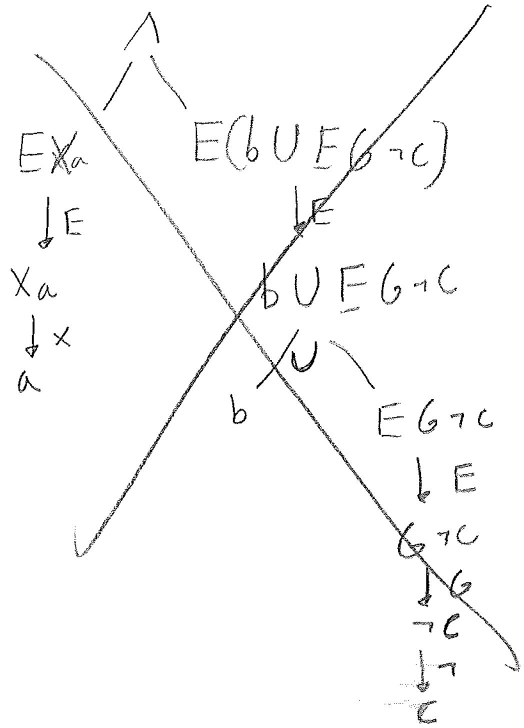
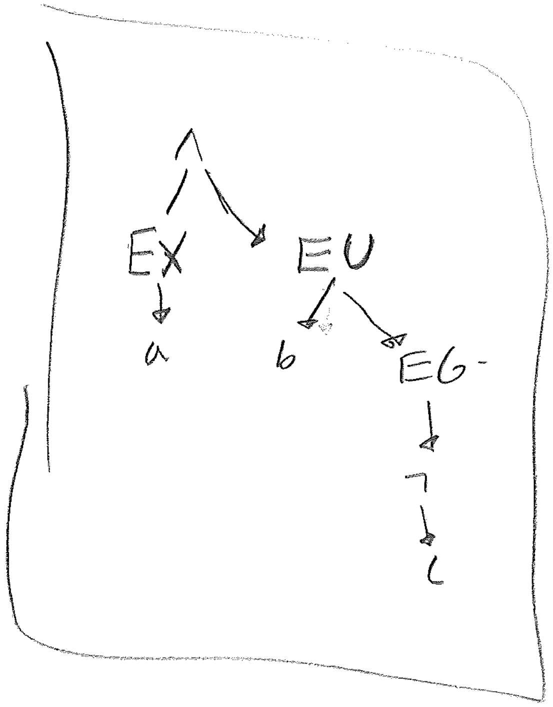
Joseph Blodgett
HW 10
CS 486

1)





2) $AG(a \to AF(b \wedge \neg a))$

$\neg EG(a \wedge \neg AF(b \wedge \neg a))$

$\neg E\, true\, U(b \wedge \neg a))$

$\boxed{\neg EG(a \wedge \neg E\, true\, U(b \wedge \neg a))}$

?

$\cancel{\neg G}(A \wedge \neg AF(b \wedge \neg a))$

$\neg\neg A \vee AF(b \wedge \neg a))$

$A \wedge \neg AF(b \wedge \neg a))$

3) $AX(E(\neg a U(b \wedge c)) \vee EG\, AX(a))$

?

$\neg EX(\neg EG(\neg a U(b \wedge c)) \wedge \neg EG\, AX(a))$

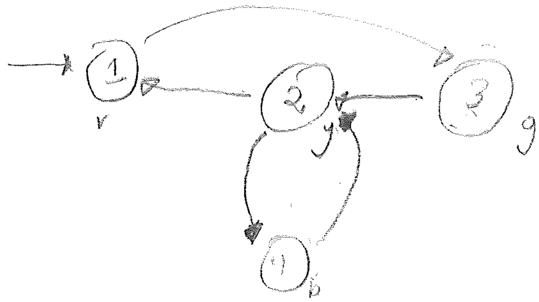
$\neg EX(\neg EG(\neg a U b \wedge c)) \wedge \neg EG(\neg EX(\neg a)))$

$\boxed{\neg EX(\neg EG(E[\neg a U b \wedge c])) \wedge \neg EG(\neg EX(\neg a)))}$

4)

What is existential normal?

