Compilatori, Gruppo 10 – Assignment 2
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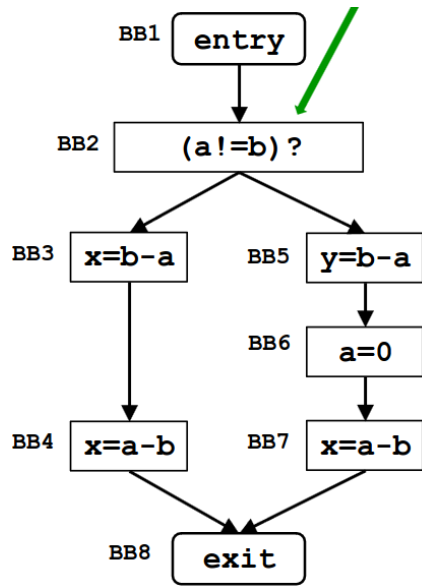
Contents

Problem 1: Very Busy Expressions

	Dataflow problem 1
Domain	Espressioni
Direction	Backward
Transfer function	$\text{GEN}(B) \cup (\text{IN}[B] - \text{KILL}[B])$
Meet operator	$\cap$, Intersezione
Boundary condition	$\text{OUT}[B]_{\text{Finale}} = \emptyset$
Initial Interior points	$\text{IN}[B]_{\text{Inizio}} = \emptyset$

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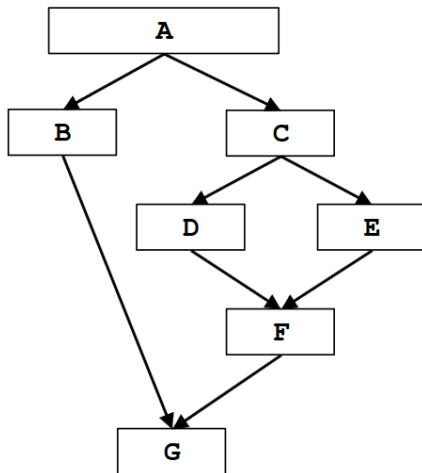
	Dataflow problem 2
Domain	Blocchi
Direction	Forward OUT[b]= f_b(IN[b]) IN[B] = $\wedge$ OUT[pred[b]]
Transfer function	$f_b(x) = \{b\} \cup x$
Meet operator	$\cap$
Boundary condition	OUT[Entry] = Entry
Initial Interior points	OUT[B]=U

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

Table 2: Tabella Iterazioni

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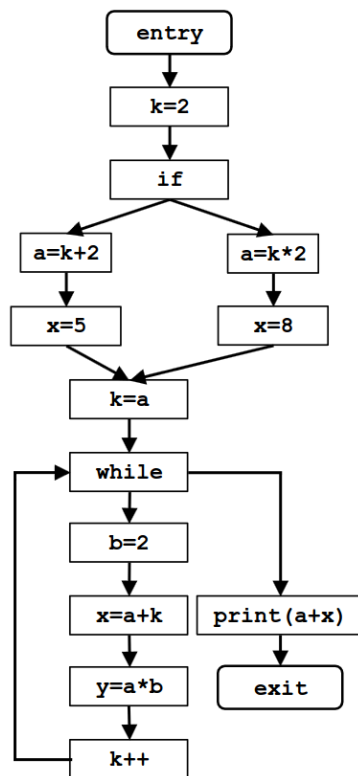
	Dataflow problem 3
Domain	Insieme di coppie <Variabile, Valore>
Direction	Forward, $\text{OUT}_B = f_b(\text{IN}_B)$ $\text{IN}_B = (\wedge \text{OUT}[\text{pred}(B)])$
Transfer function	$f_b(x) = \text{GEN}_B \cup (x - \text{Kill}_B)$
Meet operator	$\cap$, Intersezione
Boundary condition	out[entry]=$\emptyset$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