Assignment 2 Compilatori

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1 Very Busy Expressions

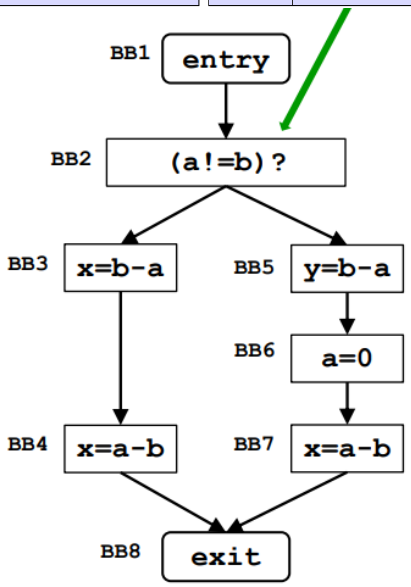
1.1 Framework di Dataflow Analysis

	Very Busy Expressions
Domain	Sets of expressions
Direction	Backward: in[b] = f_b(out[b]) out[b] = $\wedge$ in[succ(b)]
Transfer function	$f_b(x) = Gen_b \cup (x - Kill_b)$ Gen_b: espressioni generate da b $Kill_b$: espressioni con almeno una variabile definita in b
Meet Operation ($\wedge$)	$\cap$
Boundary Condition	in[exit] = $\emptyset$
Initial interior points	in[b] = U

1.2 Tabella iterazioni algoritmo

	Funzione di Trasferimento	
	Gen	Kill
BB1	∅	∅
BB2	a != b	∅
BB3	b - a	∅
BB4	a - b	∅
BB5	b - a	∅
BB6	∅	a - b , b - a
BB7	a - b	∅
BB8	∅	∅

	Iterazione 1	
	IN[B]	OUT[B]
BB1		a != b, b - a
BB2	a != b, b - a	b - a
BB3	b - a, a - b	a - b
BB4	a - b	∅
BB5	b - a	∅
BB6	∅	a - b
BB7	a - b	∅
BB8	∅	



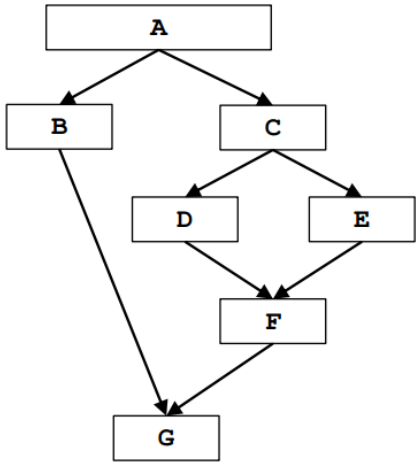
2 Dominator Analysis

2.1 Framework di Dataflow Analysis

	Dominator Analysis
Domain	Sets of Basic Blocks
Direction	Forward: out[b] = f_b(in[b]) in[b] = $\wedge$ out[pred(b)]
Transfer function	$f_b(x) = b \cup x$
Meet Operation ($\wedge$)	$\cap$
Boundary Condition	out[entry] = entry
Initial interior points	out[b] = U

2.2 Tabella iterazioni algoritmo

	Iterazione 1	
	IN[B]	OUT[B]
A	$\emptyset$	{A}
B	{A}	{A,B}
C	{A}	{A,C}
D	{A,C}	{A,C,D}
E	{A,C}	{A,C,E}
F	{OUT[D]} $(\cap)$ {OUT[E]} = {A,C}	{A,C,F}
G	{A,C,F} $(\cap)$ {A,B} = {A}	{A,G}



3 Constant Propagation

3.1 Framework di Dataflow Analysis

	Constant Propagation
Domain	Maps of Variables to Constants or $\top$ (unknown) or $\bot$ (undefined)
Direction	Forward: out[b] = f_b(in[b]) in[b] = $\wedge$ out[pred(b)]
Transfer function	$f_b(x) = Gen_b \cup (x - Kill_b)$ Gen_b: coppie (v,c) generate da b $Kill_b$: coppie (v,_) per variabili ridefinite in b
Meet Operation ($\wedge$)	$\cap$ con regola speciale: $(v,c_1) \cap (v,c_2) = \emptyset$ se $c_1 \neq c_2$
Boundary Condition	out[entry] = $\emptyset$
Initial interior points	out[b] = $\top$ (tutte le variabili con valore sconosciuto, valgono come qualsiasi valore contemporaneamente)