How to replace with least or greatest fixpoint



a) $\{1,2,3,4\}$

b) $\{\emptyset\}$!

c) $\{1,2,3,4\}$?

d) $\{1,3\}$

e) $\{1,2,3,4\}$

f) $\{\emptyset\}$

g) $\{2,4\}$

h) $\{1,2,3,4\}$

i) $\{1,2,3,4\}$

j) $\{1,2,3,4\}$

k) $\{1\}$

l) $\{\emptyset\}$

$\forall \Diamond y$

$AFy \equiv \neg(EG\neg y) = \{\emptyset\}$

$AGy \equiv \neg(EF(\neg y))$ = $\{1,2,3,4\}$

$\equiv \neg E[\text{true} \cup \neg y]$

1, 3,4 → 2 – $\emptyset$

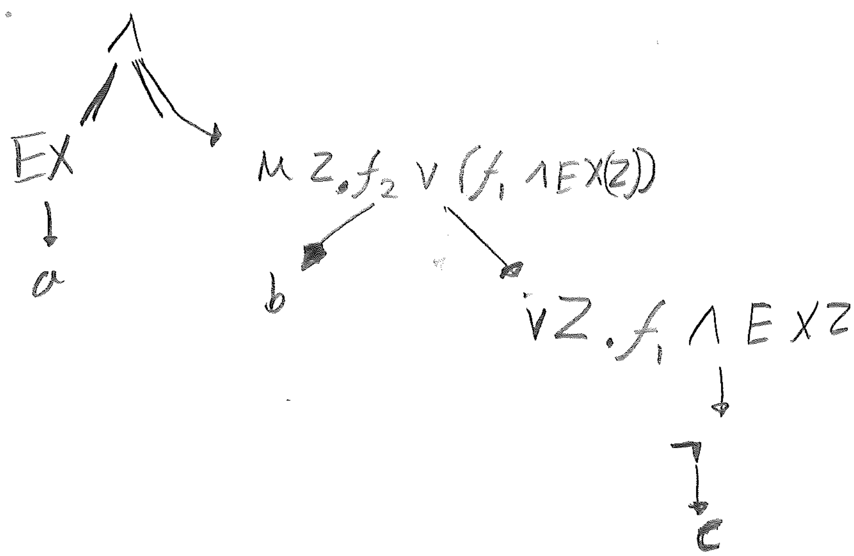
$\neg$ 1,2,3,4 = $\emptyset$

$AG(AF(y))$

$\{1,2,3,4\}$ = true

AG

5)



