) IN[b] = ($\wedge$ OUT[pred(b)])
Transfer function	$f_b(x) = \text{Gen}_b \cup (x - \text{Kill}_b)$
Meet operator	$\cap$, Intersezione
Boundary condition	OUT[entry]=$\emptyset$
Initial Interior points	OUT[b]=U

	GEN	KILL
BB1	k	BB7, BB12
BB2	/	/
BB3	a	BB5
BB4	x	BB6, BB10
BB5	a	BB3
BB6	x	BB4, BB10
BB7	k	BB1, BB12
BB8	/	/
BB9	b	/
BB10	x	BB4, BB6
BB11	y	/
BB12	k	BB7, BB1
BB13	/	/

Table 3: Tabella GEN/KILL

	Prima iterazione		Seconda iterazione	
	IN[BB]	**OUT[BB]**	**IN[BB]**	**OUT[BB]**
BB1	OUT[entry]	$\{(k,2)\}$	OUT[entry]	$\{(k,2)\}$
BB2	OUT[BB1]	$\{(k,2)\}$	OUT[BB1]	$\{(k,2)\}$
BB3	OUT[BB2]	$\{(a,4),(k,2)\}$	OUT[BB2]	$\{(a,4),(k,2)\}$
BB4	OUT[BB3]	$\{(x,5),(a,4),(k,2)\}$	OUT[BB3]	$\{(x,5),(a,4),(k,2)\}$
BB5	OUT[BB2]	$\{(a,4),(k,2)\}$	OUT[BB2]	$\{(a,4),(k,2)\}$
BB6	OUT[BB5]	$\{(x,8),(a,4),(k,2)\}$	OUT[BB5]	$\{(x,8),(a,4),(k,2)\}$
BB7	OUT[BB4] $\cup$ OUT[BB6]	$\{(a,4),(k,4)\}$	OUT[BB4] $\cup$ OUT[BB6]	$\{(a,4),(k,4)\}$
BB8	OUT[BB7] $\cup$ OUT[BB12]	$\{(a,4),(k,4)\}$	OUT[BB7] $\cup$ OUT[BB12]	$\{(a,4)\}$
BB9	OUT[BB8]	$\{(b,2),(a,4)\}$	OUT[BB8]	$\{(b,2),(a,4)\}$
BB10	OUT[BB9]	$\{(x,8),(b,2),(a,4)\}$	OUT[BB9]	$\{(b,2),(a,4)\}$
BB11	OUT[BB10]	$\{(y,8),(b,2),(a,4)\}$	OUT[BB10]	$\{(y,8),(b,2),(a,4)\}$
BB12	OUT[BB11]	$\{(k,5),(y,8),(x,8),(b,2),(a,4)\}$	OUT[BB11]	$\{(y,8),(b,2),(a,4)\}$
BB13	OUT[BB8]	$\{(a,4)\}$	OUT[BB8]	$\{(a,4)\}$

Figure 5: Tabella Iterazioni, convergenza ottenuta nella terza iterazione, non vi sono più cambiamenti