3.2 Tabella iterazioni algoritmo

	Funzione di Trasferimento	
	Gen	Kill
BB1	$\emptyset$	$\emptyset$
BB2	$\{(k,2)\}$	$\{k\}$
BB3	$\emptyset$	$\emptyset$
BB4	$\{(a,4)\}$	$\{a\}$
BB5	$\{(x,5)\}$	$\{x\}$
BB6	$\{(a,4)\}$	$\{a\}$
BB7	$\{(x,8)\}$	$\{x\}$
BB8	$\{(k,4)\}$	$\{k\}$
BB9	$\emptyset$	$\emptyset$
BB10	$\{(b,2)\}$	$\{b\}$
BB11	$\{(x,8)\}$	$\{x\}$
BB12	$\{(y,8)\}$	$\{y\}$
BB13	$\{(k,5)\}$	$\{k\}$
BB14	$\emptyset$	$\emptyset$
BB15	$\emptyset$	$\emptyset$

	Iterazione 1	
	In[B]	Out[B]
BB1	$\emptyset$	$\emptyset$
BB2	$\emptyset$	$\{(k,2)\}$
BB3	$\{(k,2)\}$	$\{(k,2)\}$
BB4	$\{(k,2)\}$	$\{(k,2),\ (a,4)\}$
BB5	$\{(k,2),\ (a,4)\}$	$\{(k,2),\ (a,4),\ (x,5)\}$
BB6	$\{(k,2)\}$	$\{(k,2),\ (a,4)\}$
BB7	$\{(k,2),\ (a,4)\}$	$\{(k,2),\ (a,4),\ (x,8)\}$
BB8	$\{(k,2),\ (a,4)\}$	$\{(k,4),\ (a,4)\}$
BB9	$\{(k,4),\ (a,4)\}$	$\{(k,4),\ (a,4)\}$
BB10	$\{(k,4),\ (a,4)\}$	$\{(k,4),\ (a,4)\ ,\ (b,2)\}$
BB11	$\{(k,4),\ (a,4)\ ,\ (b,2)\}$	$\{(k,4),\ (a,4)\ ,\ (b,2),\ (x,8)\}$
BB12	$\{(k,4),\ (a,4)\ ,\ (b,2),\ (x,8)\}$	$\{(k,4),\ (a,4)\ ,\ (b,2),\ (x,8),\ (y,8)\}$
BB13	$\{(k,4),\ (a,4)\ ,\ (b,2),\ (x,8),\ (y,8)\}$	$\{(k,5),\ (a,4)\ ,\ (b,2),\ (x,8),\ (y,8)\}$
BB14	$\{(k,4),\ (a,4)\}$	$\{(k,4),\ (a,4)\}$
BB15	$\{(k,4),\ (a,4)\}$	$\{(k,4),\ (a,4)\}$

	Iterazione 2	
	In[B]	Out[B]
BB9	$\{(a,4)\}$	$\{(a,4)\}$
BB10	$\{(a,4)\}$	$\{(a,4)\ ,\ (b,2)\}$
BB11	$\{(a,4)\ ,\ (b,2)\}$	$\{(a,4)\ ,\ (b,2),\ (x,\perp)\}$
BB12	$\{(a,4)\ ,\ (b,2)\}$	$\{(a,4)\ ,\ (b,2),\ (y,8)\}$
BB13	$\{(a,4)\ ,\ (b,2),\ (y,8)\}$	$\{(k,\perp),\ (a,4)\ ,\ (b,2),\ (y,8)\}$
BB14	$\{(a,4)\}$	$\{(a,4)\}$
BB15	$\{(a,4)\}$	$\{(a,4)\}$

	Iterazione 3	
	In[B]	Out[B]
BB9	$\{(a,4)\}$	$\{(a,4)\}$
BB10	$\{(a,4)\}$	$\{(a,4)\ ,\ (b,2)\}$
BB11	$\{(a,4)\ ,\ (b,2)\}$	$\{(a,4)\ ,\ (b,2),\ (x,\perp)\}$
BB12	$\{(a,4)\ ,\ (b,2)\}$	$\{(a,4)\ ,\ (b,2),\ (y,8)\}$
BB13	$\{(a,4)\ ,\ (b,2),\ (y,8)\}$	$\{(k,\perp),\ (a,4)\ ,\ (b,2),\ (y,8)\}$
BB14	$\{(a,4)\}$	$\{(a,4)\}$
BB15	$\{(a,4)\}$	$\{(a,4)\}$