j) $\forall(\neg b \, U \, \exists \Diamond b))$

$\neg E \neg(\neg b \, U \, EF b))$

$(\neg b U (E \, true \, U b)) = \{1, 2, 3, 4\}$

k) $\forall(g \, U \, \boxed{\forall(y \, U \, r))}$

$\neg(E(\neg(y U r)))$

$\neg E(\neg g ?$

$$\overset{f}{b} \quad \forall \, b \, U \neg \overset{g}{b}$$

$\neg E[\neg b \, U(\neg b \wedge b)] \wedge \neg EG \, b$

$b \, U[\emptyset]$ $\{1, 2, 3, 4\}$

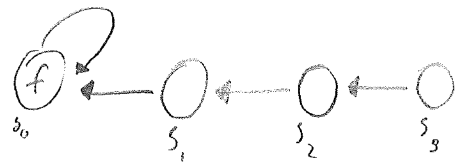
$\cancel{\emptyset}$

$\neg \, \emptyset$

$\{1, 2, 3, 4\} \wedge \{1, 2, 3, 4\}$

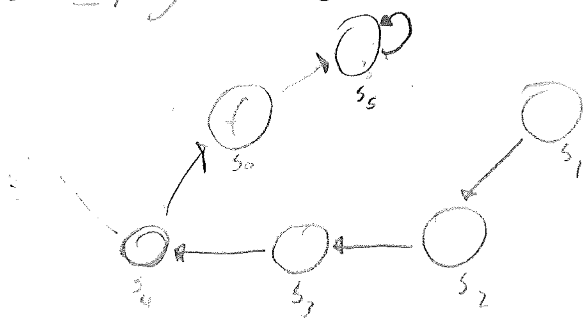
$\{1, 2, 3, 4\}$

6) $EG\boxed{f}$ 4 iterations



Iterations	Set of EGf
0	$\{s_0\}$
1	$\{s_0, s_1\}$
2	$\{s_0, s_1, s_2\}$
3	$\{s_0, s_1, s_2, s_3\}$
4	$\{s_0, s_1, s_2, s_3\}$

7) EFf – 5 iterations



Iterations	Set of EFf
0	$\{s_0\}$
1	$\{s_4\}$
2	$\{s_4, s_3\}$
3	$\{s_4, s_3, s_2\}$
4	$\{s_4, s_3, s_2, s_1\}$
5	$\{s_4, s_3, s_2, s_1\}$

4 contd.

a $AF(g) \rightarrow \neg(\cancel{E[true\ U\ \neg g]}) \rightarrow \neg(2,4), = = \{1,3\}$?

$A\ \ \cancel{\neg E(\neg F(g))}$

$\neg E(\neg\neg G(\neg g))$

$\boxed{\neg E(G(\neg g))}$

? clarify.

b

$EFg = E[true\ U\ g] \rightarrow \{1,2,3,4\}$

$\{3\}$

c $EGg \equiv \emptyset =$ No scc

$A(b\ U\ \neg b)$

$\neg E(\neg(b\ U\ \neg b))$

$\cancel{(E(b\ U\ \neg b))}$

$AU \rightarrow EU$

$\neg E(\neg b\ U\ b) = \emptyset$

d $EG(\neg g)$ $\{2,4\}$

$E\ \forall(\neg b\ U\ \exists\Diamond b)$

$A(\neg b\ U\ EF b)$

$\neg E(\neg(EFb)\ U\ (b \wedge \neg(EFb)))] \wedge \neg(EG(EFB))$

$\emptyset \quad \emptyset \quad \wedge \neg \emptyset$

$EG\{1, \cancel{2}, 3, 4\}$

$\downarrow$

$\emptyset$

$EFb = E(\text{true}\ U\ b)$

$\{1, 2, 3, 4\}$

$[1, 2, 3, 4] \wedge \{1, 2, 3, 4\}$

F $\quad A(g\ U\ \underbrace{A(y\ U\ r)}) \rightarrow \neg E(\neg r\ U\ (\neg y \wedge \neg r))] \wedge \neg EG\neg r$

$\{4, 3\}$

$\{2, 3, 4\}$

$\emptyset$

$1, 2, 3, 4$

$\neg E(\neg\{1\}\ U\ (\neg g \wedge \neg\{1\})] \wedge \neg EG(\neg\{1\})$

$\wedge \quad = 1$

$2, 3, 4 \quad \{2, 4\} \quad 3\ 2, 4$

$\neg\{2, 3, 4\} \quad \{1, 3\}$

$1 \quad \wedge$

$\{1\}$

L

$AG\,b\,U\,b]$

4

$\neg E(\neg b\,U(b\wedge\neg b))\wedge\neg EG(\neg b)$

$\emptyset$ $\emptyset$

$\emptyset$ $\wedge\{1,2,3,4\}$

$\{1,2,3,4\}$

$\{1,2,3,4\}$

$\neg E[\neg b\,U(b\wedge\neg b))\wedge\neg EG(\neg b)$

$\neg b\,U-\emptyset$ $\emptyset$

$\neg(\emptyset)$ $\wedge\{1,2,3,4\}$

$\{1,2,3,4\}$

$\{1,2,3,4\}$